Jason please handle.

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GOVERNOR OF HAWAII

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

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AQUACULTURE DEVELOPMENT PROGRAM
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LAND MANAGEMENT
STATE PARKS
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ref: ocea/dh

JAN 7 1994

File No.: HA-487A

Hawaiian Electric Light Company, Inc.
54 Halekauila Street
Hilo, Hawaii 96721-1027
Attn: Clyde Nagata

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 2
To OEQC	From DON HORIUCHI
Co.	Co. DLNR - OCEA
Dept.	Phone # 7-0377
Fax # 62452	Fax # 7-0390

Dear Mr. Nagata,

Subject: Determination of Acceptability of the Revised Final Environmental Impact Statement for Keahole Generator Station Expansion

Thank you for submitting your Revised Final Environmental Impact Statement Keahole Generator Station Expansion for our determination of acceptability.

We have determined that the document satisfactorily complies with the procedural, content, and public review requirements stipulated by the Office of Environmental Quality Control in accordance with Section 11-200-23, Hawaii Administrative Rules. The document was duly submitted to our Department on December 9, 1993 following the prescribed review and comment period of the Revised Draft Environmental Impact Statement. Notice of availability of the Revised Draft EIS for this project was published in the August 23, 1993 OEQC BULLETIN and comment period ended on October 7, 1993. Responses were made to comments received during that period and are incorporated in the Revised Final EIS. Notice of availability of the EISPN was previously published in the OEQC BULLETIN on September 8, 1992. Comments received during the EISPN consultation period and your responses are included in the document. In this manner, the document fulfilled the public review requirements stipulated under the same rule. The three volume document contains the necessary contents of an environmental impact statement with appendices in the format required by the Office of Environmental Quality Control. The document, therefore, is acceptable under the procedures established in Chapter 343, Hawaii Revised Statutes.

However, numerous issues of contention still remain and all assumptions and conclusions in the document are not accepted as necessarily valid. We are accepting the document as a basis for further discussion in the contested case hearing for the Conservation District Use Application. Among the unresolved issues for the project are accuracy of

energy demand forecasts, adverse impacts of potable water usage, sources of water for the plant, seasonal plume impacts, and those listed in the document including alternative energy sources. We hope that these issues can be resolved in the contested case hearing.

Very truly yours,

Keith W. Ahue

cc: OEQC
CH2M Hill
Mahi Cooper
Peggy Ratliff
Waimana Enterprises

OEQC LIBRARY

REVISED FINAL ENVIRONMENTAL IMPACT STATEMENT

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET, 4th FLOOR
HONOLULU, HAWAII 96813

Keahole Generating Station Expansion

North Kona, Hawaii

Hawaii Electric Light Company, Inc.

DECEMBER 1993

ADDENDUM TO:
REVISED FINAL ENVIRONMENTAL IMPACT STATEMENT
Keahole Generating Station Expansion
North Kona, Hawaii
January 4, 1994

The following paragraph is added as a third paragraph under the heading "Project Impacts" on page 3-21.

> "If ground water is not available on-site, suitable arrangements would be made with either the County of Hawaii Water Department or private sources."

REVISED FINAL
ENVIRONMENTAL IMPACT STATEMENT

Keahole Generating Station Expansion

North Kona, Hawaii

Hawaii Electric Light Company, Inc.

DECEMBER 1993

Executive Summary

Applicant and Landowner:	Hawaii Electric Light Company, Inc. (HELCO) 54 Halekauila Street Hilo, Hawaii 96721-1027
Location:	North Kona District, County of Hawaii, Ahupuaa of Kalaoa 1-4, 750 feet mauka (east) of Queen Kaahumanu Highway
Tax Map Key:	7-3-49:36
Size:	14.998 acres
Existing Land Use Regulations:	State Land Use Classification: Conservation District, General Subzone County Zoning Designation: Open Special Management Area: No
Existing Land Use:	Keahole Generating Station
Approving Agency:	Board of Land and Natural Resources
EIS Accepting Authority:	Department of Land and Natural Resources

In June 1993, HELCO submitted a Final Environmental Impact Statement (EIS) to the Department of Land and Natural Resources (DLNR) for a proposed unit addition to the Keahole Generating Station. In letters dated July 1 and July 12, 1993, DLNR requested supplemental information regarding recent developments by independent power producers. In order to provide DLNR with the requested information, in August 1993 HELCO submitted a Revised Draft EIS dated July 30, 1993.

This Revised Final EIS has been prepared in response to comments on the Revised Draft EIS, and it supersedes the June 1993 Final EIS. This Revised Final EIS incorporates by reference Volume II of the Revised Draft EIS (July 30, 1993) and Volume II of the Draft EIS (December 1992). Following is a list of the environmental documents prepared for this project. These documents are available at the libraries listed in Section 7 of this report, from HELCO, and/or from CH2M HILL.

Draft EIS (Volumes I & II)	December 1992
Final EIS	June 1993
Revised Draft EIS (Volumes I & II)	July 1993
Revised Final EIS	December 1993

As a result of the unanticipated delay in the EIS process, HELCO will not be able to complete Phase 1 of the unit addition at Keahole in 1994 as originally planned. To minimize a shortfall in generating capacity, HELCO plans to defer the scheduled retirement of older generating units until late 1995. The postponement of retirement of older generating units will increase the costs of maintenance and the likelihood of equipment failure.

The proposed unit addition will increase the capacity of the generating station from 30.25 megawatts (MW) to 86.25 MW and will be built in three phases:

- Phase 1 will add one 20-MW, simple-cycle combustion turbine (CT) in mid-1995.
- Phase 2 will add a second 20-MW CT in the third quarter of 1995.
- Phase 3 will convert the two simple-cycle CTs to a combined-cycle unit by adding two heat recovery steam generators (HRSG) and a steam turbine generator. Together, these components will constitute a 56-MW (net, or 58 MW gross), dual-train, combined-cycle unit (DTCC), which will be completed by 1997.

In addition to the new generating facilities, HELCO proposes to add control houses, an office, a warehouse and shop, a transmission switching station, fuel oil storage tanks, an exhaust stack, an air-cooled condenser, a water supply well, wastewater treatment facilities, two reinjection wells, and a battery energy storage plant (BESP). The BESP will add 5 MW to the operating reserve for a period of 3 hours, or 10 MW to the operating reserve for a period of 1.5 hours.

Keahole Generating Station is located on 14.998 acres in the North Kona District on the Island of Hawaii. It is 1 mile east of Keahole Airport and 750 feet east of Queen Kaahumanu Highway. Access to the site is from Reservoir Road, a 16-foot-wide paved road off Queen Kaahumanu Highway.

The proposed project is designed to improve system voltage, provide the additional capacity to meet projected demand for electric service, develop generation capacity near the area of demand, replace older generating facilities, and increase overall system reliability. The proposed action will add a 56-MW, diesel-fired DTCC to generate electricity. The BESP will provide economical "peak shaving" capability, as well as improved system voltage and frequency regulation.

During the preparation of this EIS, State, County, and local plans and policies were evaluated. A discussion is presented on how the proposed project conforms to the objectives and policies of State, County, and local plans.

The considered alternatives included No Action, alternative sites, alternative technologies, independent power producers (IPPs), energy conservation, and a combination of the alternatives. The alternative sites that were considered are based on the 1988 *West Hawaii Site Study*. Negotiations with IPPs for additional generating capacity are pending or ongoing. The projected time frame for these IPP projects, however, does not address the immediate generating requirements identified by HELCO's resource plan.

Alternative technologies considered included biomass conversion, geothermal, hydroelectric, solar, wind, ocean thermal, and coal. HELCO analyzed the availability of each of these alternative sources and determined that none of them would be able to address the immediate generating needs.

An unresolved issue is the long-term commercial development of alternative energy sources. Although the development of these alternative energy sources is anticipated to eventually reduce current reliance on fossil fuels, the timing and economic feasibility of such a transition remain unclear. HELCO efforts to develop a long-range resource plan will contribute to the resolution of this issue.

The proposed project has no significant adverse effects on air quality, geology, plants, animals, archaeological resources, or property values. The project is compatible with the existing land use and optimizes the use of existing facilities. Expansion of the existing facilities will provide benefits to the local population, as well as the entire Island, by increasing overall system reliability. In addition, no adverse noise, tourism, or traffic impacts are anticipated from the proposed expansion of the existing facilities.

The proposed project will create an adverse visual impact. However, the impact is not considered to be significant, because the unit addition would not alter the dominance of the Keahole facility within the viewsheds analyzed. The 104-foot-high stack will be visible to residents of Keahole Agricultural Park, occupants of vehicles traveling on Queen Kaahumanu Highway and Keahole Airport Access Road, and residents of the Kona Palisades subdivision. A landscape mitigation plan is being developed that will include a vegetative buffer around the perimeter of the site; this will help screen the existing and proposed structures, including portions of the stack.

Permits and Approvals for Keahole Generating Station		
Permit/Approval	**Agency**	**Status**
County of Hawaii		
Building, Grading and Stormwater Management Permits	Department of Public Works	Application to be submitted.
State of Hawaii		
Environmental Impact Statement Approval	Department of Land and Natural Resources	Revised Final EIS submitted December 1993.
Conservation District Use Permit	Board of Land and Natural Resources	Permit extension approved through May 18, 1994.
Authority to Construct	Department of Health	Application submitted January 1993.
Prevention of Significant Deterioration	Department of Health	Application submitted January 1993.
Permit to Construct	Department of Transportation, Airports Division	Permit approved March 1993.
Supply Well Well Construction Permit	Commission on Water Resource Management	Issued November 1992.
Pump Installation Permit		Application to be submitted.
Underground Injection Control Permit to Construct	Department of Health	
• Primary Well		Application approved April 6.
• Backup Well		Application approved April 16.
Permit to Operate	Department of Health	Application to be submitted.
Approval for Domestic Wastewater Treatment	Department of Health	Application to be submitted
Public Utilities Commission General Order 7 Approval	Public Utilities Commission	CT-4: Amended application submitted September 1992. CT-5/ST-7: Application submitted February 1993. Application for BESP to be submitted.
Federal		
Notice of Proposed Construction or Alteration	Federal Aviation Administration	FAA Determination of No Hazard to Air Navigation.
Prevention of Significant Deterioration	Environmental Protection Agency	Application submitted January 1993.

Summary of Impacts

RESOURCE	IMPACT
Physical Resources	
Climate & Air Quality	
Volcanic Hazards	
Soils & Geology	
Water Resources	
Biological Resources	
Flora	
Fauna	
Socioeconomic Resources	
Archaeological and Cultural Resources	
Land Use and Ownership	
Population and Employment	
Visual Resources	
Property Values	
Transportation	
Noise	
Public Safety and Community Services	

LEGEND

- Beneficial Impact (may be significant)
- Beneficial Impact (may not be significant)
- No Adverse Impact
- Adverse Impact (may not be significant)
- Adverse Impact (may be significant)

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Errata

Below are previously published corrections to Volume II of the Draft EIS:

- Appendix A, page A-17: add the following bibliographic entry:

  Penney, Terry R., and Thomas H. Daniel. "Energy from the Ocean: A Resource for the Future." *1989 Encyclopedia Britannica Yearbook of Science and the Future*. Chicago, Encyclopedia Britannica. 1989.

- Appendix H, page 1-1, line 2: add "subdivision" after "residential."

- Appendix H, page 4-2, line 15: change "residences are" to "residential subdivision is."

Abbreviations

AAQS	Ambient Air Quality Standards
ALISH	Agricultural Lands of Importance to the State of Hawaii
ANSI	American National Standards Institute
API	American Petroleum Institute
AQMDs	Air Quality Management Districts
ATC	Authority to Construct
BACT	best available control technology
Be	beryllium
BESP	battery energy storage plant
BOD	biochemical oxygen demand
CAA	Clean Air Act
CAB	Clean Air Branch (of Department of Health)
CAG	Community Advisory Group
CDUA	Conservation District Use Application
CDUP	Conservation District Use Permit
CFR	Code of Federal Regulations
cm	centimeter
CO	carbon monoxide
CO_2	carbon dioxide
CT	combustion turbine
dB	decibel
dBA	decibel, A-weighted
DBEDT	Department of Business, Economic Development and Tourism
DC	direct current
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DOH	State Department of Health
DOT	State Department of Transportation
DSM	Demand-Side Management
DTCC	dual-train, combined cycle
DTCT	dual-train, combustion turbine
EC	European Community
EDC	Enserch Development Corporation
EIS	Environmental Impact Statement
EMD	electro-motive diesel
EMF	electric and magnetic fields
EPA	U.S. Environmental Protection Agency
ERAM	Electric Revenue Adjustment Mechanism

FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
Fl	fluorine
FOB	free onboard vessel
FOBT	free onboard vessel and trimmed
FPC	Forecast and Planning Committee
GE	General Electric
GEP	good engineering practice
gpm	gallons per minute
gWh	gigawatt-hour
H_2S	hydrogen sulfide
H_2SO_4	hydrogen sulfate
HAR	Hawaii Administrative Rules
HCPC	Hilo Coast Processing Company
HCZMP	Hawaii Coastal Zone Management Program
HECO	Hawaiian Electric Company, Inc.
HEI	Hawaiian Electric Industries
HELCO	Hawaii Electric Light Company, Inc.
HERS	Hawaiian Electric Renewable Systems (subsidiary of Hawaiian Electric Industries)
Hg	mercury
HHC	Hawaiian Homes Commission
HOST	Hawaii Ocean Science and Technology
HRS	Hawaii Revised Statutes
HRSG	heat recovery steam generator
HVAC	heating, ventilating, and air conditioning
IPP	independent power producer
IRP	Integrated Resource Plan
ITE	Institute of Transportation Engineers
KCP	Kawaihae Cogeneration Partners
kV	kilovolt
kVA	kilovolt-ampere
kV/m	kilovolts per meter
kW	kilowatt
kWh	kilowatt-hour
L_{dn}	24-hour L_{eq} with nighttime weighting
L_{eq}	equivalent sound level
LOS	level of service
LST	landing ship tank
LUC	Land Use Commission

LUPAG	Land Use Pattern Allocation Guide
LVI	Lalamilo Ventures, Inc.
MECO	Maui Electric Company
MEV	million entering vehicles (million vehicles entering an intersection)
mG	milligauss
mgd	million gallons per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
$\mu g/m^3$	micrograms per cubic meter
MMBtu	million British thermal units
mph	miles per hour
MW	megawatt
MWh	megawatt-hour
NAAQS	National Ambient Air Quality Standards
NELH	Natural Energy Laboratory of Hawaii
NELHA	Natural Energy Laboratory of Hawaii Authority
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration
NSPS	New Source Performance Standards
NSR	New Source Review
NUG	non-utility generator
O_3	ozone
OEQC	Office of Environmental Quality Control
OPA	Oil Pollution Act
OSHA	Occupational Safety and Health Administration
OSP	Office of State Planning
OTEC	ocean thermal energy conversion
Pb	lead
PG&E	Pacific Gas and Electric Company
PGV	Puna Geothermal Ventures
PHRI	Paul H. Rosendahl, Ph.D., Inc.
PM_{10}	particulate matter less than 10 microns in diameter
ppm	parts per million
PSD	prevention of significant deterioration
PUC	Public Utilities Commission
PURPA	Public Utilities Regulatory Policy Act
RFP	Request for Proposals
RSPA	Research and Special Programs Administration

SAAQS	State Ambient Air Quality Standards
SCADA	supervisory control and data acquisition
SCCT	simple-cycle combustion turbine
SFP	State Functional Plan
SIP	State Implementation Plan
SMA	Special Management Area
SO_2	sulfur dioxide
SO_4	sulfate
SO_x	sulfur oxides
ST	steam turbine
SWEC	Stone & Webster Engineers
T&D	transmission and distribution
tpy	tons per year
TSP	total suspended particulates
UBC	Uniform Building Code
UH	University of Hawaii
UIC	underground injection control
UPS	uninterruptible power supply
vph	vehicles per hour
VRLA	valve regulated lead acid
WEI	Waimana Enterprises, Inc.

Section 1

Proposed Action

1.1 Scope of EIS

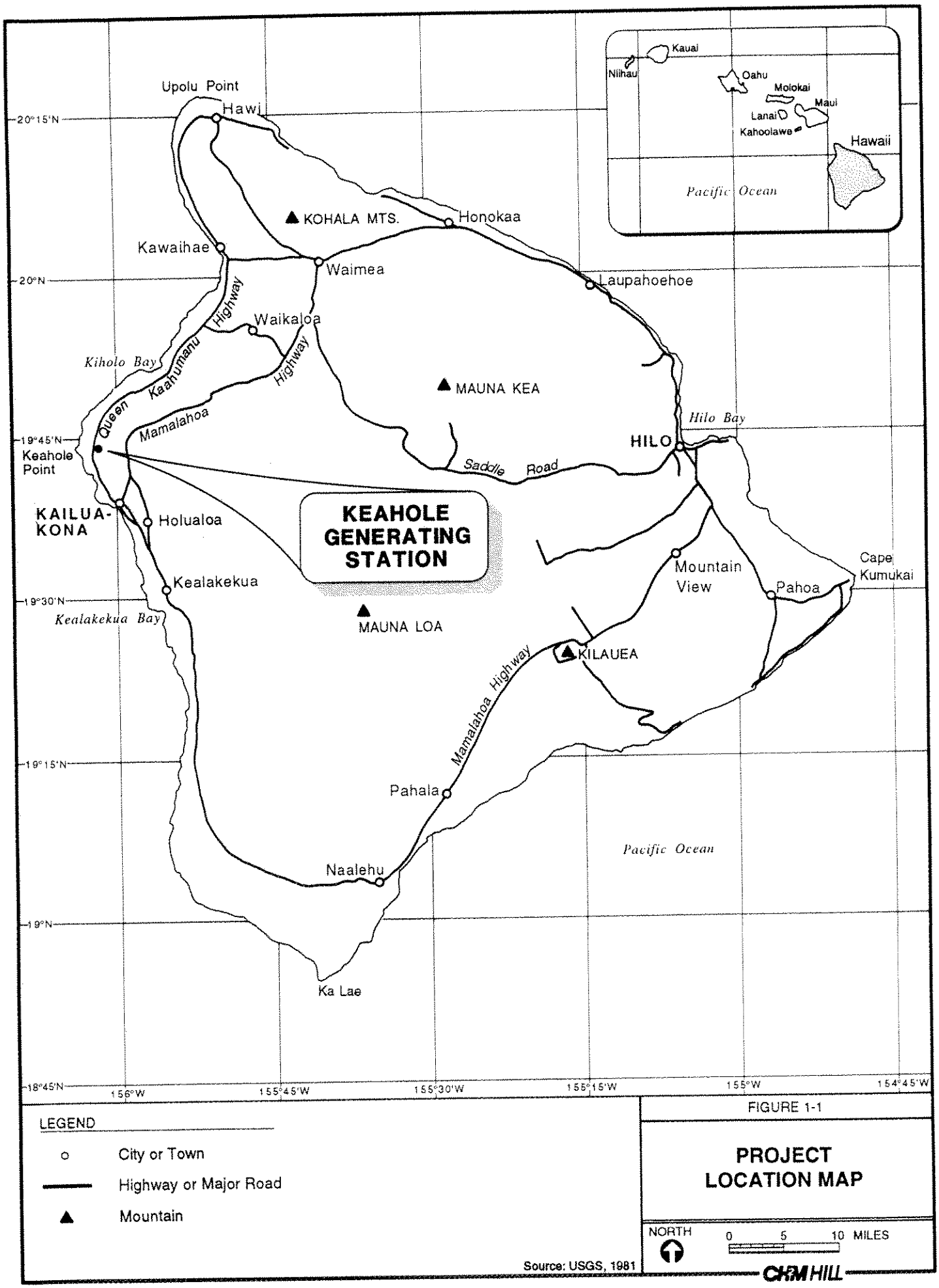
This Revised Final Environmental Impact Statement (EIS) evaluates the environmental impacts expected to occur from Hawaii Electric Light Company, Inc.'s (HELCO) proposed unit addition at the Keahole Generating Station (Figure 1-1). HELCO proposes to add a 56-megawatt (MW), dual-train, combined-cycle (DTCC) plant and a 5-MW, 3-hour (10-MW maximum, 1.5-hour) battery energy storage plant (BESP) to the existing facilities. The facility currently has six 2.75-MW diesel generating units and one 13.75-MW, simple-cycle combustion turbine (CT). The proposed project will be developed in three phases:

- Phase 1 will add a 20-MW, simple-cycle CT scheduled to be operational by mid-1995.
- Phase 2 will add a second 20-MW CT in the third quarter of 1995.
- Phase 3 will convert the two simple-cycle CTs to a combined-cycle unit by adding two heat recovery steam generators (HRSG) and a 16-MW steam turbine generator. Together, these components will constitute a 56-MW (net, or 58-MW gross), dual-train, combined-cycle unit (DTCC). Phase 3 is scheduled to become operational by 1997.

HELCO's earlier resource planning, discussed in Section 1.3.1, had identified the need for additional generating capacity by April 1994 in order to provide reliable service to its customers. Because of permitting delays, however, HELCO must again defer the scheduled retirement of some older units in order to maintain a sufficient level of reserve generating capacity. This is not an action that any utility can afford to take indefinitely. Clearly, without a unit addition to the Keahole Generating Station by 1995, HELCO will have a low margin of reserve generating capacity. This situation could lead to HELCO being unable to meet peak demands.

In addition to the new generating facilities, HELCO proposes to add control houses, an office, a warehouse and shop, a transmission switching station, fuel oil storage tanks, an exhaust stack, an air-cooled condenser, a water supply well, wastewater treatment facilities, two reinjection wells, related equipment, and a BESP. The BESP will add 5 MW to the operating reserve for a period of 3 hours, or 10 MW to the operating reserve for a period of 1.5 hours.

This EIS analyzes build-out of the project at the completion of Phase 3.



LEGEND

- ○ City or Town
- ——— Highway or Major Road
- ▲ Mountain

Source: USGS, 1981

FIGURE 1-1

PROJECT LOCATION MAP

NORTH

0 5 10 MILES

CH2M HILL

1.2 Background

In 1973, the State Board of Land and Natural Resources approved a Conservation District Use Permit (CDUP) for a new electric generating and switching station located on 14.998 acres at Keahole, Hawaii. The CDUP approved installation of three 2.75-MW diesel generators and associated facilities. Subsequent amendments to the CDUP for additional generation at the site are summarized below:

- February 1984—two additional 2.75-MW diesel generators were approved.
- February 1987—one additional 2.75-MW diesel generator was approved.
- September 1988—one 13.75-MW CT engine and ancillary facilities were approved.

The original CDUP and the three amendments provide a total existing capacity of 30.25 MW. The developed portion of the 14.998-acre generating station site is 3.1 acres, consisting of the generating plant area and a switching station area. The generating plant includes a control house, two sets of switchgear, six 2.75-MW diesel engines, a 13.75-MW CT and related equipment, and two fuel oil storage tanks. The switching station area has a switchyard, three step-up transformers, and a cesspool.

In its 1988 Conservation District Use Application (CDUA), HELCO stated that the 13.75-MW CT would be the last new unit to be installed at Keahole. The statement was made based on the assumption that HELCO would develop a new generating site at Kawaihae or at Puu Anahulu, and that an initial increment of 25 MW of geothermal power would be available in 1990 from Puna Geothermal Venture (PGV) in accordance with PGV's contract with HELCO. HELCO did not anticipate the delays encountered in acquiring a site at Kawaihae or at Puu Anahulu. HELCO also did not anticipate the delays in PGV providing its initial increment of 25 MW from a geothermal resource, and it did not anticipate the delays in PGV's second increment, the delays in True/Mid-Pacific Geothermal Venture's geothermal development program, or the loss in 1994 of firm power supplied by Hamakua Sugar.

1.3 Purpose and Need

HELCO is proposing to add a 56-MW unit and a BESP to the Keahole Generating Station to accomplish the following (refer to Section 1.5, Project Description, for a more detailed summary of the project):

- Increase the system margin of reserve generating capacity by April 1994
- Increase overall system reliability

- Improve system voltage
- Replace older generation facilities originally scheduled for retirement beginning in 1990
- Provide additional capacity to meet projected demand for electric service
- Develop generating capacity in West Hawaii where growth and the potential for future growth are greater
- Develop a BESP to improve system frequency and voltage regulation, provide the opportunity for peak shaving, and increase the operating reserve margin

Because growth on the Island of Hawaii has occurred and is projected to continue in West Hawaii, location of new generating capacity has been designated for West Hawaii. The proposed unit addition at Keahole will increase both system reserve and generating capacity in West Hawaii. Locating the proposed 56-MW DTCC and a BESP at Keahole Generating Station will reduce the need for additional cross-Island transmission lines and will optimize the use of vacant HELCO-owned land and existing utility infrastructure.

The simple-cycle combustion turbine (20 MW) can be installed within a relatively short time, which is essential to meet the need for additional generating capacity in West Hawaii by 1995. The conversion to a dual-train combined cycle will further increase generating capacity in West Hawaii and will also increase fuel efficiency.

A study by HELCO and its consultant, Zaninger Engineering Company, Inc., indicated that a 5-MW, 3-hour (10-MW maximum, 1.5-hour) BESP will result in considerable cost savings to HELCO on a 20-year, present-worth, revenue requirements basis. In addition to cost savings, the BESP will provide system voltage and frequency stabilization to improve the power quality and the reliability of the isolated HELCO system.

Resource planning, peak demand, the regional distribution of generating units, and parallel path planning are important issues in understanding the purpose and need of the proposed project. They are described in the following subsections.

1.3.1 Resource Planning

The need for additional generating capacity has been identified through a process referred to as resource planning. The forecasting methodology for the resource planning process is described more fully in Section 9 of this EIS. As a public utility, HELCO continuously reviews its system capacity to meet the forecasted demand. During resource planning, the following issues are evaluated:

- Existing and forecasted demand for energy and capacity

- Impacts of Demand-Side Management (DSM) and conservation and energy efficiency programs on the demand for energy
- Existing firm generating capacity
- Maintenance and retirement schedules of generating units (IPPs included)
- Proposals by independent power producers

Power produced by independent power producers is classified as either firm capacity or as-available capacity. Firm capacity is power that is always readily available on demand by HELCO's system operator, such as power produced by a combustion turbine. As-available, however, refers to power that may be available only on an intermittent basis, such as hydroelectric power or wind-generated power. HELCO's resource planning evaluates only producers of firm capacity in evaluating system needs.

Table 1-1 presents HELCO's resource plan for scheduled unit additions and retirements for the next 20 years. The plan calls for the retirement of 20 older generating units, or 65.3 MW of power, over the next 20 years. Hilo Coast Processing Company (HCPC) is assumed to continue providing power to HELCO through 2013. In addition, the resource plan has been revised to include the firm capacity provided by PGV since mid-1993. The availability of 25 MW from PGV, however, has not deferred the need for the proposed Keahole unit addition, because additional capacity is required to allow for the scheduled retirement of older, obsolete generating equipment which has been deferred since 1990.

HELCO's earlier resource planning identified the need for additional generating capacity by April 1994 in order to provide reliable service to its customers. Because of permitting delays, however, HELCO must again defer the scheduled retirement of some older units in order to maintain a sufficient level of reserve generating capacity. This is not an action that any utility can afford to take indefinitely. Clearly, without a unit addition to the Keahole Generating Station by 1995, HELCO will have a low margin of reserve generating capacity. This situation could lead to HELCO being unable to meet peak demands.

1.3.2 Peak Demand

The HELCO system peak occurs approximately between 6 p.m. and 8 p.m. daily. There is a lower but still significant peak between 10 a.m. and 12 p.m. daily. There is a significant difference in load between these peak periods and the lowest load period from 12 a.m. to 2 or 3 a.m.

Table 1-1
HELCO Resource Plan: Power Facility Additions and Retirements

Year	Annual Forecasted Peak (MW)	Annual Forecasted Peak[a] with DSM (MW)	Unit Description	Action	Size (Gross MW)	System Generation Capacity (MW)	System Reserve Margin (MW)
1993	157	157	PGV	Add	+25.00	207.60	50.6
1994	165	164.4	Loss of Hamakua	Retire	-10.00[b]	197.60	33.2
1995	171	170	CT-4 CT-5[c] Waimea D-8, 9, 10 Kanoelehua D-11 Shipman 1 Kanoelehua CT-1 Waimea D-12	Add Add Retire Retire Retire Retire Retire	+20.00 +20.00 -2.70 -2.00 -3.40 -9.00 -2.75	217.60 237.60 234.90 232.90 229.50 220.50 217.75	47.6 67.6 64.9 62.9 59.5 50.5 47.8
1996	177	174	--			217.75	43.8
1997	184	179	Convert CT-4 & 5 to DTCC 1 Waimea D-13, 14 and Kanoelehua D-15, 16	Add Retire	+18.00[d] -11.00	235.75 224.75	56.8 45.8
1998	191	183	Kanoelehua D-17	Retire	-2.75	222.00	39.0
1999	199	188	Keahole D-18 & 19	Retire	-5.50	216.00	28.5
2000	207	193	DTCT-(A), Phase 1 Keahole D-20, 21, 22, & 23	Add Retire	+22.70 -11.00	239.26 228.20	46.2 35.2
2001	215	199	DTCT-(A), Phase 2	Add	+22.70	250.90	51.9
2002	224	205	--			250.90	45.9
2003	233	211	--			250.90	39.90
2004	242	217	--			250.90	33.90
2005	251	223	DTCT-(A), Phases 1 and 2 to DTCC 2 Shipman 3	Add Retire	+18.90 -7.50	269.80 262.30	46.8 39.3
2006	261	230	--			262.30	32.3
2007	271	239	DTCT-(B), Phase 1	Add	+22.70	285.00	46.0
2008	283	248	Shipman 4	Retire	-7.70	277.30	29.3
2009	295	259	DTCT-(B), Phase 2	Add	+22.70	300.00	41.0
2010	308	269	--			300.00	31.0
2011	321	281	DTCT-(B), Phases 1 and 2 to DTCC (3)	Add	+18.90	318.90	37.9
2012	334	292	DTCT-(C), Phase 1	Add	+22.70	341.60	49.6
2013	348	304	--			341.60	37.6

[a]Assumes all Demand-Side Management (DSM) programs presented in HELCO's Integrated Resource Plan are approved by the Public Utilities Commission in 1994.
[b]Contracted for eight with a maximum of 10 should HELCO require.
[c]CT-5 is scheduled to be installed concurrently with CT-4 in 1995 as a cost-saving measure. Concurrent installation will significantly reduce unit manufacturing, shipping, and installation costs. The capacity need for CT-5 is April 1, 1996.
[d]Net capacity is 16 MW.

Abbreviations:
-- = no actions planned
CT = combustion turbine
D = diesel
DTCT = dual-train combustion turbine
DTCC = dual-train combined cycle

Source: HELCO. October 20, 1993.

Installation of a 5-MW, 3-hour BESP will enhance HELCO's ability to meet peak demand requirements. An energy storage system allows for the storage of low-cost, off-peak energy during periods of minimum demand with efficient generating units to meet peak demand periods, thereby displacing the need to generate energy with less efficient units and, thus, consuming less fuel during peak periods. Battery energy storage systems are particularly advantageous because of their modular design and short construction lead time. Because of the battery's extremely fast response, the BESP can provide voltage and frequency regulation for the HELCO system.

1.3.3 Regional Distribution of Generating Facilities on the Island of Hawaii

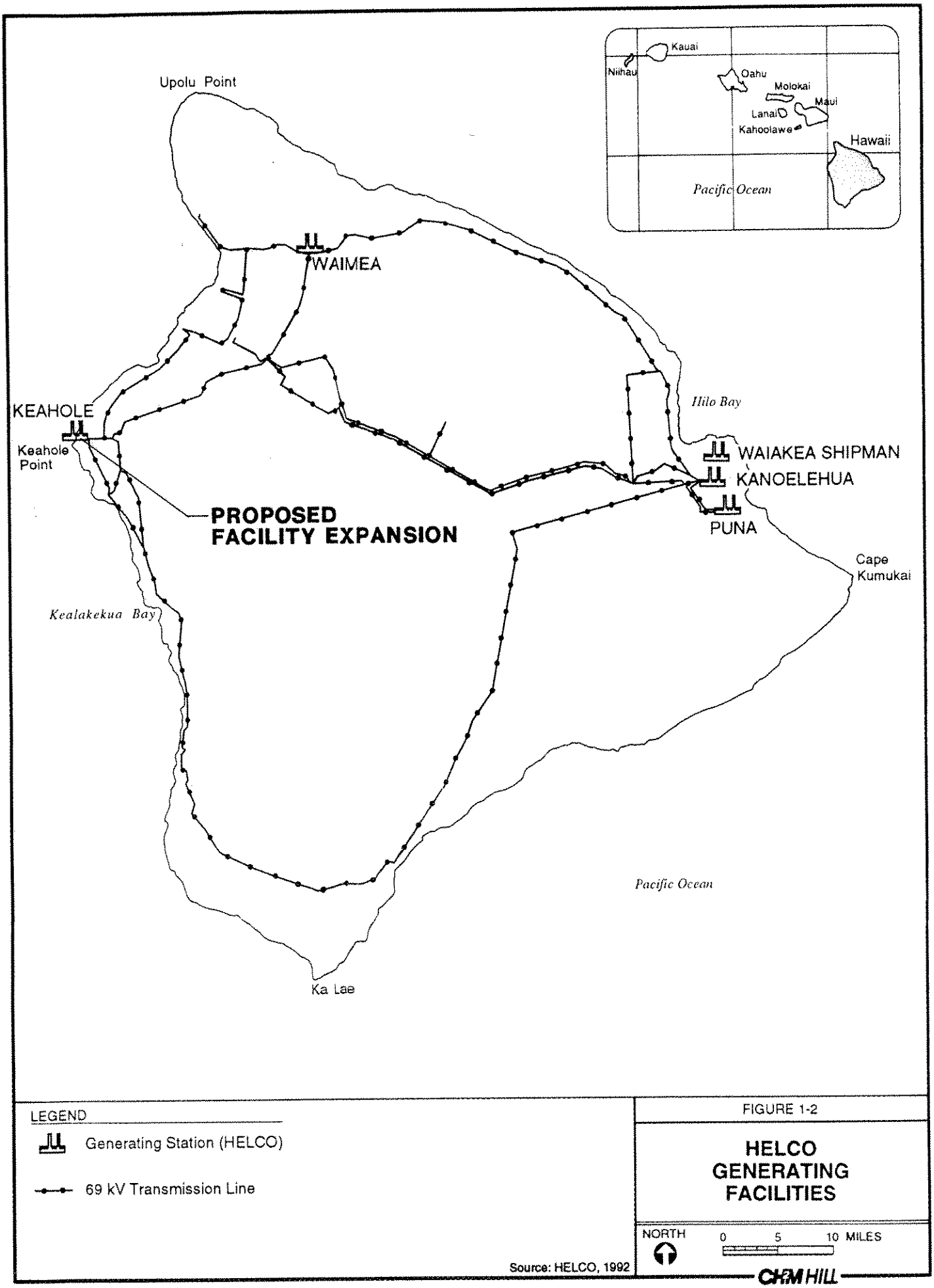
In addition to the need for increased generating capacity, the demand for electric service has increased significantly in the West Hawaii area in particular. HELCO's 1991 application to the Public Utilities Commission (PUC) reported that, between 1990 and 1994, more than half of HELCO's forecasted demand is expected to occur in West Hawaii (PUC Docket No. 7048).

Two generating facilities are currently located on the west side of the Island of Hawaii: Waimea and Keahole Generating Station (Figure 1-2). The Waimea facility consists of six diesel generators with a total generating capacity of 10.95 MW. All six generators at Waimea are between 20 and 50 years in age, and all are now scheduled to be retired between 1995 and 1997.

The Keahole Generating Station has six 2.75-MW diesel generators and one 13.75-MW combustion turbine for a total of 30.25 MW of generating capacity. The six diesels are scheduled to be retired between 1999 and 2000. A summary of these facilities and scheduled retirement dates for the diesel units is presented in Table 1-2.

Table 1-2
West Hawaii Generating Units

Unit		Capacity (MW)	Year Manufactured	Scheduled Retirement
Waimea	D-8	0.8	1943	1995
	D-9	0.9	1943	1995
	D-10	1.0	1943	1995
	D-12	2.75	1970	1995
	D-13	2.75	1972	1997
	D-14	2.75	1972	1997
Keahole	D-18	2.75	1974	1999
	D-19	2.75	1974	1999
	D-20	2.75	1966	2000
	D-21	2.75	1974	2000
	D-22	2.75	1966	2000
	D-23	2.75	1969	2000
	CT-2	13.75	1989	Unscheduled



LEGEND

Generating Station (HELCO)

69 kV Transmission Line

Source: HELCO, 1992

FIGURE 1-2

HELCO GENERATING FACILITIES

NORTH

0 5 10 MILES

CH2M HILL

By the year 2000, all existing HELCO generating equipment on the west side of the Island of Hawaii is scheduled to be retired, with the exception of the 13.75-MW combustion turbine at Keahole Generating Station. On the east side of the Island, 22.65 MW of generating capacity will be retired by 2000.

With the planned retirements, should no additional generating capacity be added to HELCO's system, the West Hawaii proportion of the total HELCO generating capacity for the Island would be reduced from 27 to 13 percent by the year 2000, while the proportion of HELCO's generating capacity in East Hawaii would increase from 73 to 87 percent (Table 1-3). West Hawaii currently consumes approximately 50 percent of the power generated on the Island of Hawaii. This share is projected to increase to 60 percent by the year 2000.

Table 1-3
Regional HELCO Generating Capacity and Demand*

Region	Existing Generating Capacity	Existing Generating Demand	Projected (Year 2000) Generating Capacity	Projected (Year 2000) Generating Demand
East Hawaii	73%	50%	87%	40%
West Hawaii	27%	50%	13%	60%

*Represents HELCO facilities only without factoring in power provided by any IPP.

1.3.4 Parallel Path Planning

Independent power producers (IPPs) (or non-utility generators [NUGs]) provide power that is incorporated into HELCO's grid. While it is HELCO's policy to purchase electric power from IPPs, HELCO must also provide reliable service at the lowest practical cost to its customers. As a contingency against IPP project delays, HELCO pursues parallel path planning for the installation of its own capacity. This contingency planning is terminated only when the IPP has met agreed-upon milestones and will meet the commercial operation date established in its contract with HELCO. Such milestones include demonstrating the availability of a fuel source, potential for permit approval, financial viability, commitment to purchase major plant equipment, and agreement on interconnection of the facility with the HELCO grid.

It is not appropriate for HELCO to use NUGs as parallel path planning for HELCO's own units (as opposed to using HELCO units as parallel path planning to proposed NUGs, which is done). This is because the NUG, unlike HELCO, does not have a legal obligation to serve the public and, therefore, could back out of its commitments. HELCO cannot incorporate IPP proposals into its resource planning until a contractual agreement (which would be subject to PUC approval) has been negotiated between the IPP and HELCO. A back-up plan would not be economically feasible for a NUG, since NUGs usually need to have signed, firm contracts in place with the utility in order to receive financing for a project. The recent experience of a 3-year delay in the

delivery of 25 MW of power from another IPP, Puna Geothermal Venture, illustrates why HELCO must continue to plan for both near-term and long-term power generation independently of IPP proposals. For example, if an IPP were to be awarded a contract and commence work on the project but, for some unforeseen reason, its proposed facility were delayed beyond 1996, HELCO would have to be prepared with alternative generating capacity in order to fulfill its obligation to serve the public.

IPP projects have been proposed by Waimana Enterprises, Inc. (WEI), which would develop the project as Kawaihae Cogeneration Partners (KCP); Enserch Development Corporation; Hui 'Enekinia Hawaii Partners; Puna Geothermal Venture; Hilo Coast Processing Corporation; and True/Mid-Pacific Geothermal Venture. None of these facilities are planned for completion within a time frame that will meet the need for more electricity by January 1995.

On July 27, 1993, the Hawaiian Homes Commission (HHC) authorized a land lease to WEI for a site in Kawaihae. KCP's proposal is for a 58-MW power facility to become operational by late 1996. The successful development of a facility in Kawaihae in late 1996, however, does not address the system need for additional reserve generating capacity required in January 1995. As of December 7, 1993, WEI had signed the lease but the chair of HHC had not.

As of November 31, 1993, neither Enserch nor Hui 'Enekinia had acquired a project location and, consequently, those proposals cannot be fully evaluated for potential to meet current energy needs. True/Mid-Pacific Geothermal Venture has a 25-MW, as-available, purchase power contract with HELCO, subject to PUC approval. True/Mid-Pacific has stated that its intended schedule is to supply 12.5 MW by December 31, 1995, and a second 12.5 MW by December 31, 1997. However, HELCO has not been apprised of any recent activity by True/Mid-Pacific in relation to its geothermal wells or power facility that would confirm the validity of the proposed schedule.

HELCO proposes to develop up to 168 MW of generating capacity on a site near Puu Anahulu, in the North Kona District, to meet the long-term energy needs of West Hawaii for the year 2000 and beyond. However, this West Hawaii Power Facility will not meet the near-term need for energy because of the time required to obtain the necessary site permits and approvals. The first unit (DTCP, Phase 1) of this facility is targeted for commercial operation in the year 2000. If any IPP is awarded a contract and is able to construct and operate a power facility by the earliest proposed date of late 1996, HELCO may be able to defer some phases of the West Hawaii Power Facility. However, HELCO cannot incorporate IPP proposals into its resource planning until a contractual agreement (which would be subject to PUC approval) has been negotiated between the IPP and HELCO. To date, HELCO does not have a contract with any of the proposed IPP projects.

In addition to proposed IPP projects, three IPPs now provide power to HELCO: Hamakua Sugar Company (10 MW or 5 percent of firm capacity), Hilo Coast Processing Company (18 MW or 9 percent), and Puna Geothermal Venture (25 MW or 12 percent). Each is located on the east side of the Island of Hawaii. The combined power generated by these three IPPs is significant, although Hamakua Sugar Company will not be in operation after 1994 and power to be provided by HCPC is uncertain because of its plans to discontinue sugar operations in late 1994. Firm

capacity provided by IPPs has been incorporated into HELCO's resource planning. As stated previously, even with the power now provided by IPPs, a unit addition at Keahole is needed.

1.4 Project Location

Keahole Generating Station is located in the North Kona District on the west side of the Island of Hawaii. The site is approximately 1 mile east of Keahole Airport and 750 feet east of Queen Kaahumanu Highway (Figure 1-3). Access to the generating station from Queen Kaahumanu Highway is from a 16-foot-wide, paved roadway. The project site, Tax Map Key 7-3-49:36, is 14.998 acres and is owned in fee by HELCO. The developed area of the site, 3.1 acres, is relatively flat. The undeveloped portion of the parcel, approximately 12 acres, is also predominantly flat and consists of lava flows, grasses, and low brush.

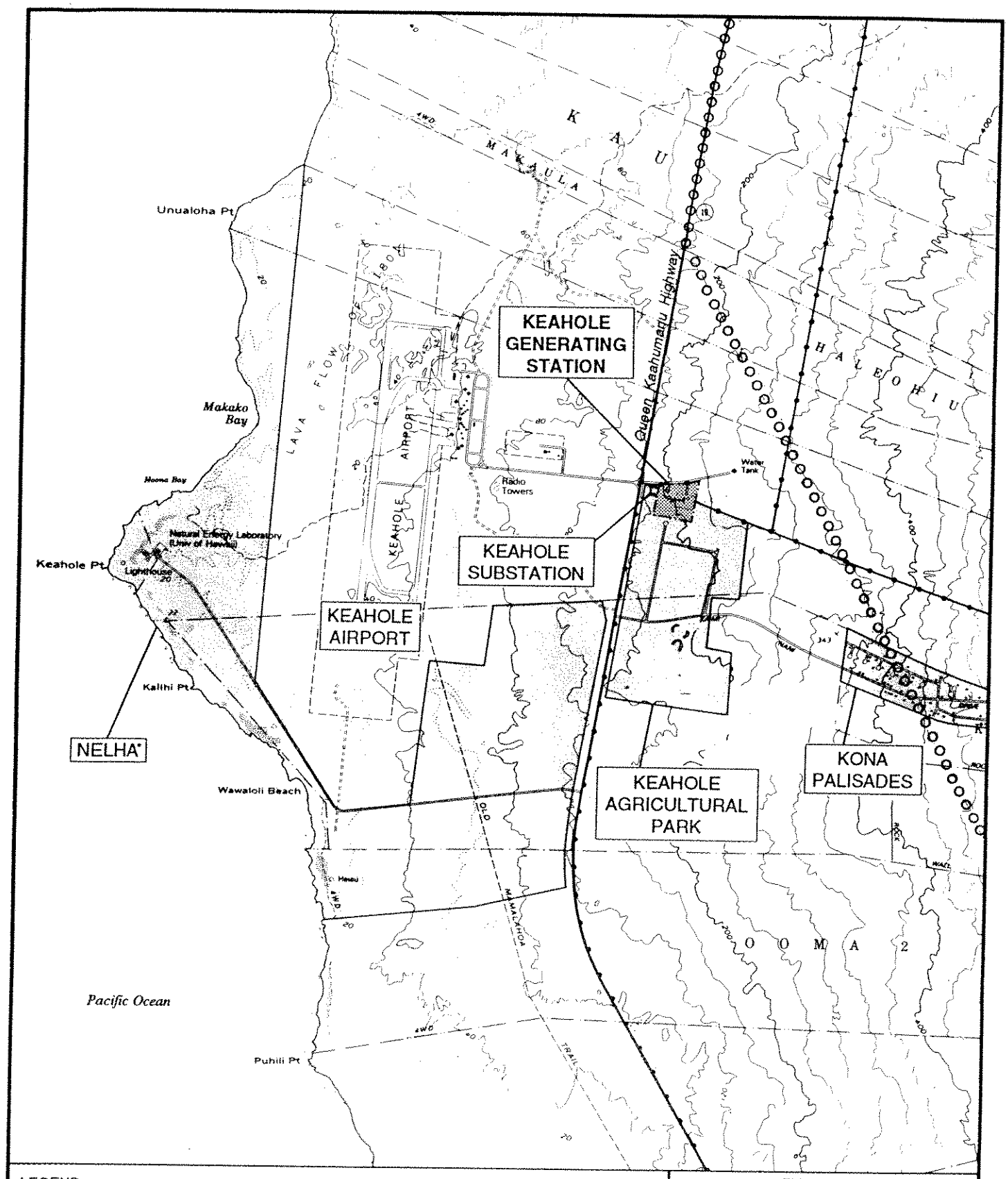
Immediately north and east of the project site are vacant areas of open lava flows. To the south and west of the project site is Keahole Agricultural Park, a subdivision of approximately 5-acre lots used for diversified agriculture. Single-family dwelling units have been developed on 22 of the 34 lots. The nearest residential subdivision, Kona Palisades, is located southeast of the project site.

Just west of Keahole Airport is the Natural Energy Laboratory of Hawaii Authority (NELHA). The NELHA facilities, located on 870 acres, were created by the State of Hawaii to conduct research, development, and commercialization of alternative energy and related technologies. Commercial companies located at NELHA specialize in a variety of land-based operations, including the production of algae, finfish, crustaceans, and mollusks. Other tenants are researching alternative energy, ocean instrumentation, marine biotechnology, and desalination.

1.5 Project Description

Phase 1 of the proposed project will add a 20-MW, oil-fired, simple-cycle CT to the power generating station. Phase 2 will add a second 20-MW CT. In Phase 3, the two simple-cycle CTs will be converted to a combined-cycle unit by adding two heat recovery steam generators and a steam turbine-generator. Together, these components will constitute a 56-MW DTCC unit, for a total generating capacity of 86.25 MW onsite. The BESP installation will add 5 MW for 3 hours (or 10 MW for 1.5 hours) of peak shaving capability and operating reserve.

The site plan for the existing generating station is presented in Figure 1-4. Figure 1-5 shows the site plan of Phase 1 development for the first CT, Figure 1-6 shows the site plan with the second 20-MW expansion, and Figure 1-7 shows the site plan of the fully developed 56-MW addition.



LEGEND

69 kV Transmission Line

OOOOO Underground Injection Control Line

* NELHA = Natural Energy Laboratory of Hawaii Authority

Source: HELCO, 1992

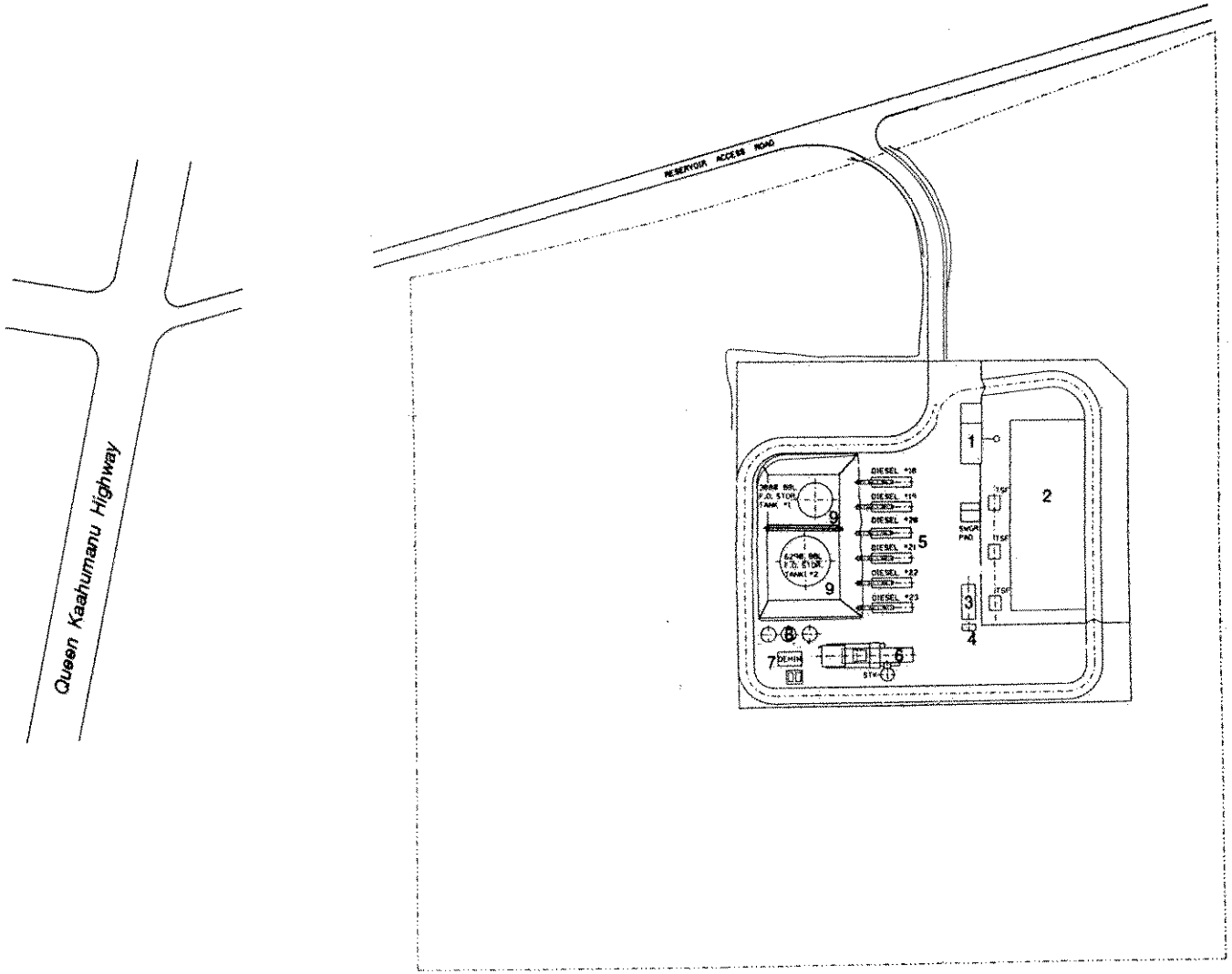
FIGURE 1-3

KEAHOLE GENERATING STATION AND VICINITY

NORTH

0 3000 FEET

CH2M HILL



LEGEND

Number	Description
1	Control House
2	Switching Station
3	Control Room
4	Emergency Diesel Generator
5	Diesel Generators (5)
6	Combustion Turbine
7	Demineralizer
8	Demineralized Water Storage Tanks
9	Fuel Oil Storage Tanks

Source: HELCO, 1992

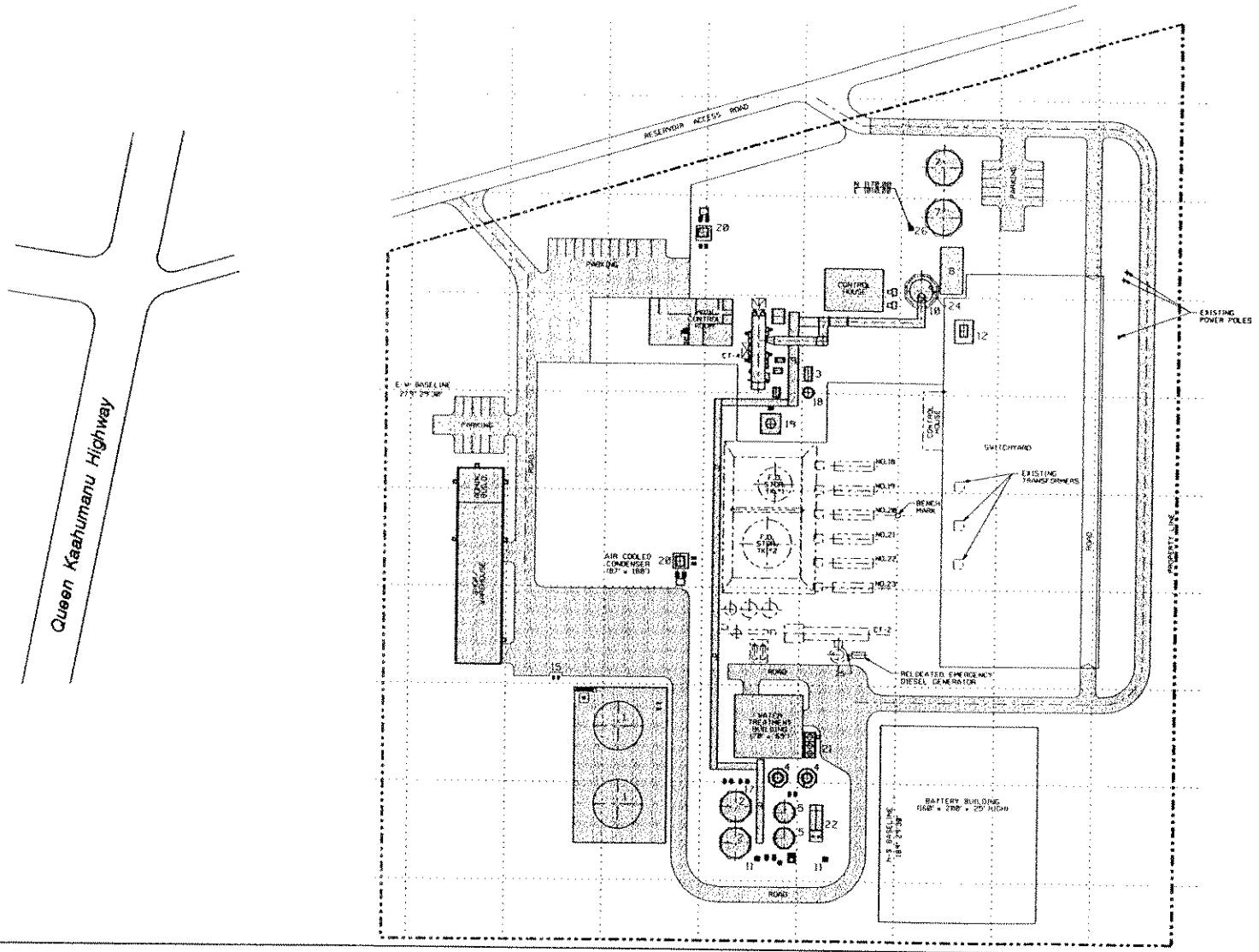
FIGURE 1-4

EXISTING FACILITIES SITE PLAN

NORTH

0 100 200 FEET

CH2M HILL



LEGEND

New Facilities

Number	Description
1	Fuel Oil Storage Tank
2	Demineralized Water Storage Tank
3	Water Injection Pumps for Combustion Turbine
4	Neutralization Tank with Containment Wall
5	Waste Water Tank
7	Fire/Service Water Tank
8	Fire Pump House
9	Pipe Rack
10	Dual Flue Stack
11	Injection Well
12	Transformer
15	Fuel Oil Unloading Facilities
17	Demineralized Water Transfer Pumps
18	Demineralized Water Day Tank
19	Fuel Oil Day Tank
20	Oil/Water Separator
21	Sulfuric Acid and Caustic Soda Storage
22	Solid Settling Basin
24	Diesel Flue Exhaust
25	Relocated Backstart Diesel
26	Brackish Water Supply Well

Source: HELCO, 1993

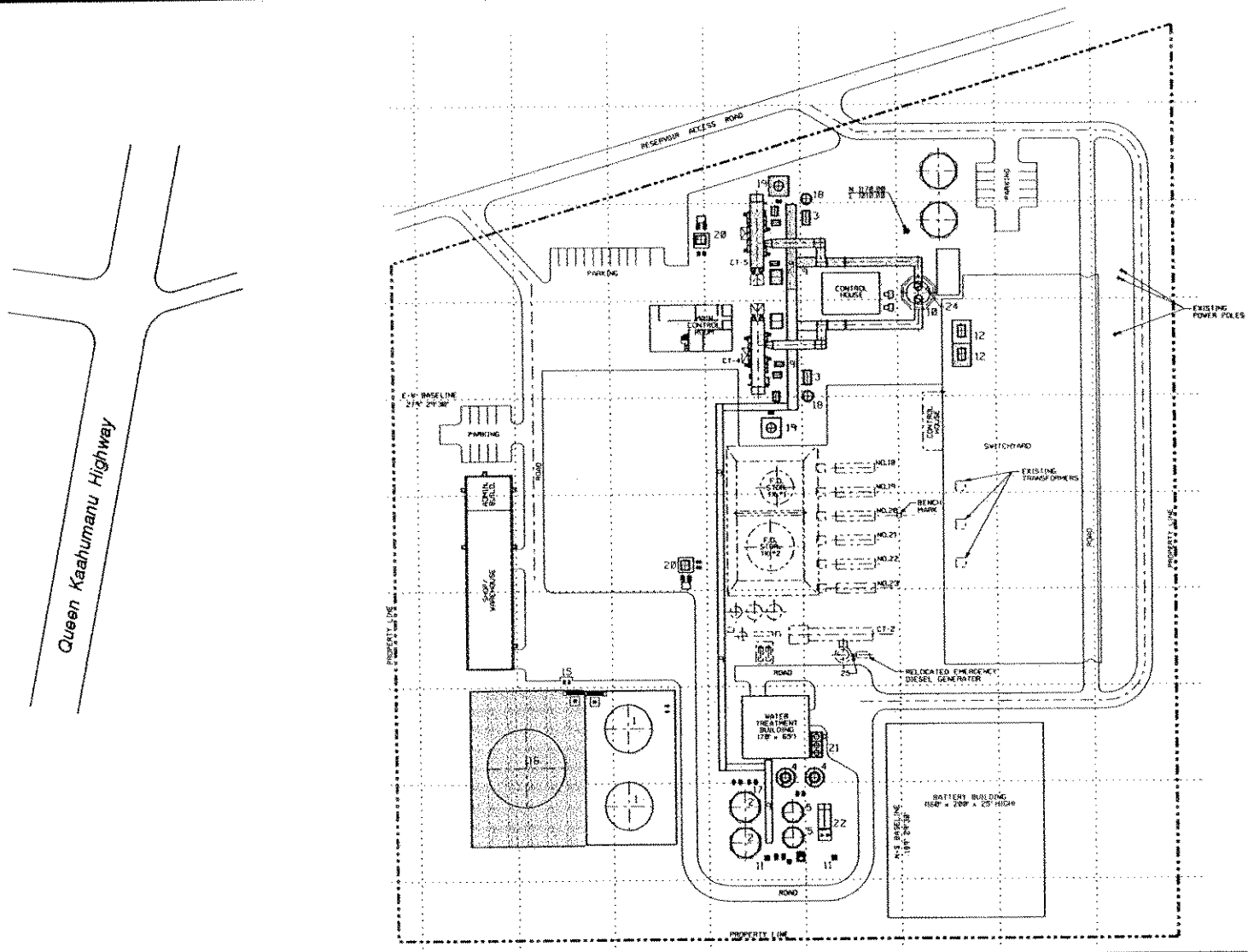
FIGURE 1-5

PHASE 1 20-MW EXPANSION SITE PLAN

NORTH

0 100 200 FEET

CH2M HILL



LEGEND

New Facilities

Number	Description
1	Fuel Oil Storage Tank
2	Demineralized Water Storage Tank
3	Water Injection Pumps for Combustion Turbine
4	Neutralization Tank with Containment Wall
5	Waste Water Tank
7	Fire/Service Water Tank
8	Fire Pump House
9	Pipe Rack
10	Dual Flue Stack
11	Injection Well
12	Transformer
15	Fuel Oil Unloading Facilities
16	Fuel Oil Storage Tank
17	Demineralized Water Transfer Pumps
18	Demineralized Water Day Tank
19	Fuel Oil Day Tank
20	Oil/Water Separator
21	Sulfuric Acid and Caustic Soda Storage
22	Solid Settling Basin
24	Diesel Flue Exhaust
25	Relocated Backstart Diesel
26	Brackish Water Supply Well

Source: HELCO, 1993

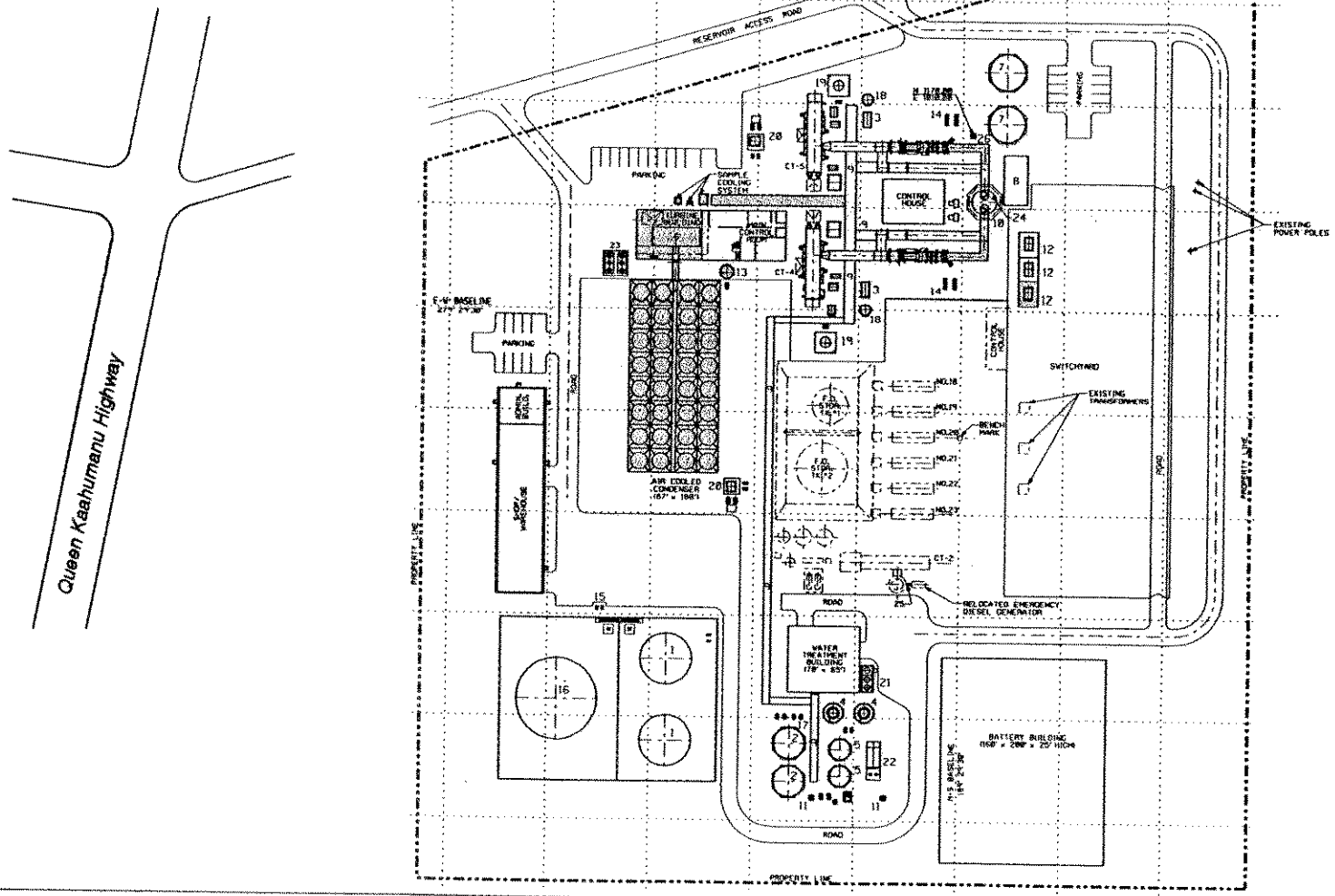
FIGURE 1-6

PHASE 2 ADDITIONAL 20-MW EXPANSION SITE PLAN

NORTH

0 100 200 FEET

CH2M HILL



LEGEND

New Facilities

Number	Description
1	Fuel Oil Storage Tank
2	Demineralized Water Storage Tank
3	Water Injection Pumps for Combustion Turbine
4	Neutralization Tank with Containment Wall
5	Waste Water Tank
6	Steam Turbine
7	Fire/Service Water Tank
8	Fire Pump House
9	Pipe Rack
10	Dual Flue Stack
11	Injection Well
12	Transformer
13	Condensate Storage Tank
14	HRSG Feed Pumps
15	Fuel Oil Unloading Facilities
16	Fuel Oil Storage Tank
17	Demineralized Water Transfer Pumps
18	Demineralized Water Day Tank
19	Fuel Oil Day Tank
20	Oil/Water Separator
21	Sulfuric Acid and Caustic Soda Storage
22	Solid Settling Basin
23	Turbine Lube Oil Radiator
24	Diesel Flue Exhaust
25	Relocated Backstart Diesel
26	Brackish Water Supply Well

FIGURE 1-7

PHASE 3 56-MW EXPANSION SITE PLAN

NORTH

0 100 200 FEET

CH2M HILL

In addition to the combustion turbines, related structures and features include the following:

- Condensate and demineralized water storage tanks
- A shop and warehouse
- An administrative building
- A new control room
- A steam turbine building
- An air-cooled condenser
- An exhaust stack approximately 104 feet high
- Fuel oil storage facilities
- Well water supply facilities
- A water treatment building
- Wastewater disposal systems
- A switching station conversion and addition
- A battery energy storage plant

The simple combustion turbine engine consists of three components: a compressor, a combustor, and a turbine, which is coupled to a generator. Efficiency of the simple-cycle, combustion-turbine plant can be increased by feeding the exhaust gas (1,000°F) into a heat recovery steam generator (HRSG) to utilize the waste heat. The hot, exhaust gas from the combustion turbine is used to make steam. This steam then drives a steam turbine-generator, and additional power is produced with essentially no additional consumption of fuel. The configuration of a simple-cycle combustion turbine and a dual-train, combined-cycle CT is shown in Figure 1-8.

The BESP will consist of:

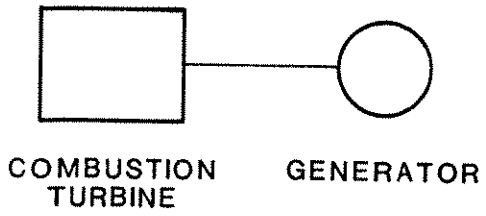
- A 5-MW, 3-hour battery system consisting of valve regulated lead acid (VRLA) cells. The VRLA design uses a sealed case design with a gel-type electrolyte.
- A 10-MW (maximum), solid-state, power conversion unit.
- A step-up transformer and circuit breakers to interface with the 69 kV switchyard at Keahole.

In order to increase system reliability, the switching station will be converted from a straight bus configuration to a breaker-and-a-half configuration.

1.5.1 Fuel and Fuel Handling

The combustion turbines will be fueled by No. 2 diesel oil. The fuel will be transported by tanker truck from Hilo until fuel storage facilities are available at Kawaihae. A 30-day supply of fuel is routinely stored at a generating site. Approximately seven to eight fuel tanker trucks per day may be required to provide fuel to the generating station at full build-out. Fuel trucks will unload at a site location designed to contain any spilled fuel.

SIMPLE CYCLE: 20 MW



DUAL-TRAIN COMBINED-CYCLE: 56 MW

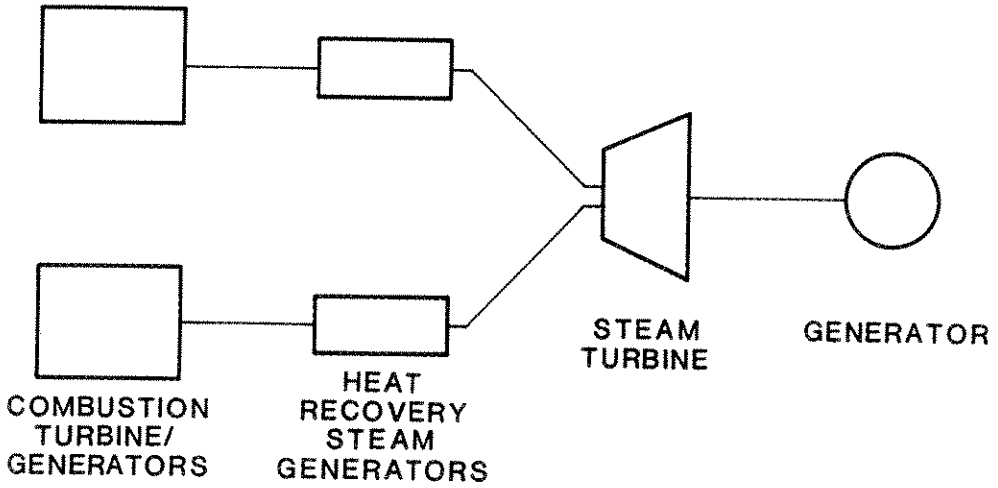


FIGURE 1-8

COMBUSTION TURBINE CONFIGURATIONS

Source: HELCO, 1992

CH2M HILL

The fuel will be stored in three new cylindrical tanks. Two of the fuel tanks, initially installed with the first combustion turbine, will be 50 feet in diameter and approximately 42 feet high; these tanks will hold approximately 600,000 gallons of fuel each. The other new fuel tank will be 80 feet in diameter and approximately 42 feet high and will hold approximately 1.5 million gallons of diesel fuel. A total of 2.7 million gallons of bulk fuel storage capacity will be added to the site.

All storage tanks will be placed on impervious surfaces and within berms designed to contain any leakage or spills. A stormwater runoff pond, as well as bermed surfaces, will be equipped with oil-water separators to remove any oil before disposing of the stormwater. Waste oil will be shipped offsite for processing and disposal.

The Keahole Generating Station currently consumes about 20,000 gallons of fuel per day. The deliveries average about 8,000 gallons per truck. When operating at full power, each new CT will consume approximately 39,000 gallons of fuel per day. When operated in a peaking or intermediate cycle mode, a 20-MW CT will typically consume 10,000 to 20,000 gallons of diesel fuel per day. As CT-5 and the HRSG units are brought on-line, the operation of the existing diesels and CT-2 is anticipated to be reduced by approximately 90 percent of the current operating schedule. The reduced operation of the diesels and CT-2 will result in a reduction of fuel delivery for these units at Keahole, as well as in reductions in noise and emissions. In 1998, with the completion of Phase 3 and prior to the planned retirements, the Keahole facility is estimated to consume approximately 54,900 gallons of fuel per day. After the retirement of diesels planned by year 2000, consumption is projected to decrease to approximately 45,000 gallons per day.

HELCO takes a variety of precautions to ensure that oil spills do not occur and that, if any oil were to spill, it would be promptly contained. Oil is delivered to the site by tanker truck. Fuel unloading occurs on an impervious unloading area, and the unloading operation is monitored by the driver. Connecting hoses contain check valves to prevent release of fuel when not fully connected. Any minor spills or drips are collected and recycled.

Fuel storage tanks have a high-level alarm to prevent overfilling and a visible gauge that is monitored by the driver during the unloading operation. The fill point on the gauge is well below the point at which the high-level alarm is triggered. Storage tanks are located within an impervious containment area that has sufficient capacity to contain the entire contents of a storage tank. The tanks are cathodically protected to prevent any internal corrosion. As a precaution, bottom draw samples from the tanks are taken regularly and analyzed for contaminants that might indicate a corrosion problem in the tank.

Employees at the facility are trained in the proper procedures for detecting and controlling oil leaks. New employees receive training before starting work at the site.

The State Department of Transportation, Airports Division, has proposed construction of a fuel pipeline from Kawaihae Harbor to Keahole Airport. The proposed pipeline, approximately 27 miles long, would follow the Queen Kaahumanu Highway alignment. A 12-inch-diameter pipeline would transport multiple products including gasoline, jet fuel, aviation gas, and diesel

fuel through a single line. As a customer of this pipeline, HELCO could benefit from a lower cost of fuel delivery. Such a pipeline could eliminate the need for fuel tanker trucks. The pipeline to Keahole Airport, however, will not be constructed until the economics of increased air traffic make the project economically feasible.

1.5.2 Project Schedule and Cost

The total cost to construct and place in service all three phases of the proposed project is approximately $102,105,500. A breakdown of costs and schedule by phase is shown in Table 1-4.

Table 1-4
Project Schedule and Cost

Phase	Unit	Cost	Operation Date
1	CT-4	$36,965,700	July 1, 1995
2	CT-5	$25,141,300	Sept. 1, 1995
3	ST-7	$39,998,500	Oct. 1, 1997

It is estimated that the cost to ratepayers for the project will be an additional 1.76 cents per kilowatt-hour (in 1998). Ultimately, the ratepayer bears some risk associated with the purchase of fuel (regardless of whether it is oil, coal, etc.). This risk is minimized, however, by the lengthy PUC approval process for rate increases, which does not allow for instant decreases or increases to the spot market price.

Section 2

Alternatives

2.1 No Action

Under the No Action Alternative, the additional generating needs identified in the Resource Plan (Table 1-1) would not be met. HELCO considered the following issues in evaluating the No Action Alternative:

- Resource planning has identified the need for a unit addition to the system in January 1995.
- Development of Demand-Side Management (DSM) energy programs will not offset the need for a unit addition in January 1995.
- The projects being proposed by IPPs will not meet or replace the need for the proposed HELCO generating unit addition in January 1995.
- The scheduled retirement of older generating equipment can be deferred for a short time in order to accommodate permitting delays; however, this action does not ensure continued operating reliability nor offset the identified need for a unit addition in January 1995.

HELCO concluded that the No Action Alternative would not allow HELCO to meet its franchise agreement to provide reliable power to its customers. Therefore, HELCO cannot consider the No Action Alternative a viable alternative and has not evaluated it further.

2.2 Alternative Sites

In 1988, a siting study was conducted to identify candidate sites for the development of a 200-MW generating facility in West Hawaii. The study area encompassed the districts of North and South Kohala, North and South Kona, and a portion of the District of Kau. The siting study was conducted by CH2M HILL, an environmental consulting firm. CH2M HILL formed a Community Advisory Group (CAG) at the beginning of the study to evaluate siting criteria and results. The CAG met three times, participated in each phase of the study, and visited several of the proposed sites.

The siting process consisted of two phases of screening. In Phase I, general areas suited for siting were mapped by identifying unsuitable areas, areas of potential constraint, and areas of opportunity. Unsuitable areas were defined as 100-year and 500-year floodplains, military lands, designated or planned parks, recognized significant historic or cultural areas, planned resort/other commercial developments, land zoned for residential or commercial use, air quality nonattainment areas, and mapped unique habitat areas.

Areas of potential constraint were defined as hazard areas (seismic faults, known slide areas, volcano hazard zones, steep slopes), Special Management Areas, Conservation lands, and land inside the underground injection control line. Areas of opportunity were defined as areas within 5 miles of existing or planned major arterial or larger roadway, and areas within 10 miles of an existing power transmission line. Twenty-one candidate sites were identified at the end of this phase (Figure 2-1). One location was a 30-acre site on State land adjacent to Keahole Generating Station. This site did not meet the criteria for a 200-MW generating station.

In Phase II, sites were screened on the basis of the following criteria:

- Land use issues

  Site ownership
  Site size
  Current land uses
  Zoning
  General plan

- Environmental issues

  Air quality sensitive receptors
  Air quality dispersion
  Noise
  Visual impact
  Underground injection control (UIC) boundary/water discharge
  Natural habitat
  Wetlands
  Flood hazards
  Geologic hazards
  Archaeological and cultural resources

- Cost/operation issues

  Transmission line access
  Fuel transport
  Road access to site
  Water supply
  Waste treatment and disposal

- Site development issues

  Site development difficulty
  Buffer opportunities

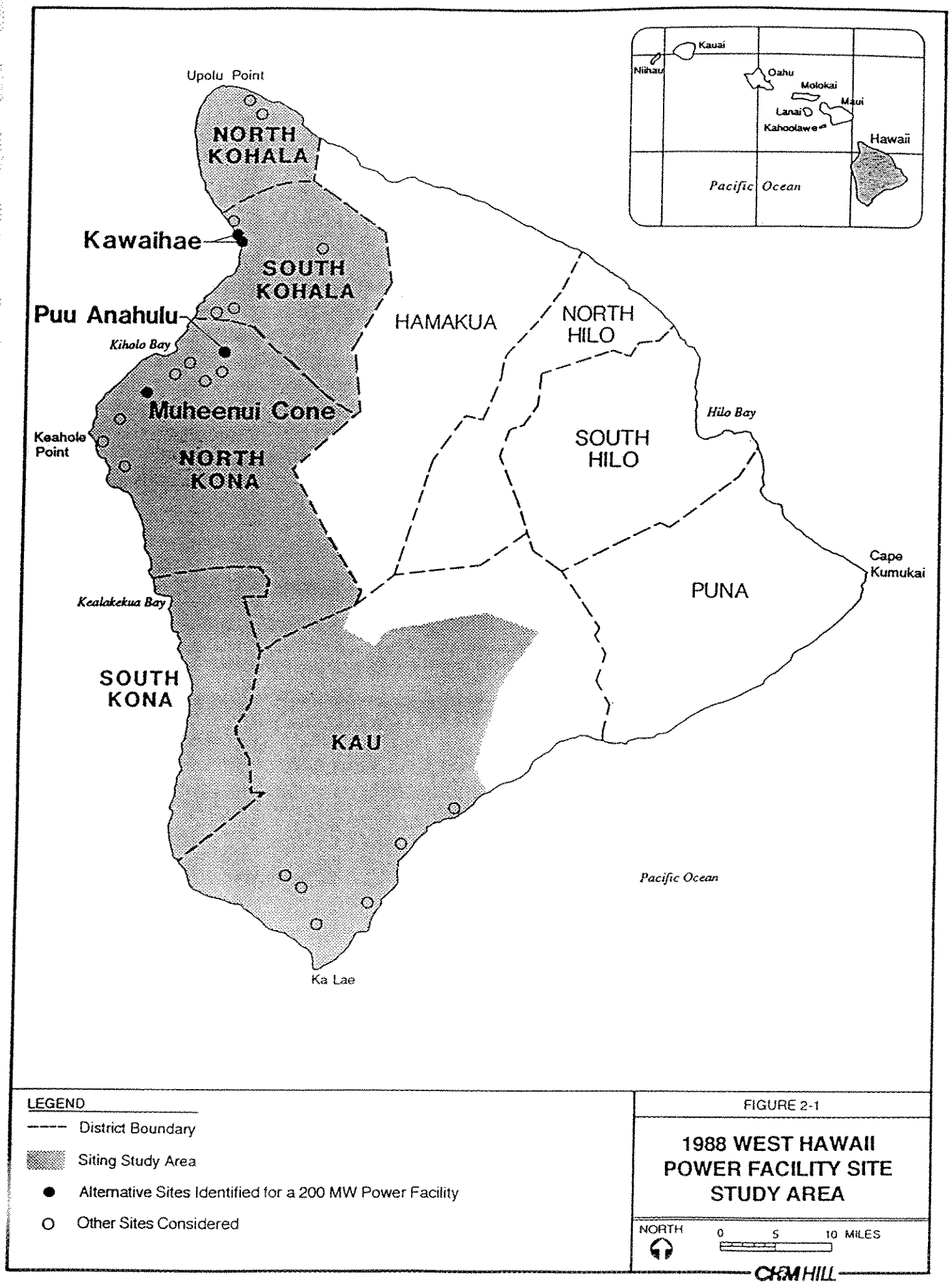


FIGURE 2-1

1988 WEST HAWAII POWER FACILITY SITE STUDY AREA

At the completion of the siting study, four sites located in the northwestern portion of the study area were identified and recommended for further evaluation. They were referred to as follows:

- Kawaihae "A"
- Kawaihae "B"
- Muheenui Cone
- Proposed Puu Anahulu landfill site

The Kawaihae A site was located on land under the jurisdiction of the Hawaiian Homes Commission (HHC). The Kawaihae B site was located on lands under the jurisdictions of HHC and the State. A third site in Kawaihae, also under HHC jurisdiction, was subsequently identified by HHC and referred to as Kawaihae C. Attempts by HELCO to acquire these sites from HHC have been unsuccessful. The Muheenui Cone was eliminated from further consideration because of private development plans by the landowner.

With the elimination of Muheenui Cone and no assurance of securing a site in Kawaihae, HELCO turned its attention to the proposed landfill site, located in the vicinity of Puu Anahulu. In early 1990, alternative sites were evaluated for the power facility in the vicinity of the proposed landfill.

After this evaluation, the County moved the proposed landfill site to another area in the vicinity of Puu Anahulu. Late in 1991, the State approved the landfill site. A 15-acre site for the power facility was subsequently identified adjacent to and northeast of this approved landfill site. In early 1992, HELCO submitted a formal request to acquire the site and initiated site studies, agency consultation, and preparation of a Draft EIS. The 15-acre site, known as the Puu Anahulu site, represents HELCO's long-term facilities planning for the development of a 168-MW facility.

There is an immediate need for additional generating capacity in early 1995, and the time required for permitting, site acquisition, and site development at Puu Anahulu will not meet this immediate need. Consequently, expansion of Keahole Generating Station is the only site available to meet HELCO's immediate needs for the following reasons:

- The site is owned by HELCO and is large enough to accommodate the proposed expansion.

- The proposed expansion in 1995 will meet the need to add new generating capacity.

- The proposed unit addition will improve overall system reliability and keep additional capital, operating, and maintenance expenses at a reasonable level.

- The proposed expansion will optimize the benefits of using existing utility infrastructure.

- Developing new generating units in West Hawaii near the area of demand will reduce transmission line losses and will reduce the need for transmission line construction between East and West Hawaii.

2.3 Alternative Technologies

Both the County of Hawaii and the State of Hawaii have a policy of reducing dependence on fossil fuels for energy by promoting development of local natural energy resources. Currently, petroleum provides approximately 60 to 65 percent of the County of Hawaii's energy needs.

Alternative energy sources being developed or in use in the County include biomass conversion, geothermal, hydroelectric, solar, wind, ocean thermal energy conversion, and coal. These technologies are expected to play an increasing role in energy production on the Island of Hawaii; however, in some cases the timing of their technological development and commercial availability to provide firm generating capacity is uncertain. A bibliography of alternative technology development in Hawaii is presented in the December 1992 Draft EIS, Volume II, Appendix A.

2.3.1 Biomass Conversion

Biomass conversion involves cultivating and harvesting plants as a natural energy alternative to fossil fuels. Biomass can be used as a fuel for combustion to produce thermal energy which is then converted to electrical power.

The fibrous waste associated with sugar cane processing, referred to as "bagasse," is used to produce electricity on the Island of Hawaii. HELCO currently purchases 18 MW or 9 percent of its firm capacity from Hilo Coast Processing Company (HCPC), and 10 MW or 5 percent of its firm capacity from the Hamakua Sugar Company. Other potential biomass sources of energy include macadamia nut hulls and wood chips.

A reduction in firm capacity is expected as a consequence of the decline of the sugar industry on the Island of Hawaii. Hamakua will cease operations in 1994 and terminate the production of 10 MW of firm capacity. HCPC is also scheduled to shut down its sugar cane operations in 1994. Although HCPC may continue to provide energy by burning coal, permits for the alternative fuel and contractual agreements have not been secured.

2.3.2 Geothermal Energy

Geothermal energy is natural heat energy from the earth that can be harnessed for electrical power generation. This energy may be found as steam, hot water, magma, or hot, dry rock. Geothermal energy is recognized as the renewable resource with the greatest potential to provide large-scale, baseload electric energy generation on the Island of Hawaii. HELCO has contracted with Puna Geothermal Venture to supply 25 MW of geothermal-generated electricity. PGV has indicated an interest in providing additional capacity and is currently discussing this with HELCO. HELCO also has an as-available contract, subject to PUC approval, with True/Mid-Pacific

Geothermal Venture for additional geothermal-generated electricity. Additional discussion on geothermal energy production by independent power producers is presented in Sections 2.4.1 and 2.4.2.

2.3.3 Hydroelectric Power

Hydroelectric power involves using water from streams or rivers for generating electrical energy. On the Island of Hawaii, hydroelectric power provides only a small portion of the County's electrical energy (13.3 MW) because of limited hydropower generation opportunities. The rivers are relatively short, and few valleys or gorges can be dammed effectively. Because of the intermittent nature of the hydroelectric resource on the Island of Hawaii, hydroelectric power is purchased as "as-available" rather than firm capacity.

HELCO has four hydroelectric units on the Wailuku River in Hilo that can generate up to 3.35 MW, depending on river flow. HELCO also has an as-available contract with the Wailuku River Hydroelectric Power Company for up to 10 MW of energy. The contract is "as available" because stream flows are variable and energy can be generated only when sufficient water is available in the river. Because dams, which would allow water storage, are not feasible, the amount of hydroelectric energy that can be generated in Hawaii is limited.

2.3.4 Solar Energy

Solar energy comes from the radiation of the sun, and it can produce electrical power directly via photovoltaic cells or solar thermal electric systems. No large-scale, commercial, solar-powered electric generating facilities are located on the Island of Hawaii. Solar energy is a power source that could be used in the future. However, to be a reliable source of electricity at night and during extended cloudy periods, it must be coupled with an energy storage system.

Although such large-scale, solar-powered electric generation facilities have been shown to be technically feasible, they are not currently economical, especially if energy storage costs are included. A solar-powered electric generating facility is also land intensive and would require a larger amount of land than a fossil-fuel facility would. Approximately 170 to 280 acres would be needed for a 56-MW solar energy facility.

2.3.5 Wind Energy

Wind energy can be used to generate electricity through windmill electrical generators. Lalamilo Ventures, Inc. (LVI), a subsidiary of Hawaiian Electric Industries, has been operating wind farms on the Island of Hawaii. LVI currently operates a wind farm (2.3 MW) at Lalamilo that provides energy to the County of Hawaii for water pumping; any excess energy produced is sold to HELCO. From its South Point installation, Kamaoa Wind Energy Partners supplies 7 MW of power to the HELCO system. Energy generated by the wind farms is typically intermittent and is considered "as-available" energy. For planning purposes, electric utilities normally do not include intermittent or nondispatchable sources of energy production as assured system generating capacity.

Wind farms generally have been maintenance intensive and not cost effective. For wind energy to be a reliable energy source, it must also have an energy storage component. Although wind energy technology has been advancing, it is not competitive with other conventional technologies. HELCO is an active participant with the State Department of Business and Economic Development—Energy Division, on its Wind Pumped Hydroelectric Integration and Test at Kahua Ranch Facilities. In addition, HELCO is represented on a Facilities Oversight Board for Kahua Ranch activities.

2.3.6 Ocean Thermal Energy Conversion

Ocean thermal energy conversion (OTEC) is a form of solar energy in which the ocean acts as a solar heat collector. This process uses the thermal differences between the warm surface waters and the cold deep waters to power a turbine-generator for electrical power generation. OTEC is an emerging technology, and no commercial plants for electrical power generation are operational yet.

NELHA at Keahole Point is the site for research and development of the use of OTEC systems as an alternative energy source. Hawaiian Electric Company, Inc. (HECO) is a participant in a 100-kilowatt (kW) demonstration project at the NELHA complex. OTEC systems are promising as a future alternative energy source with the possibility of providing firm capacity.

2.3.7 Coal

Coal technology received extensive evaluation as an energy resource during HELCO's preparation of its Integrated Resource Plan (IRP). The IRP is available at public libraries. In developing its IRP, HELCO was required to consider all supply-side and demand-side resource options, including coal technology, that are appropriate for Hawaii and are available in the planning horizon. HELCO identified and assessed supply-side resource options in *Supply-Side Resource Option Portfolio Development, Final Report*, prepared by Black & Veatch and issued in July 1993. This report is available from HELCO for review. Coal technology is one of the supply-side resource options evaluated in the report.

The approach used in the assessment included the identification of a wide range of commercial and developing resources appropriate for consideration as potential supply-side resource options. These resources were then screened to eliminate resources not appropriate, or reasonably available, for Hawaii or the HELCO system. The resources were further screened to develop a listing of commercially available and developing resources that would be evaluated in detail during the assessment process.

The intent of the screening process was to place all resource options into one of three categories: commercial, developing, or other. Coal is categorized as a commercial resource option. Commercial resources are those considered to be available for utility application in the 1994 to 1999 time frame and that meet the following five criteria:

- Vendor availability
- Proven technology
- Utility scale
- Well-established capital and operating costs
- Resource availability

A coal-fired facility would not fit HELCO's operations, which have two daily peak demands for power. The technology of coal-fired units does not easily allow the units to cycle their power to follow the load demand on the Island; the ability to cycle is required of any new units. A coal-fired facility was also not considered a reasonable alternative to meet the projected short-term demand because it would be more costly and would require more land for coal storage and ash disposal. The dollars-per-kilowatt installed cost for a coal-fired unit is nearly three times the installed cost for an oil-fired, combined-cycle combustion turbine plant. In addition, the coal-fired alternative would require construction of new support infrastructure at the harbor facility for receiving bulk coal shipments, including a coal ship off-loading conveyor system, a transfer loading system, and an interim coal storage area. Also, a coal-fired plant would require a land area more than 50 percent larger than for an equivalent-capacity, oil-fired, combined-cycle plant. The larger land area would be needed to accommodate coal storage, waste products storage, and wastewater ponds. Finally, a coal-fired facility could not be developed by 1995.

2.4 Independent Power Producers

2.4.1 Puna Geothermal Venture

HELCO has a purchase power agreement with PGV under which PGV was committed to deliver 25 MW of firm capacity by December 31, 1990. PGV experienced technical difficulties during development of its facility, but on June 25, 1993, PGV successfully completed the testing required to demonstrate that the facility is capable of producing 25 MW of electricity. With the completion of a transmission interconnection facility on June 27, 1993, the 25 MW of power produced by PGV is now considered firm capacity within HELCO's generating system.

HELCO's resource plan (Table 1-1), which identifies the schedule for installation and retirement of generating units, includes PGV's 25-MW capacity. The availability of 25 MW from PGV, however, has not deferred the need for the first two phases of the proposed 56-MW unit addition to the Keahole Generating Station, because additional capacity is required to allow for the scheduled retirement of older generating equipment in West Hawaii. PGV has indicated its interest in providing additional capacity, and discussions with HELCO are ongoing. Increasing PGV's production of power may require the development of another reinjection well and a backup production well. Additional permits from the State and County would also be required. A system study analyzing these issues, as well as necessary transmission improvements, is currently under way.

2.4.2 True/Mid-Pacific Geothermal Venture

The PUC is currently considering a 25-MW,"as-available" purchase power agreement between HELCO and True/Mid-Pacific Geothermal Venture, a geothermal energy developer that is in the process of acquiring the necessary permits to resume drilling operations. True/Mid-Pacific Geothermal Venture has stated that its intent is to supply 12.5 MW by December 31, 1995, and a second 12.5 MW by December 31, 1997. HELCO, however, is not aware of any recent activity by True/Mid-Pacific in relation to its geothermal wells or power facility that would confirm the validity of its proposed schedule.

2.4.3 Hilo Coast Processing Company

HCPC currently provides 18 MW of firm capacity to HELCO. The company is scheduled to cease its sugar cane processing operations in 1994, and it will no longer be able to provide bagasse-generated electricity. However, HCPC is now evaluating whether to convert its power facility to use an alternative fuel, probably coal. If HCPC converts to an alternative fuel, it should be able to provide 20 MW of electricity because the loss of its sugar cane operations will also mean the loss of the associated energy requirements. HCPC is also evaluating additional options that may result in increased generation capacity to 22 MW (with modifications to the transmission interconnection) or 30 MW (with major modifications to the generating system). Alternatively, HCPC may decide not to convert to an alternative fuel and to stop providing electricity when its sugar cane operations cease. HELCO expects that a decision may be reached by the end of 1993. A fuel change will necessitate a new contractual agreement with HELCO and additional air permits. HELCO's resource planning assumes that HCPC will continue to provide electricity through 2013.

2.4.4 Proposals to Develop a Power Plant at Kawaihae

The Department of Hawaiian Home Lands (DHHL) published a Request for Proposals (RFP) in September 1992 for construction and operation of a power generating plant in Kawaihae. Applications were open to native Hawaiians and organizations owned or controlled by native Hawaiians. The deadline for submission of proposals was November 16, 1992. Three proposals were submitted, one of which was nonconforming. DHHL rejected all three proposals.

DHHL solicited proposals once again from native Hawaiians and organizations owned or controlled by native Hawaiians. An RFP was published in March 1993. On May 26, 1993, the Hawaiian Homes Commission notified Waimana Enterprises, Inc. (WEI) that WEI was the only qualified bidder for the industrial lease at Kawaihae, and that DHHL was prepared to enter into negotiations with WEI. On July 27, 1993, the Hawaiian Homes Commission authorized a land lease to WEI for a site in Kawaihae, although no lease agreement has been finalized. A 58-MW cogeneration power facility has been proposed by WEI through Kawaihae Cogeneration Partners (KCP) to become operational in late 1996. KCP has stated plans to operate a desalination plant along with the power generation facility.

The successful development of a facility in Kawaihae in late 1996, however, will not offset the need for CT-4 at the Keahole Generating Station. The proposed unit addition to the Keahole Generating Station is essential, both to provide and maintain reliable power on the Island of Hawaii, and to balance the distribution of generating capacity between East and West Hawaii. The successful development of a generating facility by WEI, or any other IPP, in late 1996, however, may defer the need for a new West Hawaii Power Facility at Puu Anahulu in the year 2000.

2.4.5 Other IPP Proposals

In addition to WEI, HELCO also has two other IPP proposals under consideration for projects involving power production technology similar to that of CT-4. These proposals (from Enserch Development Corporation and Hui 'Enekinia Hawaii Partners), all of which fall into the 1996-97 time frame, are for sites in Hamakua, Kawaihae, and elsewhere. However, none of the proposers has yet unconditionally acquired a site. (As of November 1993, WEI had yet to sign a formal lease agreement with DHHL; the other proposers, while indicating the ability to obtain rights to a site, had yet to evidence such a right.) Negotiations are ongoing, but at present it appears that none of these proposals could be an alternative to development of CT-4 at the Keahole site by 1995.

Even the successful development of a facility by an IPP in 1996-97, however, would not offset the need for a unit addition to the Keahole Generating Station. Fifty percent of the generating capacity at HELCO's Waimea facility in West Hawaii is scheduled to be retired by 1995. The proposed unit addition to the Keahole Generating Station is essential, both to provide and maintain reliable power on the Island of Hawaii, and to balance the distribution of generating capacity between East and West Hawaii. The successful development of a generating facility by an IPP in 1996-97, however, may defer the need for a new HELCO facility at Puu Anahulu.

2.5 Deferred Retirement of Existing Units

HELCO's generation planning criteria require HELCO to be able to meet the daily peak demand should the largest available unit fail while another unit is off-line for scheduled maintenance. Currently, HELCO can meet this requirement. However, as demand for electricity grows and the reserve margin diminishes, HELCO cannot rely on the use of these older units to operate reliably over an extended period of time even with the most optimistic appraisal of what HELCO could achieve through its DSM programs.

Many factors affect the decision to retire a generating unit. Violation of HELCO's generation planning criteria reserve margin is evaluated in determining whether or not a HELCO generating unit should be retired. In addition, any one or a combination of the following factors are evaluated:

- Parts availability
- Reliability

- Operations and maintenance expenses
- Environmental concerns

The availability of major parts and components of the generating unit is critical in maintaining the generating unit for operations. Units are considered for retirement if parts are not readily available or will take an unreasonable amount of time to be manufactured and delivered to HELCO. Currently, parts for several of the older diesel units cannot be purchased and must be specially made, which increases the down time of these units for maintenance and repair.

Reliability of the unit must also be taken into account. A generating unit that is constantly out of service reduces the generation reserve margin.

Operations and maintenance expenses are another factor considered before a unit is retired, including fuel efficiency and the cost to keep the unit "available" to meet the dispatcher's needs. Generally, the electro-motive diesels operated by HELCO are costly to maintain and operate, which results in a higher overall kilowatt cost. The Waimea units are more costly to operate than the other diesel units because they require manual operation.

Environmental concerns are the final factor considered. Several of the diesel units are considered noisy or may add to local air quality degradation. HELCO places a priority on replacing such generating units as soon as possible.

The manufacture year of the existing HELCO units and their planned retirements are shown in Table 2-1.

Several of the units listed in Table 2-1 to be retired in 1995 were actually scheduled for earlier retirement. However, PGV's inability to provide firm capacity until mid-1993 resulted in deferment of these planned retirements. In addition, rather than retiring units, HELCO operated units on a continuous basis to provide baseload generation.

With the addition of PGV's baseload power in mid-1993, HELCO has been able to bring units down for overhaul and maintenance. However, during this maintenance it has become apparent that some units are no longer cost effective to maintain. In addition, the continuous use of some units has greatly increased the risk that they will malfunction in the future. For example, the three Waimea units (8, 9, and 10), manufactured during World War II, can no longer be operated at full capacity because the additional stress could cause a breakdown. Given that parts for some of these units are no longer manufactured, the next loss of a unit may result in a lengthy repair period as replacement parts are specially ordered, manufactured, and delivered to HELCO. Lengthy repair periods would result in even greater stress on HELCO's generating system.

Although HELCO could defer retirement of its generating units until they can no longer be operated, without newer replacement generation in the short term, breakdowns in the older units become more likely. This will result in a repeat of the rolling blackouts experienced on the Island of Hawaii in 1991-92. It is HELCO's responsibility to provide reliable service to the public, and HELCO will not assume such a risk. Consequently, continuing to defer retirement of existing units is not a reasonable alternative.

Table 2-1
Planned Retirements of Existing HELCO Units

Unit	Capability (MW)	Year Manufactured	Retirement Year
Steam Units			
Shipman 1	3.4	1943	1995
Shipman 3	7.5	1955	2005
Shipman 4	7.7	1958	2008
Puna	15.5	1970	undetermined
Keaau CT-3	20.0	1992	undetermined
Hill 5	14.1	1965	undetermined
Hill 6	23.0	1974	undetermined
Diesel Units			
Kaneolehua 11	2.0	1962	1995
Kaneolehua 15	2.75	1972	1997
Kaneolehua 16	2.75	1972	1997
Kaneolehua 17	2.75	1973	1998
Kaneolehua CT-1	9.0	1962	1995
Waimea 8	0.8	1943*	1995
Waimea 9	0.9	1943*	1995
Waimea 10	1.0	1943*	1995
Waimea 12	2.75	1970	1995
Waimea 13	2.75	1972	1997
Waimea 14	2.75	1972	1997
Keahole 18	2.75	1974	1999
Keahole 19	2.75	1974	1999
Keahole 20	2.75	1966	2000
Keahole 21	2.75	1974	2000
Keahole 22	2.75	1966	2000
Keahole 23	2.75	1969	2000
Keahole CT-2	13.75	1989	undetermined

* Estimated year of manufacture. Units were built during World War II for use on landing ships (LSTs).

2.6 Conservation and Energy Efficiency

HELCO is developing a long-range energy plan that evaluates both the supply and the demand sides of energy. The process, integrated resource planning, is designed to evaluate conventional and alternative energy resources, along with energy conservation and efficiency programs, for the purpose of meeting forecast energy demands.

HELCO has already developed DSM programs and has developed a 20-year, long-range IRP, combined with a 5-year action plan, which was submitted to the PUC for approval in October 1993. Conservation and energy efficiency programs are major elements in HELCO's IRP to meet the future requirements of its customers in a cost-effective manner. The public participated in the planning through advisory groups formed by HELCO. The advisory groups consisted of 28 members representing business, government, environmental, cultural, and community groups.

Through the IRP process, HELCO selected a number of individual DSM programs to promote. The proposed programs included in the IRP are described in Table 2-2. They include "resource" programs operated to substitute for generation capacity, and "service" programs operated to provide marketing impetus and to offer special services to low-income customers. HELCO's overall DSM program is both aggressive and achievable.

DSM savings can be considered in terms of annual energy requirements (i.e., total fuel consumption) or peak demand (i.e., the maximum amount of energy required at any one time). As the DSM programs have developed, expected energy savings have been refined. Updated peak capacity savings are shown in Table 1-1. The actual timing of peak savings is dependent on two variables: PUC approval of individual DSM programs, and customer acceptance of individual programs. If all programs are approved by the PUC in 1994 (one year after submission by HELCO), and if anticipated levels of customer acceptance are achieved, savings of 13.3 MW may be achieved in the fifth year of program implementation. This is nearly 7 percent of HELCO's annual peak demand. By the year 2013, DSM programs are expected to save approximately 12 percent of peak demand, or 44 MW.

HELCO has one conservation program currently in place and several more under development or awaiting PUC approval. An ongoing Pilot Commercial Lighting Retrofit Program involves replacement of standard fluorescent lamps and magnetic ballasts with new lamps and electric ballasts. The estimated load reduction for this program is 700 kW per year.

HELCO's proposed conservation and energy efficiency programs include an interim commercial lighting program, a pilot residential lighting program, residential retrofits, a residential water heating program, an interruptible rate program, an interim standby rate program, and a cool storage air conditioning demonstration project. These programs are described below.

The Interim Commercial Lighting Program is similar to the Pilot Commercial Lighting Retrofit Program in that energy-efficient lamps and ballasts are strongly promoted. In addition, the program will offer incentives for "delamping," fixture light reflectors, and occupancy sensors.

Table 2-2
Description of HELCO's Proposed DSM Programs Included in the IRP

Program	Description
Standby and Interruptible Rate Program	Using rate discounts as an incentive, the interruptible and standby generator rate program will encourage customers to defer energy use or provide their own power during peak periods.
Commercial HVAC Program	This program will attempt to influence commercial customers to purchase higher efficiency equipment than they normally would to reduce the electrical energy consumption and peak capacity requirements of the cooling plant.
Commercial Lighting Program	This program will encourage customers to retrofit their existing lighting systems with high-efficiency electronic ballasts, high-performance lamps, and reflectors that allow fewer lamps to provide similar effective lighting levels. The program is also intended to influence decisions made in new commercial buildings as well as addressing the exterior lighting systems used in parking lots, walkways, and garages.
Commercial Refrigeration Program	Refrigeration systems used in grocery stores, cold storage facilities, and refrigerated warehouses are large electrical energy users. This program will promote high-efficiency refrigeration equipment to reduce electricity use, peak capacity requirements, and customer bills.
Commercial Water Heating Program	The objective of the commercial water heating program is to influence the choice by commercial customers (hotels, restaurants, etc.) close to the time that they choose to replace their water heating equipment. The program will promote the use of high-efficiency water heaters (e.g., heat pumps) as well as solar water heating.
Industrial Motors Program	This program will target customers who have significant motor loads. High-efficiency motors can reduce energy use by a modest amount.
Custom Rebate Program	The purpose of the custom rebate program is to provide a mechanism to develop energy efficiency opportunities that otherwise might go undeveloped. Customers will be able to identify opportunities in their facilities, develop a proposal, and present it to HELCO. HELCO will then evaluate the proposal, determine if it is a cost-effective application, and establish a cost-sharing arrangement with the customer.
Residential Water Heating Program	The residential water heating program promotes the use of high-efficiency water heating technologies such as solar water heating and heat pump water heaters. Because there are also customers who may not be capable of installing either a heat pump or a solar system, efficiency resistance water heaters are also being offered. Low-flow shower heads and water heater thermal insulation blankets will be offered to further reduce hot water consumption and conserve water.

The Pilot Residential Lighting Program is a sale and mail order program to provide compact fluorescent lamps at a subsidized cost.

The Interim Residential Retrofit Program will involve installing one or more of the following items in each of about 3,700 households: water heater insulating blankets, hot water pipe wrap insulation, lower water heater temperature setting, provisions to drain water heater tanks to improve efficiency, low-flow showerheads, faucet aerators, compact fluorescent bulbs, and toilet tank water displacement and leak detection kits. In addition, participating customers will be given energy conservation and energy efficiency educational literature and will be polled on appliance inventory and use.

The Pilot Residential Water Heating Program will involve installation of solar and heat pump water heating systems in about 100 homes island-wide. The program will be designed to establish a good database for future full-scale promotion.

The Interim Interruptible Rates Program will offer customers an incentive to curtail prescribed loads of 100 kW or more during periods when load curtailment is needed to maintain a reasonable generation margin. The Interim Standby Rate Program is similar, with additional incentives to be paid for customer-generated kilowatt-hours (kWh).

Cool storage is a practical, proven way to reduce air conditioning costs by making and storing coldness in ice or chilled water during off-peak hours, then using that stored coldness to help cool the building during on-peak hours. The Air Conditioning Demonstration Project will apply this technology at one or more locations.

Altogether, these programs are projected to provide peak-demand savings of 2,000 kW in 1993, 3,200 kW in 1994, and 6,000 kW in 1995 (Table 2-3). Only the Pilot Commercial Lighting Program has been approved by the PUC and may therefore be included in HELCO forecasts of demand savings. The Pilot Commercial Lighting Program has projected demand savings of 700 kW per year through 1995.

Because energy efficiency and peak capacity reductions have not been comprehensively pursued by any organization in Hawaii to date, there is considerable uncertainty about how to structure the DSM programs. Therefore, monitoring of the implementation process will be important. Programs will need to be adjusted as the implementation process moves forward. HELCO expects to update its DSM program plans annually to optimize program implementation and energy savings.

HELCO considers its DSM program one of the most aggressive and dynamic in the United States. Most of the aggressive U.S. programs save 7 to 10 percent of peak, compared with HELCO's projected 12 percent savings in its 20-year plan. However, this level of conservation is not sufficient to offset the need for the proposed unit addition at Keahole in 1995.

Table 2-3
Projected Peak Demand Reductions *
for Demand-Side Management Programs
(kW)

DSM Program	Peak Demand Reductions		
	1993	1994	1995
Pilot Commercial Lighting	700	700	700
Interim Commercial Lighting	700	1,000	2,500
Pilot Residential Lighting	100	100	100
Interim Residential Retrofit	100	200	300
Pilot Residential Water Heating	---	100	100
Interim Interruptible Rates	400	400	1,100
Interim Standby Rates	---	200	700
Air Conditioning Demonstration	---	500	500
Total Estimated kW	2,000	3,200	6,000

* As of November 1993, only the Pilot Commercial Lighting Program had been approved by the PUC and included in the HELCO resource plan (Table 1-1 in this document).

2.7 Conclusion

HELCO has reviewed alternative sites, alternative technologies, IPPs, and conservation and energy-efficiency efforts in its evaluation of current system needs. This analysis determined that a combustion turbine unit addition will be required, and Keahole Generating Station is best suited to accommodate this addition within the time constraints of the system. Although alternative technologies and conservation and energy-efficiency efforts are expected to play an increasing role in energy production and use, they are not sufficiently developed to replace conventional methods of generating the amount of power needed by 1995.

The oil-fired combustion turbine, therefore, was chosen by HELCO to meet the near-term operating needs for the following reasons:

- The proposed combustion turbine is the least-cost alternative.
- The proposed combustion turbine is a fuel-efficient design.
- A unit addition at Keahole Generating Station can be accommodated in 1995.
- A unit addition at Keahole Generating Station will optimize the benefits of existing utility infrastructure.

Section 3

Environmental Setting, Impacts, and Mitigation Measures

3.1 Physical Resources

3.1.1 Climate and Air Quality

Ogden Environmental and Energy Services prepared an air quality impact analysis for the proposed project. The analysis used dispersion modeling to predict emissions of regulated air pollutants expected to be emitted from the proposed facility.

Existing Conditions

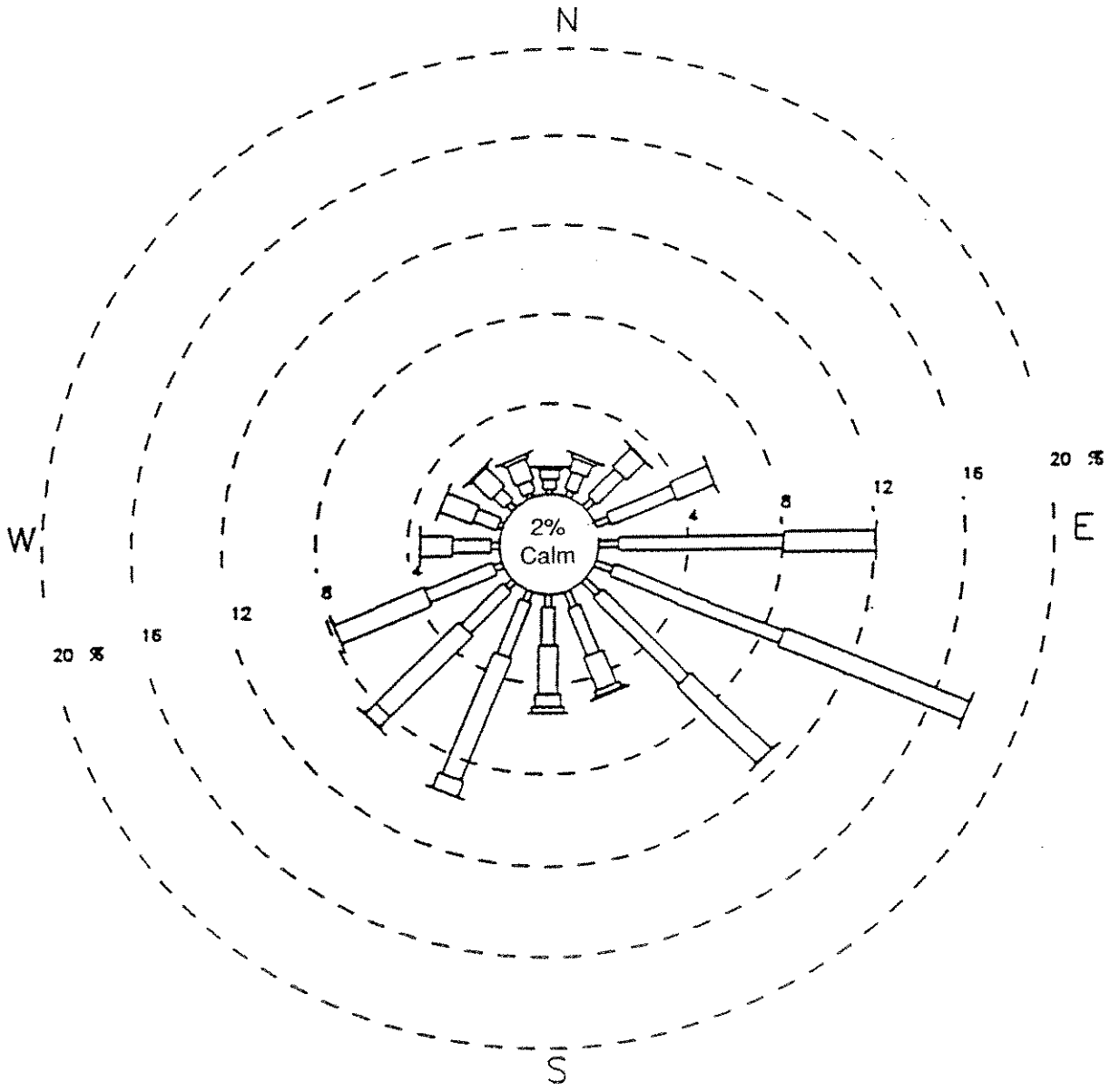
Topography. The Keahole site is located in terrain that slopes gently downward from the mountains east of the project site to the Pacific Ocean. Contours of constant elevation parallel the coastline. There are no significant terrain features (such as cliffs, bluffs, and hills) in the immediate area that would affect air circulation. The site's elevation ranges between 190 and 230 feet above mean sea level.

Meteorology/Climate. The Island of Hawaii is located in the trade wind band. For most of the year, the large-scale clockwise air circulation pattern results in winds from the east through the northeast (Figure 3-1). These tradewinds are modified along the North Kona coast. Data collected on wind patterns in the general area show a strong daily recurring (diurnal) flow for much of the year.

Meteorological data for the Keahole site were collected from February 1984 to January 1985 at an air quality monitoring station located approximately 0.8 mile southeast of the project site. This station was operated in compliance with U.S. Environmental Protection Agency (EPA) guidelines. Data from the station are summarized in Table 3-1.

Average monthly temperatures at the proposed site range from the low 70s (°F) in the coldest month of February to the upper 70s in August and September. Annual rainfall is approximately 10 to 20 inches per year. Rainfall is uniformly distributed from March to October, with 60 percent or more of the annual rainfall occurring in the remaining 4 winter months.

Air Quality. HELCO has operated air quality monitoring stations approximately 0.8 mile southeast of Keahole Generating Station and at Waiakea approximately 46 miles to the east. Table 3-1 shows maximum background concentrations of sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), total suspended particulates (TSP), nitrogen dioxide (NO_2), and carbon monoxide (CO).



LEGEND

Wind Speed (in knots)

1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	22 - 99
(8%)	(43%)	(46%)	(2%)	(0%)	(0%)

NOTE: Wind direction is the direction wind is blowing from.

Source: HELCO Meteorological Monitoring Data, February 1984 to January 1985

Stability Class Distribution

A - 5%
B - 7%
C - 19%
D - 22%
E - 36%
F - 11%

FIGURE 3-1

WIND ROSE

CH2M HILL

Table 3-1
Maximum Background Concentrations of Selected Pollutants

Pollutant	Averaging Period	Maximum Background Concentration ($\mu g/m^3$)	Monitoring Location[a]
Sulfur Dioxide	3-hour 24-hour Annual	110.0 20.4 0.3	1 1 1
PM_{10} (Particulate Matter less than 10 microns in diameter)	24-hour Annual	28 14	2 2
TSP (Total Suspended Particulate Matter)	24-hour Annual	28 14	2 2
Nitrogen Dioxide	Annual	2	1
Carbon Monoxide	1-hour 8-hour	2,290 2,290	3 3

[a]Monitoring Locations: (1) Keahole air quality monitoring station, (2) Department of Health station located at the Kona Health Center at Kealakekua about 25 miles south of Keahole, and (3) Waiakea air quality monitoring station.

Note: $\mu g/m^3$ = micrograms per cubic meter.

Source: Ogden Environmental and Energy Services. *Air Quality Impact Analysis for a 56-MW Unit at Keahole*. October 1992.

The proposed project site is located about 1 mile east of Keahole Airport and about 2 miles northwest of the Kalaoa residential area. No other major industrial stationary sources are in the vicinity.

The worst air pollution episodes experienced on the Island of Hawaii are the result of volcanic eruptions. Visibility is reduced by the presence of fine particulate resulting directly from volcanic activity and, secondarily, from forest fires caused by ensuing lava flows. In addition, there can be substantial increases in the ambient concentrations of sulfur dioxide and a number of toxic pollutants, such as heavy metals, during volcanic events.

Applicable Federal Regulations. Emissions of air pollutants are regulated at the federal level pursuant to the Clean Air Act (CAA). The following are major provisions of the CAA:

- National Ambient Air Quality Standards (NAAQS)
- New Source Review (NSR)
  - Prevention of Significant Deterioration (PSD) Program
  - Nonattainment Regulations
- New Source Performance Standards (NSPS)
- National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- Good Engineering Practice (GEP) Stack Height Provisions

National Ambient Air Quality Standards. The NAAQS represent the maximum pollution levels considered to be acceptable, with an adequate margin of safety, to protect public health and welfare. These standards must be attained in all ambient areas that are accessible to the general public. The following are the six criteria pollutants for which NAAQS have been established: SO_2, NO_2, CO, ozone (O_3), PM_{10}, and lead (Pb).

Hawaii's State Ambient Air Quality Standards (SAAQS) are very similar to the NAAQS, although the State has more stringent standards for carbon monoxide, ozone, and nitrogen dioxide. Hawaii also has a standard for hydrogen sulfide (H_2S). Hawaii's particulate standards have not yet been modified to reflect the 1987 NAAQS change from TSP to PM_{10}. Table 3-2 shows the federal and state ambient air quality standards.

New Source Review. The PSD regulations (40 Code of Federal Regulations [CFR] 52.21) define a major source as any source that belongs to a list of 28 source categories that emit or have the potential to emit 100 tons per year or more of any pollutant regulated under the CAA, or any other source type that emits or has the potential to emit pollutants in amounts equal to or greater than 250 tons per year. Keahole Generating Station is currently classified as a major stationary source (Table 3-3).

A PSD review is required for all pollutants from a major source showing significant net increases in emissions because of a modification and for which the project area is in compliance with the applicable NAAQS. Because the Keahole area has been designated either attainment or unclassifiable for all the NAAQS, a PSD review is required for all the pollutants that show a significant increase because of the proposed project.

Because the proposed project will be a major source in an area that is in attainment for all NAAQS, the PSD permitting process will be required.

Hawaii's attainment status for all criteria pollutants means that the nonattainment regulations do not apply to the proposed project.

Table 3-2
Summary of State of Hawaii and Federal Ambient Air Quality Standards

Pollutant	Hawaii State Standard	Federal Primary Standard[a]	Federal Secondary Standard[b]	Federal Class II PSD Increment
Carbon Monoxide				
1-hour	10 mg/m^3	40 mg/m^3	40 mg/m^3	—
8-hour	5 mg/m^3	10 mg/m^3	10 mg/m^3	—
Nitrogen Dioxide				
Annual (arithmetic)	70 μg/m^3	100 μg/m^3	100 μg/m^3	25 μg/m^3
TSP (Total Suspended Particulate Matter)				
24-hour	150 μg/m^3	—	—	37 μg/m^3
Annual (arithmetic)	60 μg/m^3	—	—	19 μg/m^3
PM_{10} (Particulate Matter less than 10 microns in diameter)				
24-hour	—	150 μg/m^3	150 μg/m^3	—
Annual (arithmetic)	—	50 μg/m^3	50 μg/m^3	—
Ozone				
1-hour	100 μg/m^3	235 μg/m^3	235 μg/m^3	—
Sulfur Dioxide				
3-hour	1,300 μg/m^3	—	1,300 μg/m^3	512 μg/m^3
24-hour	365 μg/m^3	365 μg/m^3	—	91 μg/m^3
Annual (arithmetic)	80 μg/m^3	80 μg/m^3	—	20 μg/m^3
Hydrogen Sulfide				
1-hour	35 μg/m^3	—	—	—
Lead				
3 months (arithmetic)	1.5 μg/m^3	1.5 μg/m^3	1.5 μg/m^3	—

[a]Designed to prevent adverse effects on public health.

[b]Designed to prevent adverse effects on public welfare, which include effects on comfort, visibility, vegetation, animals, aesthetics, and soiling and deterioration of materials.

Notes: mg/m^3 = milligrams per cubic meter
μg/m^3 = micrograms per cubic meter

Source: Ogden Environmental and Energy Services. *Air Quality Impact Analysis for a 56-MW Unit at Keahole*. October 1992.

Table 3-3
Potential Emissions Increases for CT Modes for Keahole Generating Station Expansion

Pollutant	CT Emission Rate (tpy)		PSD Significant Emission Rate (tpy)	Emission Rate Subject to PSD Review
	Phase 1	Phases 2 & 3		
Nitrogen Oxide	185	370	40	Yes
Sulfur Dioxide	482	964	40	Yes
Carbon Monoxide	117.0-2,083.0	236-4,006	100	Yes
Volatile Organic Compounds	4.0-1,304	7-2,374	40	Yes
Particulate Matter	86.3	172.6	25	Yes
Particulate Matter less than 10 microns in diameter	86.3	172.6	15	Yes
Hydrogen Sulfate Mist	9.2	18.4	7	Yes
Beryllium	0.00017	0.0004	0.0004	No
Mercury	0.0006	0.0012	0.1	No
Lead	0.0675	0.1350	0.6	No
Fluoride	0.0009	0.0018	3	No

Notes: tpy = tons per year.

Phase 1 values represent emission rates for a single turbine. Phase 2 will add a second combustion turbine that will double the emission rate. During Phase 3, two heat recovery steam generators and one steam generator will be added to increase efficiency. No additional fuel will be consumed.

The CT estimated maximum emissions are based on the operation of one General Electric LM2500 combustion turbine operated at ambient conditions of 59°F, 70 percent relative humidity, and atmospheric pressure of 29.92 inches of mercury. The maximum fuel flow is 13,758 lb/hr for simple-cycle operation and 13,751 lb/hr for combined-cycle operation. These data are based on manufacturer's data that have been adjusted for a minor heat rate loss expected after 25,000 hours of operation and for a minimum heat content range in the fuel (No. 2 fuel oil-diesel). The assumed minimum fuel heat content is 18,210 Btu/lb lower heating value (LHV), or 129,219 Btu/gal. The emissions are based on operation at 100 percent load unless otherwise denoted below.

The CT potential emission rate for sulfur dioxide is based on peak load fuel flow rates and fuel sulfur content of 0.4% by weight. It is assumed that 100 percent of the sulfur is converted to sulfur dioxide.

The CT oxides of nitrogen (NO_x) emissions are based on the molecular weight of nitrogen dioxide of 46 lb/mole and CT manufacturer data of 42 parts per million by volume (ppmv) at 15% oxygen, dry and assuming less than 0.015% fuel bound nitrogen. These data should be adjusted to accommodate an expected fuel bound nitrogen content of 0.1% by weight based on New Source Performance Standards Subpart GG. This is equivalent to 82 ppmv at 15% oxygen, dry.

The maximum CT carbon monoxide and volatile organic compound (VOC) emissions are based on manufacturer's data for operation at a nominal 25 percent load.

The CT particulate emissions are assumed to be less than 10 microns aerodynamic mean diameter. The PM/PM_{10} emission rate of 19.7 lb/hr (86.3 tons/year) was provided by the manufacturer.

The CT hydrogen sulfate emission rate is 0.038 lb/hr sulfur in fuel based on an EPA report *Health Impacts, Emission Factors for Noncriteria Pollutants Subject to De Minimis Guidelines and Emitted from Stationary Conventional Combustion Processes, EPA—450/2-80-74, June 1980.*

The beryllium, lead, and mercury emission rates for simple and combined cycles are based on fuel analysis with the following average in parts per million by weight: lead (1.12), beryllium (0.003), and mercury (0.01). These data were used in the PSD HI 87-01 and 90-02 analysis.

The fluoride emission rates for the simple and combined cycles are based on the average of two fuel analyses of 0.15 ppmw. This value was also used in the PSD HI 88-01 and 90-02 analysis.

Source: Ogden Environmental and Energy Services. *Air Quality Impact Analysis for a 56-MW Unit at Keahole.* October 1992.

De minimis refers to those levels below which the DOH may exempt a stationary source or modification from the air quality analysis preconstruction monitoring requirements. The *de minimis* emission levels and the maximum potential emission increases for the proposed project are listed in Table 3-4. These emission increases are based on worst-case operations of 8,760 hours per year. On this basis, the proposed modification is a significant source of nitrogen oxide (NO_x), sulfur dioxide, carbon monoxide, particulate matter, and hydrogen sulfate (H_2SO_4) mist. It is not a significant source for beryllium (Be), mercury (Hg), lead, or fluorine (Fl). Therefore, the project is subject to PSD review only for nitrogen oxide, sulfur dioxide, carbon monoxide, PM/PM_{10}, and hydrogen sulfate (H_2SO_4) mist as follows:

- Application of Best Available Control Technology (BACT)
- Analysis of ambient air quality impacts from the project (PSD Class II increments for sulfur dioxide, PM/PM_{10}, and nitrogen dioxide; NAAQS/SAAQS for sulfur dioxide, nitrogen dioxide, PM/PM_{10}, and carbon monoxide
- Analysis of air quality and/or visibility impacts on Class I areas
- Analysis of air-quality-related values such as soils, vegetation, and visibility that are affected directly as a result of the project and general commercial, residential, and other growth associated with the project

The PSD regulations provide for the designation of all geographic areas into one of three classes:

- Class I applies to these areas where practically any deterioration in air quality would be significant.
- Class II applies to areas where moderate, well-controlled, and sited industrial growth would be permitted.
- Class III applies where industrial areas would be allowed to experience the greatest degree of air quality deterioration.

The State Department of Health (DOH) has designated the Keahole area Class II. The closest Class I area is the Volcanoes National Park, about 50 miles southeast of the project. The Class I and Class II PSD increments and the NAAQS/SAAQS for sulfur dioxide, nitrogen dioxide, PM/PM_{10}, and carbon monoxide are presented in Table 3-4. The significant impact levels (and *de minimis* monitoring levels) for sulfur dioxide, nitrogen dioxide, carbon monoxide, and PM/PM_{10} are also presented.

Table 3-4
Summary of Impact Levels, Monitoring Levels, PSD Increments, and State and Federal Standards for Selected Pollutants

Pollutant	Averaging Period	Significant Impact Levels ($\mu g/m^3$)	*de minimis* Monitoring Levels ($\mu g/m^3$)	PSD Increments		NAAQS ($\mu g/m^3$)	SAAQS ($\mu g/m^3$)
				Class I ($\mu g/m^3$)	Class II ($\mu g/m^3$)		
Sulfur Dioxide	3-hour	25	—	25	512	1,300	1,300
	24-hour	5	13	5	91	365	365
	Annual	1	—	2	20	80	80
Nitrogen Dioxide	Annual	1	14	2.5	25	100	70
Particulate Matter	24-hour	5	10	10	37	—	150
	Annual	1	—	5	19	—	60
Particulate Matter less than 10 microns in diameter	24-hour	5	10	—	—	150	—
	Annual	1	—	—	—	50	—
Carbon Monoxide	1-hour	2,000	—	—	—	40,000	10,000
	8-hour	500	575	—	—	10,000	5,000

Notes: The 3- and 24-hour PSD increments and NAAQS and SAAQS are not to be exceeded more than once per year. Annual NAAQS, SAAQS, and PSD increments are never to be exceeded.

Source: Ogden Environmental and Energy Services. *Air Quality Impact Analysis for a 56-MW Unit at Keahole.* October 1992.

New Source Performance Standards. The New Source Performance Standards (NSPS) are a set of national emission standards that apply to new, modified, or reconstructed stationary source categories that include the emission limitations that apply to a new, oil-fired combustion turbine:

- Sulfur dioxide—0.015 percent sulfur dioxide in the exhaust gas at 15 percent oxygen, or 0.8 percent sulfur fuel by weight
- Nitrogen oxide—75 parts per million (ppm) in the exhaust gas at 15 percent oxygen

National Emissions Standards for Hazardous Air Pollutants. The NESHAP regulations do not apply to fossil-fuel-fired power plants.

Good Engineering Practice Stack Height Provisions. The federal guidelines for GEP stack height apply to the project. These guidelines identify design criteria acceptable to regulatory agencies to establish a method for determining the stack height that will minimize the influence of nearby structures on normal plume dispersion. The GEP stack height analysis for Keahole Generating Station indicates that a 104-foot-high exhaust stack will be required.

Applicable Hawaii Regulations. In addition to the federal regulations, the State of Hawaii regulates air pollution under Hawaii Administrative Rules (HAR), Title 11, Chapters 59 and 60; Hawaii State Ambient Air Quality Standards (SAAQS); and Hawaii Air Pollution Control Rules, respectively. The Environmental Management Division of DOH, Clean Air Branch (CAB), is responsible for implementing and enforcing both the state and federal air quality regulations.

As noted above, the SAAQS have been set for the same criteria pollutants as the federal standards, with the exception of particulates and H_2S. In 1987, the federal government changed the TSP standards to standards for PM_{10}. The State of Hawaii particulate standards have not been changed as of April 1993.

Project Impacts

EPA guideline dispersion models ISCST2 and COMPLEXI were used to calculate maximum concentrations of combustion pollutants that would potentially result from the proposed addition at Keahole Generating Station. The two models are required to estimate the impacts in the various terrain types surrounding the facility. The following information was used to predict the maximum ground-level concentrations of air pollutants from Keahole Generating Station:

- A full year of meteorological data collected at the Keahole monitoring station
- The proposed unit addition emission rates as defined in Table 3-3
- The currently permitted sources of emission rates as defined in PSD permit application 88-01, which includes CT-2 and all existing sources at the facility
- The existing facility configuration GEP analysis

Construction Air Emissions. Construction will produce two types of emissions: exhaust from vehicles and construction equipment and dust generated during site excavation and equipment movement. Equipment exhaust emissions will be small, localized, and transient. Dust emissions will also be nonsignificant because of the nature of the soil (that is, the lava field). As long as precautions are taken to water the site during dry or windy periods, construction emissions are not expected to be significant.

Operational Air Emissions. The modeling analysis predicted the maximum ground-level concentrations for nitrogen oxide, sulfur dioxide, and PM_{10} for the proposed project (that is, for the two combustion turbines) and the existing diesel and combustion turbine units at Keahole. Because the project layout and facility site have not been finalized, the building wake effects for the modeling analysis were performed using the existing source configuration. The maximum predicted concentrations were added to the maximum background concentration data and compared with the most stringent state or federal AAQS. Table 3-5 contains the results.

According to these modeling results, no federal or state AAQS are exceeded. The pollutant with the largest impact is nitrogen oxide. The maximum annual concentration for nitrogen dioxide

added to the background concentration will consume 85 percent of the SAAQS. As stated earlier, this maximum ground-level concentration is from all existing units at the facility plus the proposed turbines, operating at 100 percent load. As source configuration and facility plot plans are finalized, these data will be modified.

Table 3-5
Comparison of Maximum Predicted Sulfur Dioxide, Nitrogen Dioxide, and PM/PM_{10} Concentrations with Applicable NAAQS/SAAQS

Pollutant	NAAQS/SAAQS (%)		
	3-hour	24-hour	Annual
Sulfur Dioxide	30.32	21.10	13.05
Nitrogen Dioxide	—	—	81.80
PM/PM_{10}	—	35.81	26.43

Notes:

The maximum concentrations were calculated using the COMPLEXI and ISCST2 models, 1-year meteorological data from a Keahole monitoring station, end point GEP analysis, and all Keahole existing sources.

Sulfur dioxide is based on two turbines operating at an emission rate of 13.87 grams per second (g/s) per turbine and 0.4% sulfur content.

Nitrogen dioxide is based on two turbines operating at an emission rate of 5.33 g/s per turbine.

PM/PM_{10} is based on two turbines operating at an emission rate of 2.48 g/s per turbine.

Calculations are based on a stack height of 104 feet for two 28-MW, combined-cycle combustion turbines sharing a common stack.

Source: Ogden Environmental and Energy Services. *Air Quality Impact Analysis for a 56-MW Unit at Keahole*. October 1992.

The PSD permit application for this project will provide the following:

- Impacts of the proposed combustion turbine units
- An update of the NAAQS/SAAQS data as necessary
- Comparisons with applicable Class II increments
- Other potential impacts (such as soils, vegetation, and visibility)

Impacts to Vegetation. Federal Primary Air Quality Standards are based on protection of human health. Federal Secondary Air Quality Standards (which in most cases are no less stringent than the primary standards) are based on human "welfare," which includes such considerations as impacts to vegetation, animals, visibility and comfort. Based on the air quality modeling, which

indicates that secondary air quality standards will not be exceeded, HELCO has concluded that no significant impacts to vegetation will occur.

The air quality analysis indicates that the location where the proposed project will cause the greatest reduction in air quality is approximately 0.4 mile northeast of the Keahole facility. At this location, the project is projected to contribute 4 percent of the federal standard. No exceedances to applicable federal and state standards are projected to occur at this location. The Keahole Agricultural Park is south of the proposed project.

Because of concerns expressed about the proximity of the project to the Keahole Agricultural Park, HELCO had several special studies and literature searches conducted. These studies and a summary of the results are included in Section 9 of this document. HELCO is continuing its discussions with the State Department of Agriculture and the Keahole Agricultural Park residents concerning the results of these studies. HELCO remains committed to answering the concerns raised by the Agricultural Park residents.

For one of the special studies mentioned above, HELCO contracted with Dr. Alvin Greenberg, of Risk Science Associates in California, to conduct three ecological risk assessments to examine the risk of impacts from generating station emissions to crops grown in the Agricultural Park. One assessment was of ethylene, one of sulfur and nitrogen oxides, and one of acid precipitation. Dr. Greenberg concluded that concentrations of ethylene would be 100 to 10,000 times below the concentrations shown to cause adverse impacts to orchids. Ethylene is a naturally occurring plant hormone that is toxic to plants at high levels but is required at low concentrations for normal plant development.

Because of the limited data on SO_2, NO_x, and a combination of those pollutants, Dr. Greenberg was not able to conclusively evaluate the risks associated with these compounds, although he did indicate that modeled results were about 100 to 700 times below the concentrations at which adverse impacts had been reported in the literature. A similar situation exists with acid precipitation. No data were found in the literature that address the effects of acid precipitation on plant species grown at the Keahole Agricultural Park. However, on the basis of information on other species and the results of the PSD modeling for the proposed project, it may be concluded that adverse impacts from acid precipitation will not occur.

HELCO also had Ogden Environmental and Energy Services conduct a literature review of studies of air quality impacts to vegetation and compare these data with the maximum projected concentrations of emissions at the Agricultural Park. The studies encompassed a wide variety of plants, including fruits, flowers, vegetables, and ornamental trees. In these studies, the concentrations at which impacts to vegetation were shown were all above concentrations projected at the Agricultural Park. All concentrations that caused effects and that were documented for periods corresponding to modeled periods (e.g., 1-hour, 3-hour, 24-hour, and annual averages) were at least double the projected concentrations, and in most cases they were much more than twice the projected concentrations. This independent review further substantiates that federal air quality standards are protective of vegetation.

A plume impact study was conducted by B. D. Neal & Associates. This study focused on meteorological data collected at the generating station and on nitrogen oxides data collected at the Agricultural Park. The study concluded that nitrogen oxides concentrations attributable to the diesel generator units impact the Agricultural Park approximately 2 percent of the time.

These impact events range in duration from a few minutes to a few hours. Operations of the diesel units are expected to be curtailed with the proposed unit addition. The nitrogen oxide concentrations attributable to the diesel generator units are well within ambient air quality standards.

James M. Morrow conducted an aerosol study to determine whether acid aerosols from existing operations may affect the Keahole Agricultural Park. The study also considered potential ethylene impacts, which are of particular concern to commercial flower growers. The studies found no indication of elevated levels of acid aerosols at the Keahole Agricultural Park that might be attributable to current generating station operations.

It is important to note that the PSD modeling process makes a number of conservative assumptions that overstate emissions from the proposed generating station expansion. Therefore, projected concentrations that result from the modeling can be considered "worst case," and typical ground-level concentrations should be lower than those described in the PSD application. The post-construction modeling is designed to confirm that this is the case.

Mitigation Measures

The proposed project will be permitted for construction and operation only if it demonstrates, to the satisfaction of state and federal regulatory authorities, that it fully complies with the applicable rules, regulations, and air quality standards. Mitigation measures will be determined by the DOH during the permitting process and may include limitations on the allowable size of the facility, emission control technology requirements, or specification of fuel properties. Post-construction air quality monitoring will be performed continuously for 1 year after initial startup.

3.1.2 Volcanic Hazards

Existing Conditions

The Island of Hawaii was formed by five shield volcanoes: Kohala, Mauna Kea, Hualalai, Mauna Loa, and Kilauea. Kohala (highest peak 5,480 feet) is at the northern end of the Island and is the oldest. To the east is Mauna Kea (13,796 feet), which first erupted approximately 4,500 years ago. The Kohala Range and Mauna Kea have not erupted in historical time and are considered inactive. Hualalai (8,271 feet), on the western part of the Island, has erupted once in historical time, in 1801. One of the flows covered the northern part of the current site of Keahole Airport, approximately 1 mile north of the Keahole Generating Station site. The two southernmost volcanoes, Mauna Loa (13,679 feet) and Kilauea (4,093 feet), have been active frequently throughout historical time. The last recorded lava flow from Mauna Loa to reach the North Kona District was the lava flow of 1859.

Keahole Generating Station is situated on the western coastal slope of Hualalai Volcano; the crest of Hualalai is located 12 miles southeast of the site. Mauna Loa is located 34 miles southeast of the site and Kilauea is located 54 miles southeast of the site. The Kohala Range is located 31 miles northeast of the site, and Mauna Kea is 38 miles east of the site.

The U.S. Geological Survey has established volcanic hazard zones for the Island of Hawaii for long-term planning purposes. These zones are presented in Figure 3-2. Lava flow hazard zones are based on the percentage of the potential flow area that has been covered by lava flows during specific time periods, the frequency of past eruptive events, and the assumption that the rate of current volcanic activity will continue for the next several decades. On a rating scale where Zone 1 reflects the greatest volcanic hazard and Zone 9 the lowest, Keahole Generating Station is located within Lava Flow Hazard Zone 4 (Figure 3-2).

Hazard zones for tephra (airborne volcanic material produced by lava fountains) have also been established (Figure 3-3). They are based on eruption frequency, proximity to potential vents, and prevailing wind direction. The rating scale is broken into three zones, with Zone 1 indicating the greatest tephra falling hazard, and Zone 3 the lowest. Keahole Generating Station is located within Tephra Fall Hazard Zone 2 (Figure 3-3). No tephra eruptions on Hualalai are known in historical time. However, a potential exists for coverage by a thin layer (0.5 inch to 4 inches) of volcanic cinders from an eruption in Zone 1.

Four hazard zones for potential ground fractures and subsidence have been identified on the Island of Hawaii. The area of highest hazard is Zone 1, and Zone 4 is subjected to the least hazard. Keahole Generating Station is located within Zone 4 for ground fractures and surface subsidence.

Project Impacts

The Keahole Generating Station site has a moderate potential for volcanic hazard due to lava flow (Zone 4). U.S. Geological Survey personnel at the Hawaii Volcano Observatory have indicated that prediction of lava flow paths is unreliable at best and should not be a consideration in facility siting in the North Kona District. Consequently, this is not a significant factor for facility siting.

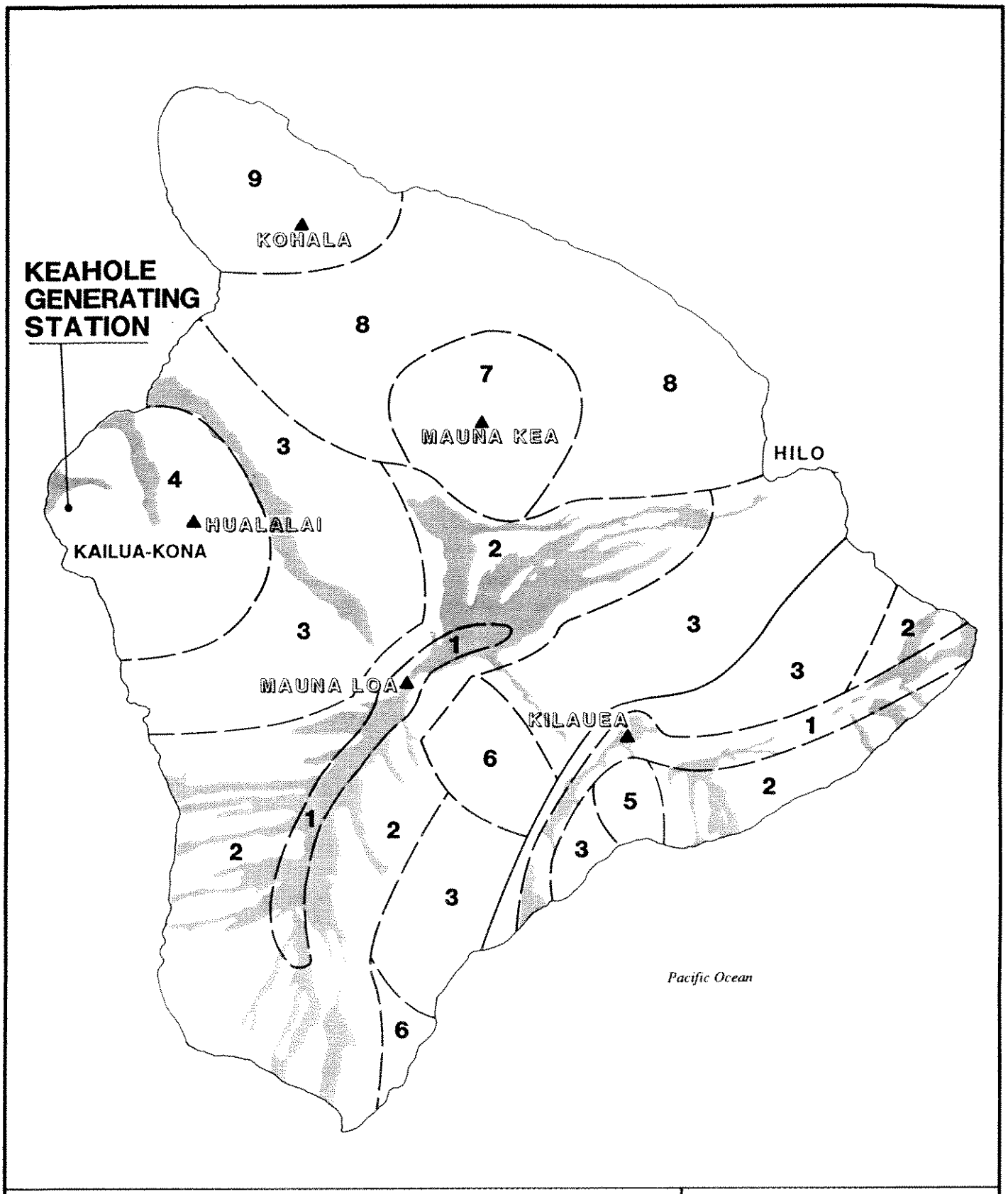
The site has a low hazard potential for tephra and negligible potential for ground fractures and subsidence.

Mitigation Measures

Airborne volcanic material has the potential to affect the operation of a combustion turbine. The turbines may be shut down in the event of volcanic activity and/or the occurrence of tephra in the atmosphere.

3.1.3 Soils and Geology

This section summarizes the geological and geotechnical report prepared by Masa Fujioka & Associates, which is provided in the Draft EIS, Volume II, Appendix B.



LEGEND

Pre-1975 Historical Lava Flows

Hazard Zone for Lava Flows

Boundary between Mauna Loa and Kilauea Volcanoes

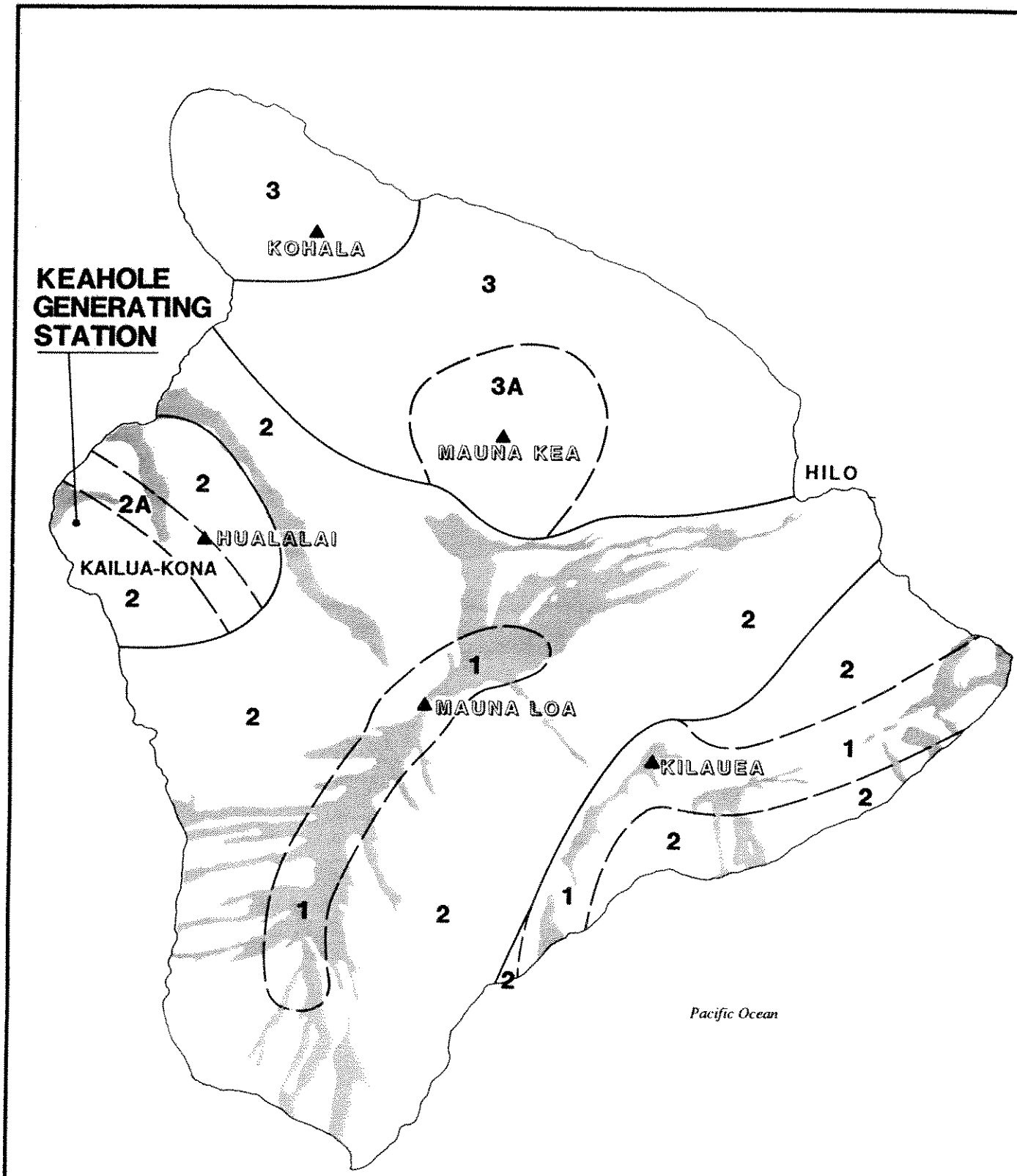
▲ Volcano

FIGURE 3-2

HAZARD ZONES FOR LAVA FLOWS

NORTH 0 5 10 MILES

CH2M HILL



LEGEND

Pre-1975 Historical Lava Flows

Hazard Zone for Tephra

Boundary between Volcanoes

Volcano

FIGURE 3-3

HAZARD ZONES FOR TEPHRA

NORTH 0 5 10 MILES

CH2M HILL

Existing Conditions

Keahole Generating Station is situated on the western coastal slopes of Hualalai Volcano. Hualalai was last active in 1801, when pahoehoe lava flowed from two vents along the northwest trending rift of the volcano. The northwest rift represents the major geologic structure in the area. At its nearest point, the rift is 4.5 miles northeast of the site. Lava flow from the vent at the 1,500-foot elevation spread out along the coast as far south as the current site of Keahole Airport, approximately 1 mile north of the Keahole Generating Station site.

The site is located on the older prehistoric lava flows of Hualalai. Elevation of the ground surface ranges from approximately 190 to 230 feet above mean sea level. The surface consists of aa and pahoehoe lava that slopes to the west in the direction of the coastline.

Aa basalt lava occurs in the northeast portion of the site. The aa appears to be an extension of a larger flow that is located north of the site. Aa flows normally consist of a surface layer of loose clinker overlying a dense basalt core. The average thickness of aa flows measured on the Island of Hawaii is approximately 15 feet. The aa consists of a surface layer of loose, jumbled blocks of jagged, highly vesicular basalt. Large vesicular basalt spines protrude through the clinker layer. The thickness of the clinker layer is unknown because the underlying dense interior of the flow is not exposed. The total thickness of the aa flow is also unknown because the base of the aa flow is concealed beneath more recent pahoehoe flows.

Pahoehoe lava flows cover approximately 95 percent of the site surface, including most areas of the proposed facility expansion. Pahoehoe lava flows consist of dense vesicular basalt with a ropy or smooth surface. Cooling joints and blisters were observed on the surface of the pahoehoe. The surface of the moving flow crusts over quickly and provides a roof over the moving lava stream. A characteristic feature of pahoehoe lava flows is the development of lava tubes, which range from a few feet to more than 40 feet in diameter and may stretch for miles in the subsurface. No lava tube entrances were observed at the surface of the site. However, lava tubes are known to exist in nearby pahoehoe flows.

A review of boring and probing logs drilled at the site indicated that cavities, ranging from a few inches to more than 3.5 feet, are present in the subsurface of the site. In addition, probings in the area of Fuel Oil Storage Tank No. 2 encountered 3-foot-thick layers of basalt clinker beginning at depths of approximately 5 feet and 12.5 feet below the ground surface.

The presence of soil on the aa and pahoehoe is sparse. Where present, soils consist of thin accumulations of windblown sand and silt.

Project Impacts

No readily identifiable major geotechnical concerns were discovered. The wells that will be installed on the site will encounter both aa and pahoehoe flows. Both types of flows are generally highly permeable in the vicinity, and neither type of formation is expected to be unstable for

supporting a well structure. Because the proposed expansion is limited to pahoehoe flow areas, construction methods on this type of surface and subsurface material are described below.

Pahoehoe flows can generally be excavated without blasting by using large bulldozers equipped with ripper bars. Because of the many blisters and surface openings at the site, initial grading will consist of grading and leveling. The oversized pahoehoe material will need to be compacted into smaller size particles. The grading process usually results in a net loss of material volume as the materials are crushed and compacted. The earthwork will be planned to avoid the need to import grading materials to the site.

Pahoehoe flows will generally provide sufficient structural support for the proposed expansion. Checking for subsurface cavities or lava tubes and remedial excavation and filling work will be necessary. The amount of site preparation work will depend on the anticipated loading at the site.

Mitigation Measures

No mitigation measures are anticipated.

3.1.4 Water Resources

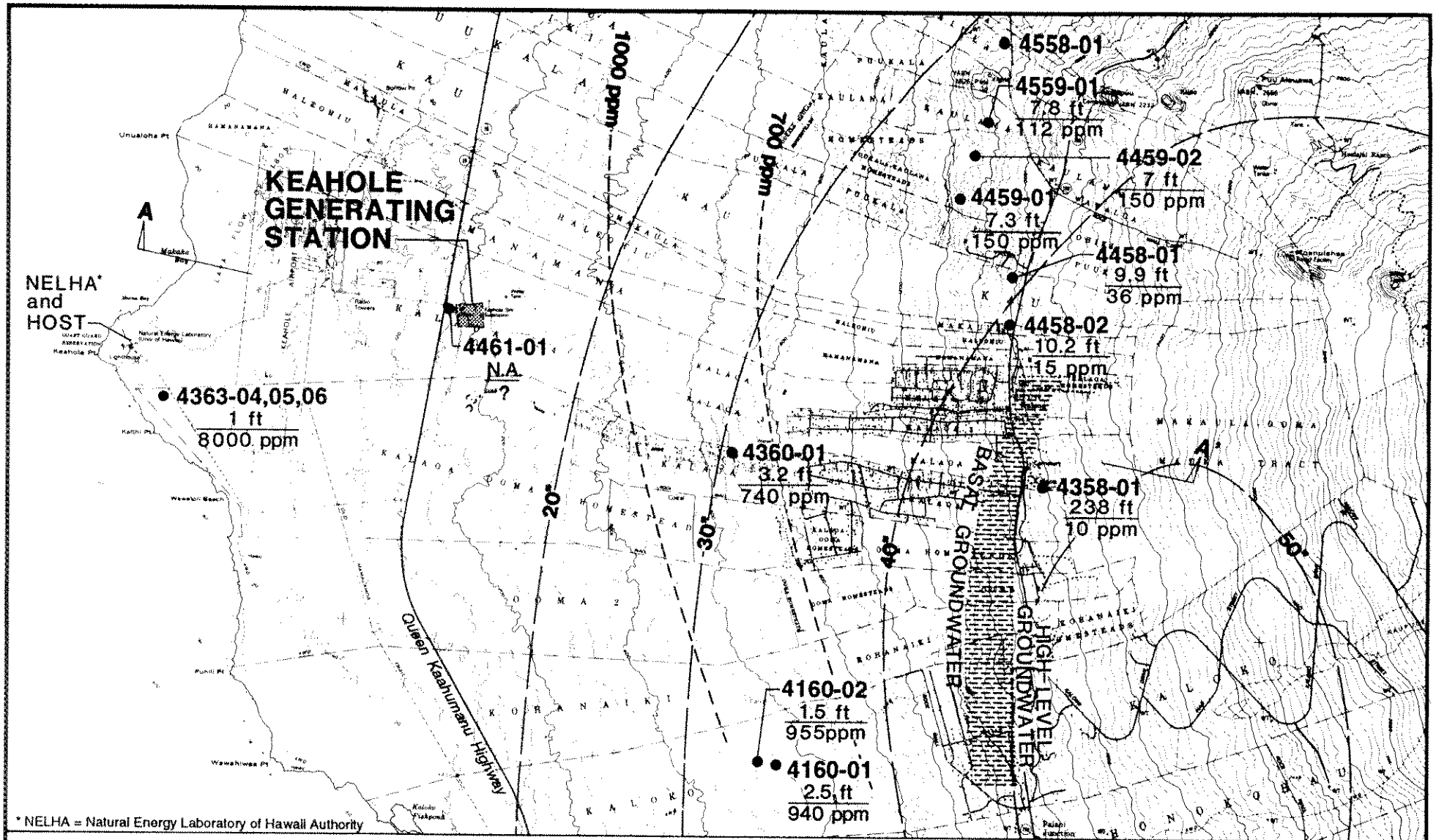
This section summarizes a report on regional groundwater resources prepared by Water Resource Associates and a groundwater impact report prepared by CH2M HILL. The complete reports are provided in the Draft EIS, Volume II, Appendices C and D.

Existing Conditions

The average annual rainfall at the generating station site is about 20 inches. In the area, the mean annual rainfall ranges from less than 20 inches near the coast to more than 75 inches on the upper slopes. The distribution of the average annual precipitation for the Keahole area is shown in Figure 3-4.

Rainfall on the upper slopes of Kona, above a general elevation of 2,500 feet, is the source of virtually all of Kona's groundwater resources. This rainfall occurs in a 4- to 5-mile-wide belt that is parallel to the coast and centered south of the project site about 4 miles inland. Rainfall at this location averages 40 to 75 inches a year, most of which percolates quickly into the ground. There is little, if any, runoff to the sea, even during times of heavy rainfall. Perennial streams do not exist in Kona.

The hydrogeology of the region and site vicinity is described below in terms of groundwater occurrence, movement, and quality.


KEAHOLE GENERATING STATION
NELHA* and HOST
A
A'
4558-01
4559-01
7.8 ft
112 ppm
4459-02
7 ft
150 ppm
4459-01
7.3 ft
150 ppm
4458-01
9.9 ft
36 ppm
4458-02
10.2 ft
15 ppm
4461-01
N.A.
?
4363-04,05,06
1 ft
8000 ppm
4360-01
3.2 ft
740 ppm
4358-01
238 ft
10 ppm
4160-02
1.5 ft
955ppm
4160-01
2.5 ft
940 ppm
1000 ppm
700 ppm
20'
30'
40'
50'
BASAL GROUNDWATER
HIGH-LEVEL GROUNDWATER
Queen Kaahumanu Highway
* NELHA = Natural Energy Laboratory of Hawaii Authority
LEGEND
Well Location
4360-01 Well Number
7.3 ft / 150 ppm Head (in feet) / Chlorides (in parts per million)
Hydrogeologic Discontinuity
Basal Aquifer Isochlor (in parts per million)
Median Annual Rainfall (in inches)
Source: Water Resource Associates, 1992
FIGURE 3-4
COASTAL HYDROLOGY
NORTH
0
1 MILE
CH2M HILL

Groundwater Occurrence. The project site is located within the Keauhou aquifer system, which encompasses the southern half of Hualalai Volcano and is delineated by the northwest rift zone to the north and the surface contact between Hualalai lavas and Mauna Loa lavas to the south. According to the Department of Land and Natural Resources (DLNR), the Keauhou system covers an area of 167 square miles and has an estimated sustainable yield of 38 million gallons per day (mgd). This sustainable yield represents the total developable groundwater, which is the sum of both potable and nonpotable groundwater. Figure 3-4 shows the location of wells for an area within a 3-mile radius of Keahole Generating Station. These wells were identified from DLNR records and from information provided by NELHA.

Groundwater on the Island of Hawaii may occur as high-level groundwater or basal groundwater. Figure 3-5 is a generalized west-to-east cross section through the Kona coast area that shows the conceptual relationship between high-level and basal groundwater. In general, high-level groundwater occurs inland, at higher elevations, whereas basal groundwater generally occurs at much lower elevations (near sea level) in coastal areas. High-level confined groundwater results on the Island of Hawaii from the presence of geologic formations that restrict horizontal groundwater flow. Such geologic features include semi-impermeable dikes, ash beds, and dense cores of lava.

Groundwater Movement. The groundwater underlying the generating station vicinity is brackish and is moving in a westerly direction toward the ocean. As the brackish groundwater moves closer to the ocean, the brackish basal lens thins appreciably and becomes more saline.

Groundwater Quality. The variation in groundwater quality downgradient of the site is not precisely known, but groundwater quality likely becomes more brackish in a westerly direction toward the coast. This inference is based on the occurrence of groundwater with salinities up to 30,000 milligrams per liter (mg/L) in shallow monitoring wells near the coast at NELHA.

Marine Environment. Several EISs completed for NELHA were reviewed for information about the existing marine environment and oceanographic conditions in the vicinity of Keahole Point. These documents report that the marine environment off Keahole Point is exceptionally diverse. The surface waters also support a low crop of phytoplankton. A cluster of seven small anchialine ponds lies adjacent to the NELHA access road. These ponds are reported to have opae'ula (*Halocaridina rubra*) and small, unidentified red amphipods. One of the ponds also has opae'o'haa (*Macrobrachium grandimanus*). This species is the most abundant of the seven types of shrimp found in Hawaiian anchialine ponds, and they are extremely hardy animals. In terms of rare, threatened, endangered, and protected species, the endangered humpback whale (*Megaptera novaengliae*) is seasonally present, and a number of dolphin species are common. In addition, the threatened green sea turtle (*Chelonia mydas*) is occasionally observed in the area. However, the nearest important resident area of green turtles to the Keahole region is at the northwestern tip of Hawaii.

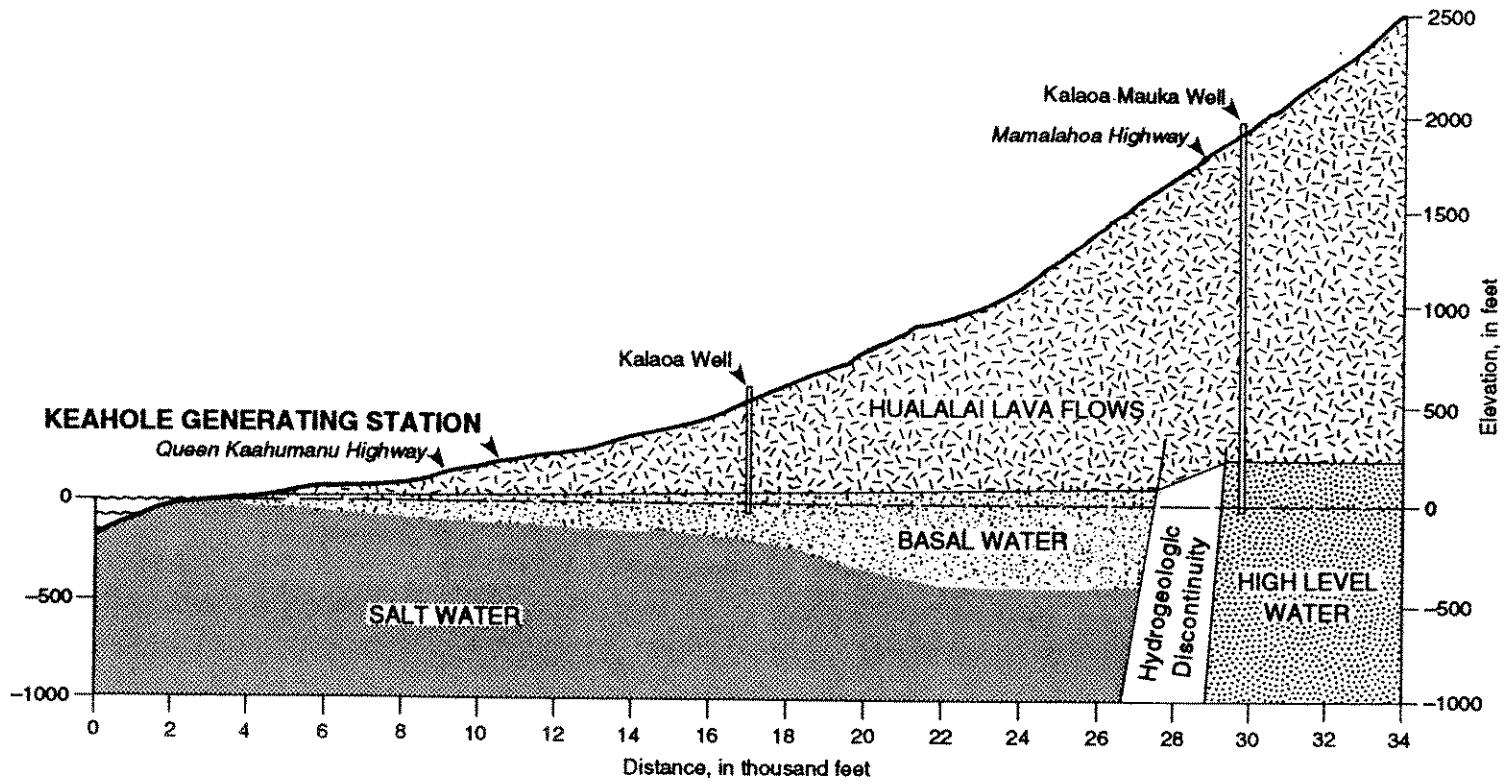


FIGURE 3-5

CONCEPTUAL HYDROGEOLOGIC PROFILE

Not to scale

CH2M HILL

Coastal waters near Keahole are classified AA by the Department of Health (Chapter 54, Water Quality Standards). Offshore waters, beyond 100-fathom depths, are "oceanic," all Class A. Several studies have reported that coastal water quality standards are exceeded near the shore. This is not considered unusual, because nutrient concentrations are generally elevated as a consequence of a high proportion of groundwater in very nearshore surface samples. The principal sources of the nutrients in the groundwater are, however, believed natural rather than manmade (MCM Planning, 1987).

Project Impacts

Water Supply. The County Water Department currently provides 20 gallons per minute (gpm) for the operation of the existing combustion turbine and related facilities. The water supply for the proposed facility will be provided from two sources: the County Water Department and an onsite supply well tapping the brackish aquifer. The County has indicated that it will increase its supply to HELCO to an average of 90 gpm. The water supplied by the County will be used for operation of the existing combustion turbine and the proposed 20-MW CT.

The addition of the second 20-MW CT unit, two HRSG units, and a 16-MW steam turbine generator will increase the water demand above that which is proposed by the County. A brackish groundwater supply well, therefore, will be developed in Phase 1 to meet additional water requirements and also provide water for fire suppression. The supply well will be pumped at an average rate of 160 gpm with a potential maximum of 500 gpm. The well will be about 265 feet deep and completed so that it withdraws brackish groundwater from the interval 0 to 50 feet below the groundwater level.

If groundwater is not available on-site, suitable arrangements would be made with either the County of Hawaii Water Department or private sources.

Wastewater. The project will generate an average of 128,000 gallons of wastewater per day (89 gpm). The wastewater stream will reflect typical treatment processes associated with the operation of a combustion turbine. The principal source of wastewater will be the reverse osmosis process. Reverse osmosis is a water treatment designed to produce relatively pure water from brackish groundwater. The treated water will be used for injection into the combustion turbine for NO_x control and for the steam turbine generator. A by-product of the process is a concentrated solution of salts and minerals.

Further refinement is provided by demineralization. During demineralization, the process water is passed through cation and anion resin beds to remove minerals. The resin beds are periodically regenerated by backwashing, followed by acid and caustic injection, and additional rinsing of the beds. The wastewater from backwashing will contain minerals removed from the water, acid and caustic solutions used for neutralization, and traces of the resin chemicals.

Wastewater will also be produced from the heat recovery steam generator cycle. This wastewater will contain a number of chemicals, such as phosphate, sulfites, ammonia, and acids and caustics, that have been added to minimize corrosion within the steam cycle. Other sources of wastewater include water from the dual media filters and storm water, which has gone through an oil/water separator. Wastewater generated from the use of brackish supply water will contain more minerals and salts than wastewater generated from the use of a potable supply water.

HELCO is also investigating the installation of an in-process, batch-type, boiler cleaning wastewater system to treat boiler cleaning waste generated periodically during major system overhauls.

Wastewater will be collected in a wastewater storage tank. After the wastewater storage tank is filled to a prescribed capacity, the wastewater will be pumped through a nutshell filter medium and a reinjection cartridge filter to remove residual oil and suspended solids to a concentration of approximately 1 ppm. Because the wastewater will be stored in a storage tank prior to injection, the wastewater will be at ambient air temperature when it is pumped to the injection well. A maximum injection rate of 250 gpm will be used until the tank is emptied. The injection well is expected to operate for 8-1/2 hours per day, with an average daily injection rate of 89 gpm.

The reinjection filter containing the nutshell medium is designed to automatically backwash the medium whenever it becomes dirty. This backwash will be based on a high differential pressure across the filter bed, or a preset time interval, whichever occurs first. The automatic backwash is expected to take place every 18 to 24 hours. A scrubbing cycle reconditions the filter bed during each backwash cycle by removing dirt and oil from the medium. Cleaning the medium in this way ensures a continually clean filter medium.

The estimated wastewater quality for the expansion is shown in Table 3-6. These data represent a worst-case scenario because all source water is assumed to be supplied by brackish groundwater. The assumed source water quality (brackish groundwater) is also shown in Table 3-6.

The groundwater quality at the injection depth is currently unknown. The brackish water lens beneath the site is believed to be less than 150 feet thick. Because the target injection zone extends from 250 to 300 feet below that water table or 400 to 500 feet below ground surface, the groundwater at the injection depth is expected to be saline.

The Keahole expansion will also require a new septic system. A septic tank and leach field will be installed to treat effluent from the existing and added sanitary facilities. A network of trenches will be dug 1 to 5 feet deep for the perforated distribution pipe. The bottom of the trenches will be filled with 6 inches of gravel or crushed stone. The fill material selected will depend on the infiltration rates obtained during the percolation tests planned as part of the site geotechnical investigation. The area and geometry of the leach field will also be determined from the percolation tests. The septic tank will have a capacity of 2,000 to 2,250 gallons.

Detailed plans for the septic wastewater treatment system will be submitted to the Department of Health for review and approval as part of a treatment works approval application. The treatment system will conform to applicable provisions of the DOH Administrative Rules, Chapter 11-62, including but not limited to section 11-62-32, which specifies spacing for individual wastewater systems, and section 11-62-33.1 (a), which contains requirements for septic tanks.

Table 3-6
Assumed Characteristics of Water Supply and Process Water Effluent for Phase 3

Constituent	Unit	Seawater[a]	County Water[b]	Influent[c]	Wastewater Quality (Assuming a Groundwater Source)[d,e]
Total Dissolved Solids	mg/L	35,000	205	3,800	19,750
Bicarbonate (HCO_3) as $CaCO_3$	mg/L	142	—	340	1,385
Ammonium (NH_4)	mg/L	—	—	0.2	1.4
Chloride (Cl) as $CaCO_3$	mg/L	19,350	11	2,730	11,040
Fluoride (F)	mg/L	1.3	0.4	0.02	0.25
Sulfate (SO_4) as $CaCO_3$	mg/L	2,710	31	280	3,685
Nitrate (NO_3) as $CaCO_3$	mg/L	0.005-2	—	10	38
Calcium (Ca) as $CaCO_3$	mg/L	411	9.8	—	472
Sodium (Na) as $CaCO_3$	mg/L	10,760	30	2,350	11,930
Potassium (K) as $CaCO_3$	mg/L	399	5.3	50	194
Magnesium (Mg) as $CaCO_3$	mg/L	1,290	9.5	540	2,210
Silica (SiO_2)	mg/L	0.5–10	53	53	232
Total Suspended Solids	ppm	—	—	<5	1
Biochemical Oxygen Demand (BOD)	mg/L	—	—	negligible	<5
Oil and Grease	mg/L	—	—	negligible	<5
pH	—	—	—	8.0	6-9
Temperature	°F	—	—	—	60-85[f]

[a]Composition of sea water after Riley and Chester, 1971; Wilson, 1975; and other sources as presented by Drever, 1982.
[b]County water analysis from October 30, 1991, groundwater sample from the North Kona Water System, Kalaoa well (State Well No. 4358-1).
[c]Influent characteristics provided by Stone and Webster Engineering Corporation.
[d]Reinjection water quality is estimated by Stone and Webster Engineering Corporation for a dual-train combined-cycle power facility.
[e]The process components producing the reinjection water include the following: dual media backwash, neutralized demineralization, boiler blowdown, reverse osmosis, floor drains, and other processes. This does not include sanitary wastes.
[f]Ambient air temperature at Keahole.

Note: — = Data not available.

The system will also conform to applicable sections of the Ten States Standards, and Chapters 10, 20, 40, and 50 of the DOH Administrative Rules. As specified in Chapter 10, information concerning soil and site conditions will be evaluated to determine an appropriate design for the proposed septic system. Factors to be evaluated will include depth of permeable soil over high groundwater, bedrock or other limiting layer, soil factors, land slope, flooding hazard, and amount of suitable area available.

Impacts on Groundwater. Four potential impacts to groundwater and marine resources have been evaluated:

- Potential changes in groundwater levels and quality in the site area as a result of pumping from the brackish aquifer
- Potential groundwater quality changes downgradient of the site resulting from wastewater injection
- Potential impacts on the marine environment at locations where groundwater affected by wastewater migrates into the ocean
- Potential impacts to downgradient receptors

Each potential impact is discussed below.

Potential Changes in Groundwater Levels and Quality in the Site Area As a Result of Pumping from the Brackish Aquifer. Drawdown of groundwater levels associated with pumping the brackish water well is expected to be approximately 0.2 foot. Because of the limited extent and magnitude of the influence of the brackish water supply well, the impact of pumping on local groundwater levels and quality is expected to be negligible even when the pump is intermittently pumped at its maximum rate. No measurable changes in groundwater levels are expected to occur beyond 600 feet from the pumping well. The proposed withdrawal volume is within the estimated sustainable yield of the Keauhou aquifer. The salinity of the brackish groundwater is not expected to increase as a result of operation of the proposed well. Within 600 feet from the well, impacts are expected to be minimal, and no mitigation measures are anticipated.

Potential Groundwater Quality Changes Downgradient of the Site Resulting from Wastewater Injection. The potential impacts from wastewater injection depend on the characteristics of the effluent to be injected and on the quality of the existing groundwater in the target injection zone. An average of 89 gpm of wastewater will be injected into the saline aquifer at a depth of about 450 to 500 feet beneath the site. The groundwater at the target depth for wastewater reinjection is expected to be saline. The expected composition of the wastewater is presented in Table 3-6.

Density differences between the injected water and the saline water may cause the wastewater plume to rise and eventually reach the bottom of the brackish aquifer. The rate of this buoyant rise is a function of the density difference between the waters and the vertical permeability of the aquifer. After reaching the brackish aquifer, the wastewater will be swept downgradient by

the ambient groundwater flow in a seaward direction, eventually discharging to the ocean (Figure 3-6).

The width of the groundwater flow field affected by the reinjection at 89 gpm is estimated to be about 320 feet near the injection well. The injection of approximately 89 gpm is expected to produce a water table rise of less than approximately 0.2 foot.

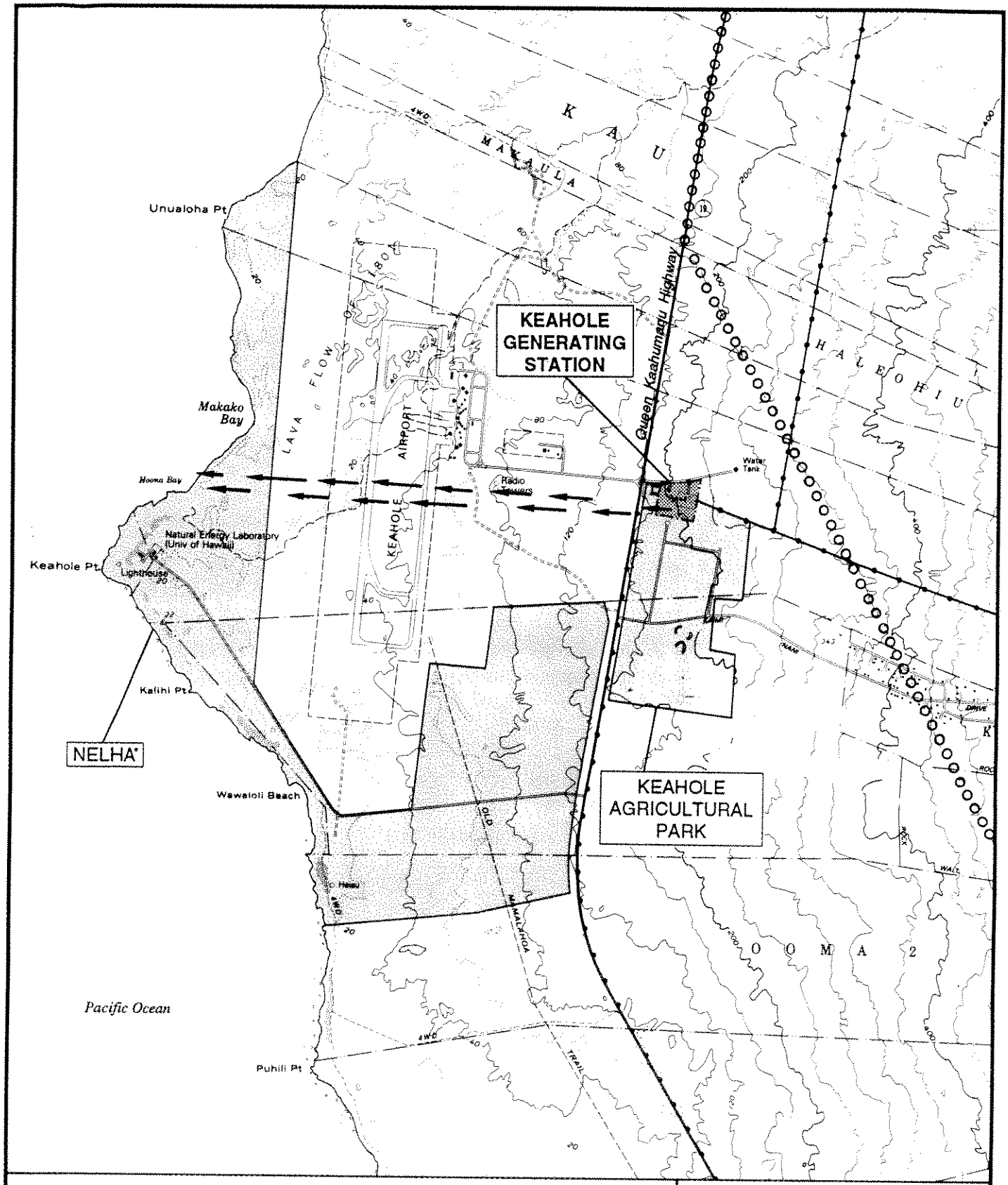
As the wastewater plume migrates downgradient from the injection well, it will be affected by dispersion. Dispersion is the process by which a plume tends to spread by mechanical mixing and molecular (chemical) diffusion. The width of the plume will increase by dispersion, although the concentration within the plume will decrease until it eventually reaches that of the ambient groundwater.

Currently, no information on the dispersive properties of the basalt aquifer at the Keahole site is available. However, using values of dispersivity that range from zero (no dispersivity) to 30 feet (maximum likely transverse dispersivity), the wastewater plume would either virtually disappear within several hundred feet of the injection well or would continue as a 320-foot-wide coherent plume to the shoreline.

Although few data are available in the immediate vicinity of Keahole Generating Station, groundwater quality in the brackish aquifer is expected to become more saline toward the ocean. Salinities of 6,000 to 30,000 mg/L have been reported at NELHA. Because the total dissolved solids and the wastewater salinity are estimated to be similar to the brackish groundwater, the potential impact of the wastewater plume on general downgradient groundwater quality is not expected to be significant.

Potential Impacts on the Marine Environment at Locations Where Groundwater Affected by Wastewater Migrates into the Ocean. Wastewater injected beneath the proposed facility will move with the groundwater and eventually discharge to the ocean. As the brackish groundwater containing the diluted wastewater plume migrates to the ocean off Keahole Point, it is anticipated to enter the seawater column as dispersed plumes from small fissures in the sea floor over a wide area extending from the shoreline down to a depth of about 500 feet. The total wastewater discharge over the entire area would be equal to the average injection rate, or 89 gpm. A quantification of the magnitude of dilution as the dispersed plumes discharge into the ocean was performed to assess impacts of the plume on the ocean water quality.

Simulation modeling results indicate that, for dilution factors between 2 and 500, mixing is intense and rapid. For example, a dilution of 2, regardless of depth and spacing, occurs within 0.03 second at a height of 4 inches above the sea floor and the discharging fissures. A dilution of 500 is accomplished within approximately 60 seconds at a height of approximately 30 feet above the fissure. This implies that, under the worst-case scenario of a single point discharge, the diluted wastewater plume would become completely dispersed within 30 feet of the point of discharge. In actuality, the discharge is more likely to occur as a multitude of minute point discharges into the marine environment. Therefore, no significant impacts to the marine environment are anticipated.



LEGEND

ooooo Underground Injection Control Line

←— —← Estimated Groundwater and Wastewater Flow Direction

* NELHA = Natural Energy Laboratory of Hawaii Authority

FIGURE 3-6

HYDROLOGIC ZONE OF IMPACT

NORTH 0 3000 FEET

CH2M HILL

Potential Impacts to Downgradient Receptors. Impacts to wells downgradient of Keahole Generating Station were assessed. The nearest well is located on a parcel owned by M. Cooper. The parcel is located adjacent to the project site. This well is registered for irrigation and domestic use. However, the well, first registered in 1989, reportedly has not been used, and it does not have an installed pump. This well was completed to a depth of 185 feet below ground surface.

If used, however, the Cooper well may be affected by the withdrawal of water, because the well is within the groundwater flow field expected to be affected by well pumping for the Keahole Generating Station. As a result, the Cooper well may be subject to a change in groundwater levels of 0.2 foot. A 0.2-foot change in the groundwater level, however, is not considered significant.

The Cooper well may also be affected by the discharge of wastewater from the reinjection well. Although the Cooper well was completed to a depth of 185 feet below the ground surface and the reinjection well will be located at a depth of 450 to 500 feet, the wastewater plume may migrate upward toward the Cooper well intake. Additional analyses will be conducted following the development of onsite exploratory wells and geotechnical borings.

NELHA facilities use several shallow wells to withdraw groundwater for aquaculture. The shallow wells are located within one-quarter mile of the ocean at several locations to the east and south of the NELHA facility. They withdraw brackish groundwater from 15 to 30 feet below the water table. Existing project plans involve expanding the use of groundwater, and several new proposals submitted to NELHA also involve use of groundwater. All proposed projects are near the ocean to reduce well drilling costs. NELHA also pumps seawater directly from the ocean at depths of 35 and 2,000 feet below sea level.

The NELHA facility currently disposes of up to 10,000 gpm of seawater into several trenches located around the facility. NELHA is considering increasing its discharge rate to more than 18,000 gpm. These trenches are hydraulically connected to the shallow groundwater system. This rate of seawater disposal to the aquifer has a significant impact on the rate, direction, and quality of groundwater flow in the area. Studies performed by NELHA (1992), Nance (1991), and Dames & Moore (1985) for NELHA indicate that disposal of the seawater creates a large recharge mound that produces hydraulic gradients radially (both vertically and horizontally) away from the NELHA facility. These reports suggest that the gradients produced by the recharge mound at NELHA will act to deflect groundwater away from NELHA.

In summary, the supply wells and the marine environment adjacent to NELHA are not expected to be impacted by the use of a reinjection well for the disposal of wastewater at Keahole Generating Station for the following reasons:

- The Keahole Generating Station reinjection well is located nearly 2 miles away from NELHA facilities.

- The rate of wastewater injection is extremely small in comparison with the rate of groundwater movement.

- The wastewater discharge plume will be diluted as a result of mechanical mixing and diffusion.

- Gradients produced by the recharge mound at NELHA are expected to deflect groundwater movement, including any residual plume from Keahole Generating Station.

- The diluted wastewater plume is not expected to be detectable at seawater intakes.

- Any residual plume that may reach the marine environment is expected to be quickly dispersed.

Monitoring Program

Monitoring and reporting requirements will be required by both DOH and EPA for the use of an injection well. A daily record of the injectate quantity being discharged into the injection wells will be maintained. Representative samples of the injectate will be routinely collected for analysis by an approved laboratory.

In addition, a groundwater monitoring program has been developed that is designed to monitor compounds and minerals associated with the reverse osmosis water treatment and the heat recovery steam generators. Groundwater monitoring will be conducted onsite. The constituents and frequency of monitoring are presented in Table 3-7. The monitoring program has also incorporated the groundwater protocol guidelines of the West Hawaii Coastal Monitoring Program. The development of this monitoring program has been coordinated with NELHA.

Mitigation Measures

The potential impacts to groundwater resources from the operation of a supply well and reinjection well have been evaluated, and no adverse impacts have been identified at this time.

Table 3-7
Groundwater Monitoring Program

Constituent	Unit	Frequency
Total Dissolved Solids (TDS), salinity	mg/L	quarterly
Bicarbonate	mg/L	quarterly
Chloride	mg/L	quarterly
Fluoride	mg/L	quarterly
Sulfate	mg/L	quarterly
Ammonium	mg/L	quarterly
Nitrate + NO_2	mg/L	quarterly
Phosphate, Total Phosphorus	mg/L	quarterly
Calcium	mg/L	quarterly
Sodium	mg/L	quarterly
Potassium	mg/L	quarterly
Magnesium	mg/L	quarterly
Silica	mg/L	quarterly
Oil and Grease	mg/L	quarterly
Total Recoverable Hydrocarbons	mg/L	quarterly
pH	unit	quarterly
Temperature	degree	quarterly
Electrical Conductivity	μmhos/cm	quarterly
Water Levels	feet	quarterly
Dissolved Organic Nitrogen	mg/L	quarterly
Dissolved Organic Phosphorus	mg/L	quarterly

Abbreviations:
mg/L = milligrams per liter
μmhos/cm = micromhos per centimeter

3.2 Biological Resources

3.2.1 Flora

A botanical survey report was prepared by Char & Associates. This section summarizes the report; the complete report is provided in Appendix E (in Volume II of the Draft EIS).

Research Methods

Existing botanical literature relevant to the project area was examined before the survey was conducted. Topographic maps and a project map were examined for terrain characteristics, access, boundaries, and reference points. A field survey of the Keahole Generating Station site was conducted on July 9, 1992. The survey consisted of a walkthrough of the undeveloped area, with a more intensive examination of the grassland area.

Existing Conditions

Vegetation on the project site is dominated by introduced species. Native plants, in general, occur as scattered individuals. Species, both indigenous (native to the Hawaiian Islands and elsewhere throughout the Pacific) and endemic (native only to the Hawaiian Islands), can be found throughout West Hawaii and in similar habitats in the Hawaiian Islands. None of the plants inventoried on the site are officially listed as threatened or endangered species, nor are any species proposed or candidates for such status.

Substrate on the proposed expansion area consists of undisturbed pahoehoe lava that supports low, scattered patches of fountain grass and a few shrubs, collectively referred to as a "grassland." Along the outside perimeter of the facility fence is a variety of landscape plantings. These two plant communities, grassland and planted area, are described in more detail below. All plants inventoried during the survey are listed in Table 3-8.

Grassland. The dominant vegetation type onsite consists of fountain grass. Shrubs are somewhat denser on the southern and eastern portions of the project site. The most common shrubs include the native caper or maiapilo (*Capparis sandwichiana*), 'ilima (*Sida fallax*), 'uhaloa (*Waltheria indica*), indigo (*Indigofera suffruticosa*), and koa-haole (*Leucaena leucocephala*). Less common are partridge pea (*Chamaecrista nictitans*), *Pluchea symphytifolia*, Christmas berry (*Schinus terebinthifolius*), noni (*Morinda citrifolia*), klu (*Acacia farnesiana*), and a'ali'i (*Dodonaea viscosa*). Fountain grass (*Pennisetum setaceum*) and piligrass (*Heteropogon contortus*) are scattered throughout the site. A few smaller herbaceous species were recorded and include coat buttons (*Tridax procumbens*), lovegrass (*Eragrostis tenella*), red pualele (*Emila fosbergii*), and hairy spurge (*Chamaesyce hirta*). In addition, a few clumps of the hairy sword fern (*Nephrolepis multiflora*) occur in the somewhat moister microhabitats found in the larger cracks and crevices on the lava flow.

Table 3-8
Inventory of Plants Observed at Keahole Generating Station

Scientific Name	Common Name	Status[a]	Grassland[b]	Planted Area[b]
Ferns				
NEPHROLEPIDACEAE (Sword Fern Family) *Nephrolepis multiflora (Roxb.) Jarrett ex Morton*	Hairy sword fern	X	+	-
Flowering Plants				
MONOCOTS				
AGAVACEAE (Sisal Family) *Sansevieria trifasciata Prain*	Snake plant, mother-in-law's tongue	X	-	+
ARECACEAE (Palm Family) *Cocos nudifera L.*	Coconut, niu	P	-	+
CYPERACEAE (Sedge Family) *Cyperus rotundus L.*	Nutgrass, nut sedge	X	-	+
LILIACEAE (Lily Family) *Aloe vera L.*	Aloe	X	-	+
POACEAE (Grass Family)				
Cenchrus echinatus L.	Common sandbur, 'ume 'alu	X	-	+
Digitaria sp.	Crabgrass	X	-	+
Eleusine indica (L.) Gaertn.	Wiregrass, goosegrass	X	-	+
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	Lovegrass	X	+	+
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	Pili, piligrass	I	+	-
Pennisetum setaceum (Forssk.) Chiov.	Fountaingrass	X	+	+
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	X	+	+
ZINGIBERACEAE (Ginger Family) *Hedychium sp.*	Ginger	X	-	+
DICOTS				
ANACARDIACEAE (Mango Family)				
Mangiera indica L.	Mango, manako	X	-	+
Schinus terebinthifolius Raddi	Christmas berry	X	+	+
APOCYNACEAE (Periwinkle Family)				
Nerium oleander L.	Oleander, 'oleana	X	-	+
Plumeria rubra L. (hybrid)	Plumeria	X	-	+
ASCLEPIADACEAE (Milkweed Family) *Calotropis procera (Ait.) Ait. f.*	Small crown flower	X	-	+
ASTERACEAE (Sunflower Family) *Bidens pilosa L.*	Spanish needle, beggar's tick, ki	X	-	+
Conyza bonariensis (L.) Cronq.	Hairy horseweed	X	-	+
Crassocephalum crepidioides (Benth.) S. Moore	Crassocephalum	X	-	+
Emilia fosbergii Nicolson	Red pualele	X	+	+
Pluchea symphytifolia (Mill.) Gillis	Pluchea, sourbush	X	+	+
Tridax procumbens L.	Coat buttons	X	+	+
BORAGINACEAE (Borage Family) *Heliotropium amplexicaule Vahl*	Heliotrope	X	-	+
CAPPARACEAE (Caper Family)				
Capparis sandwichiana DC.	Maiapilo, paupilo	E	+	-
Cleome gynandra L.	Wild spider flower, honohina	X	-	+

Table 3-8
Inventory of Plants Observed at Keahole Generating Station

Scientific Name	Common Name	Status[a]	Grassland[b]	Planted Area[b]
CARICACEAE (Papaya Family)				
Carica papaya L.	Papaya, mikana	X	-	+
CONVOLVULACEAE (Morning-glory Family)				
Ipomoea obscura (L.) Ker-Gawl.	Field bindweed	X	-	+
CUCURBITACEAE (Squash Family)				
Momordica charantia L.	Wild bittermelon	X	-	+
EUPHORBIACEAE (Spurge Family)				
Chamaesyce hirta (L.) Millsp.	Hairy spurge	X	+	+
Chamaesyce prostrata (Aiton) Small	Prostrate spurge	X	-	+
FABACEAE (Pea Family)				
Acacia arnesiana (L.) Willd.	Klu	X	+	-
Chamaecrista nictitans (L.) Moench.	Partridge pea, lauki	X	+	+
Erythrina usca Lour.	Columnar erythrina	X	-	+
Erythrina variegata Stickm.	Tiger's claw	X	-	+
Indigofera suffruticosa Mill.	Indigo, 'iniko	X	+	-
Leucaena leucocephala (Lam.) de Wit	Koa-haole, ekoa	X	+	+
Macroptilium lathyroides (L.) Urb.	Wild bushbean, cowpea	X	-	+
MALVACEAE (Mallow Family)				
Malvastrum coromandelianum (L.) Garcke	False mallow, hauuoi	X	-	+
Sida fallax Walp.	'Ilima	I	+	+
MOLLUGINACEAE (Carpetweed Family)				
Mollugo cerviana (L.) Ser.	Threadstem carpetweed	X	-	+
MORACEAE (Mulberry Family)				
Ficus microcarpa L. f.	Chinese banyan	X	-	+
NYCTAGINACEAE (Four-o'clock Family)				
Bougainvillea hybrid	Bougainvillea	X	-	+
PORTULACACEAE (Purslane Family)				
Portulaca oleracea L.	Pigweed, common purslane, 'ihi	X	+	+
Portulaca pilosa L.		X	-	+
RUBIACEAE (Coffee Family)				
Morinda citrifolia L.	Noni	P	+	+
Paederia scandens (Lour.) Merr.	Maile pilau	X	-	+
SAPINDACEAE (Soapberry Family)				
Dodonaea viscosa Jacq.	A'ali'i	I	+	-
SOLANACEAE (Nightshade Family)				
Lycopersicon pimpinellifolium (Jusl.) Mill.	Currant tomato, 'ohi'a ma ka nahele	X	-	+
STERCULIACEAE (Cacao Family)				
Waltheria indica L.	'Uhaloa, hi'aloa, kanakaloa	I?	+	-
ZYGOPHYLLACEAE (Caltrop Family)				
Tribulus terrestris L.	Puncture vine	X	-	+

[a] E = endemic (native only to the Hawaiian Islands).
I = indigenous (native to the Hawaiian Islands and elsewhere throughout the Pacific).
P = Polynesian (plants originally Polynesian and introduced before Western contact (1778); not native.
X = introduced or alien (all those plants introduced by humans to the islands, intentionally or accidentally, after Western contact, not native).

[b] + or - indicates the presence (+) or absence (-) of a particular species within each vegetation type (grassland or planted area) recognized on the project site.

Planted Area. The outside perimeter of the fence is landscaped. Groupings of cultivated specimens are found on the north, west, and south perimeters. The east perimeter is not planted. The most common ornamental plants onsite are coconut trees (*Cocos nucifera*), two *Erythrina* species, oleander (*Nerium oleander*), and orange and red *Bougainvillea* hybrids, which together provide a visual screen for the facility.

The *Pluchea,* Christmas berry, and the noni grow tall and luxuriant because the landscaped area is irrigated. Also abundant are various grasses and weeds such as Natal redtop grass (*Rhynchelytrum repens*), wild bittermelon (*Momordica charantia*), puncture vine (*Tribulus terrestris*), wild spider flower (*Cleome gynandra*), red pualele (*Crassocephalum crepidioides*), and Spanish needle (*Bidens pilosa*).

Project Impacts

The planned expansion will result in removing the existing grassland vegetation and displacing the planted vegetation. Because none of the plants inventoried on the site are officially listed as threatened or endangered species, nor are any species proposed or candidates for such status, the proposed expansion of Keahole Generating Station is not expected to have a significant impact on botanical resources.

Mitigation Measures

Because no significant impacts have been identified, no mitigation measures are proposed. Where possible, existing landscape vegetation will be replanted in a new vegetative buffer zone.

3.2.2 Fauna

A bird and mammal inventory survey report of the Keahole Generating Station site was prepared by Phillip L. Bruner, Environmental Consultant—Faunal Surveys. This section summarizes the report; the complete report is provided in Appendix F (in Volume II of the Draft EIS).

Research Methods

Published and unpublished reports of birds known from similar habitat elsewhere were consulted to acquire a more complete picture of the possible species that might occur in the region of the proposed project. A bird and mammal survey of the 14.998-acre project site was conducted on July 14, 1992. The survey consisted of a walkthrough of the property and nearby lands.

Existing Conditions

Most of the property is covered in dry grass. The present fenceline of the facility is planted with a variety of introduced trees and shrubs. No wetland habitat exists at this site. No waterbirds or seabirds were found onsite.

No endemic birds were observed during the survey. The only endemic species that might occasionally occur in this area are the short-eared owl or pueo (*Asio flammeus sandwichensis*) and Hawaiian hawk or 'Io (*Buteo solitarius*). Ten species of exotic (introduced) birds were recorded during the field survey (Table 3-9). It should be noted that the data in Table 3-9 are based on a 1-day survey. The number of species present and the relative abundance of each species may vary throughout the year. Other species that may also occur on or near the property include barn owl (*Tyto alba*), saffron finch (*Sicalis flaveola*), yellow-billed cardinal (*Paroaria capitata*) and warbling silverbill (*Lonchura malabarica*).

Table 3-9
Exotic Birds Observed at Keahole Generating Station

Scientific Name	Common Name	Relative Abundance[a]
Francolinus francolinus	Black francolin	C=6
Francolinus pondicerianus	Gray francolin	R=3
Streptopelia chinensis	Spotted dove	U=2
Geopelia striata	Zebra dove	C=6
Acridotheres tristis	Common myna	C=7
Cardinalis cardinalis	Northern cardinal	R=2
Zosterops japonicus	Japanese white-eye	U=3
Lonchura punctulata	Nutmeg mannikin	C=8
Carpodacus mexicanus	House finch	U=4
Passer domesticus	House sparrow	R=7

[a]Relative abundance pertains to the number of times observed during the survey or average number on 8-minute counts in appropriate habitat.

A = abundant (average 10+)
C = common (average 5-10)
U = uncommon (average less than 5)
R = recorded (seen or heard at times other than on 8-minute counts or on one count only; number that follows is the total number seen or heard over the duration of the survey).

The two most common migrants that may visit this property from September to April are ruddy turnstone (*Arenaria interpres*) and the Pacific golden plover (*Pluvialis fulva*). No migratory birds, however, were recorded during the survey.

One small Indian mongoose (*Herpestes auropunctatus*) was observed. Another mammal that occurs on the Island is the endangered Hawaiian hoary bat. Records of the occurrence of this

species are relatively limited. No bats were observed during the survey, and this species is not likely to forage or roost at the project site.

No particularly special or unique bird or mammal habitat was discovered at the project site.

Project Impacts

The proposed expansion will result in the removal of existing grassland and ornamental vegetation. No significant impact on bird or mammal species is expected, however, because no wetlands, waterbirds, endemic birds, unusual exotic birds, unusual concentrations of mammals, and no particularly special or unique bird or mammal habitat were discovered at this site.

Mitigation Measures

No mitigation measures are required.

3.3 Socioeconomic Environment

3.3.1 Archaeological and Cultural Resources

An archaeological inventory of the Keahole Generating Station site was prepared by Paul H. Rosendahl, Ph.D., Inc. (PHRI). This section summarizes the PHRI report; the complete report is provided in Appendix G (in Volume II of the Draft EIS).

Research Methods

PHRI examined existing archaeological and historical literature relevant to the project area. Fourteen archaeological studies have been conducted in the vicinity of the project area between 1973 and the present, identifying hundreds of archaeological sites and features.

Because of limited historical information about the project area, information regarding the North Kona district was also reviewed.

An archaeological inventory survey of the 14.998-acre Keahole Generating Station site was conducted on June 29, 1992. The survey was conducted along north-south and east-west transects that were a maximum distance of 66 feet apart.

Existing Conditions

Four sites were identified in the project area during the survey. All identified sites were pahoehoe excavations that were interpreted to have been prospect pits rather than productive quarries. These site types have not been previously documented in Kalaoa, although they are widespread elsewhere in Kona. It is likely that the pahoehoe excavations are related to periods of prehistoric occupation.

Based on the National Register criteria for evaluation, the archaeological remains found within the proposed project area were determined to be significant solely for information content. These four sites were assessed as being of low significance for research value, interpretive value, and cultural value. The sites have been measured, mapped, described, photographed, and transferred onto a topographic map. Because the information recovered is considered sufficient, no further work is recommended for these sites.

Project Impacts

The archaeological inventory survey of the project area concluded that the proposed expansion of Keahole Generating Station is not expected to have a significant impact on archaeological or cultural resources. The findings of this study have been submitted to the Office of Conservation and Environmental Affairs and forwarded to the State Office of Historic Preservation for review.

Mitigation Measures

On the basis of the archaeological survey findings, no mitigation measures are indicated. If any historic or prehistoric surface or subsurface archaeological features or deposits are uncovered during construction, HELCO will stop work in the immediate vicinity and contact the DLNR–State Historic Preservation Division for a determination of significance.

3.3.2 Land Use

Existing Conditions

The study area encompasses approximately a 3-mile radial distance from Keahole Generating Station. The existing land uses in the study area are shown in Figure 3-7. Undeveloped land lies to the north of the project site. Keahole Agricultural Park is located immediately adjacent to the project site's southern and western boundaries.

Existing Land Use. Four 90-foot radio towers are located on a 4-acre parcel on the eastern boundary of the project site. The towers are owned by the Big Island Broadcasting Company. A portion of the agricultural park and vacant land occupy the remainder of the eastern boundary.

Queen Kaahumanu Highway, Keahole Airport, and the Natural Energy Laboratory of Hawaii Authority (NELHA) are located west of the generating station. The nearest residential subdivision in the study area is Kona Palisades to the southeast of the site.

Keahole Agricultural Park. The 179-acre park is State owned and leased for agricultural purposes. It is divided into 34 lots of approximately 5 acres. Thirty-one of the lots are leased for 55-year terms to farmers for growing flowers and trees. One residential dwelling unit is allowed per parcel; there are 22 residences in the park.

Keahole Airport. Keahole Airport is approximately 1 mile west of the project site. The airport's runway runs along the airport's western boundary in a north-south orientation. The airport is used by large commercial aircraft, air taxi operations (small commercial aircraft with 60 seats or fewer), private jets, corporate jets, and helicopters. Military aircraft, both fixed and rotary wing, also use the airport. The average annual number of aircraft landings and takeoffs for all types of air travel was 66,418 from 1981 through 1991. The total number of landings and takeoffs for 1991 was 56,140. The largest aircraft landing at the airport are DC-9s, DC-10s, and 737s.

The Federal Aviation Administration (FAA) evaluates the location and height of the structures adjacent to an airport. An aeronautical study of the proposed action has been conducted to ensure that the proposed structures will not impair aviation safety. The FAA then issued a Determination of No Hazard to Air Navigation for the proposed action. A State of Hawaii Permit for Construction was subsequently submitted to the Hawaii Department of Transportation, Airports Division, for review. It was approved on March 4, 1993.

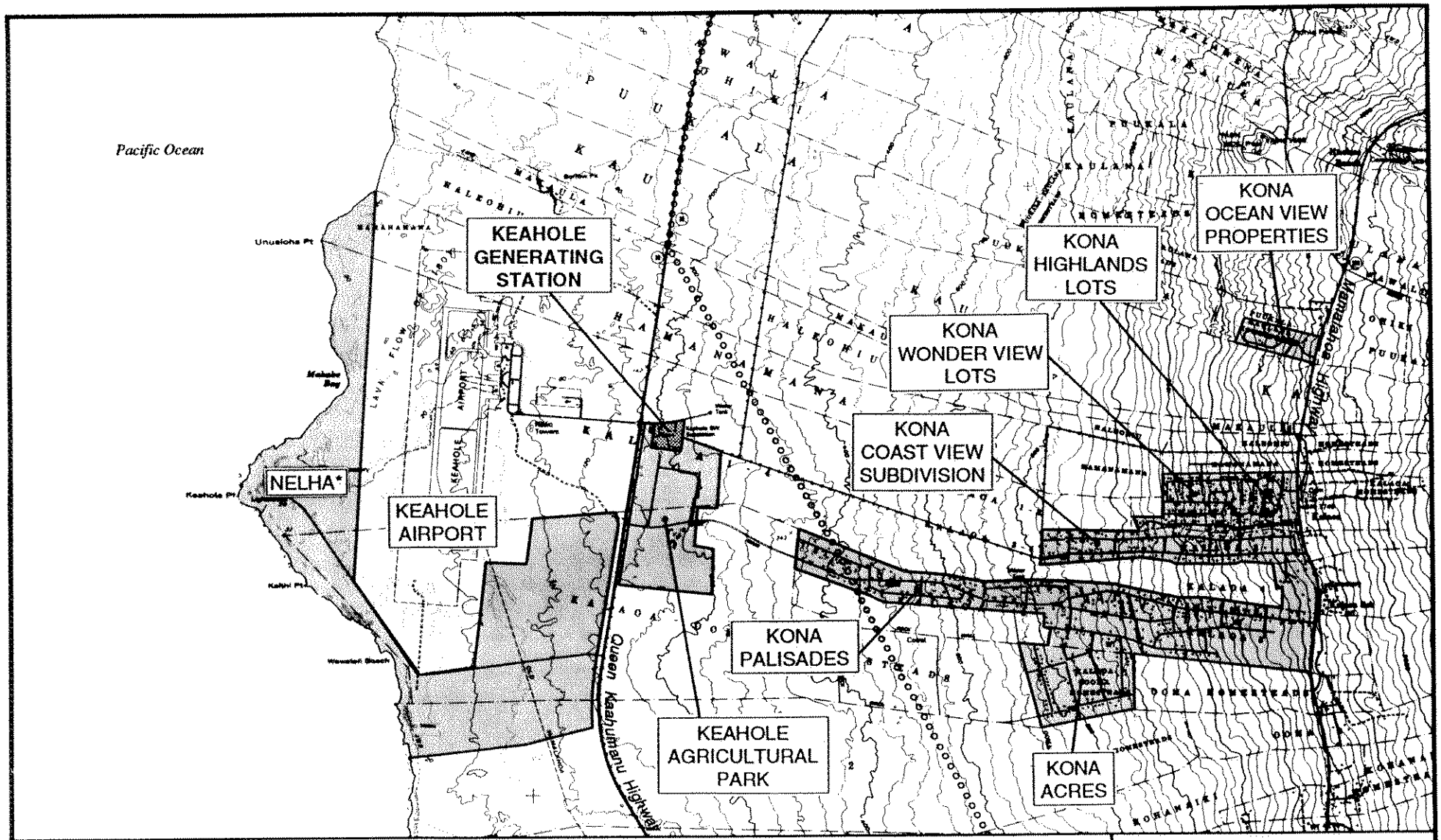


FIGURE 3-7

EXISTING LAND USE

Natural Energy Laboratory of Hawaii Authority. NELHA is located at Keahole Point on 870 acres of State-owned land. The Authority comprises the Natural Energy Laboratory of Hawaii (NELH) and the Hawaii Ocean Science and Technology (HOST) Park. NELH supports the research, development, and demonstration of OTEC and OTEC-related technologies. OTEC creates energy by using the temperature difference between warm ocean water at the surface and cold seawater pumped up from depths of 2,000 feet. HOST Park supports the commercialization of those technologies.

Kona Palisades. Kona Palisades is located approximately 1 mile southeast of Keahole Generating Station. It is the closest residential subdivision to the facility site. The 1991 Keahole to Kailua Development Plan identifies Kona Palisades as the largest subdivision in the North Kona district, with 532 single-family units.

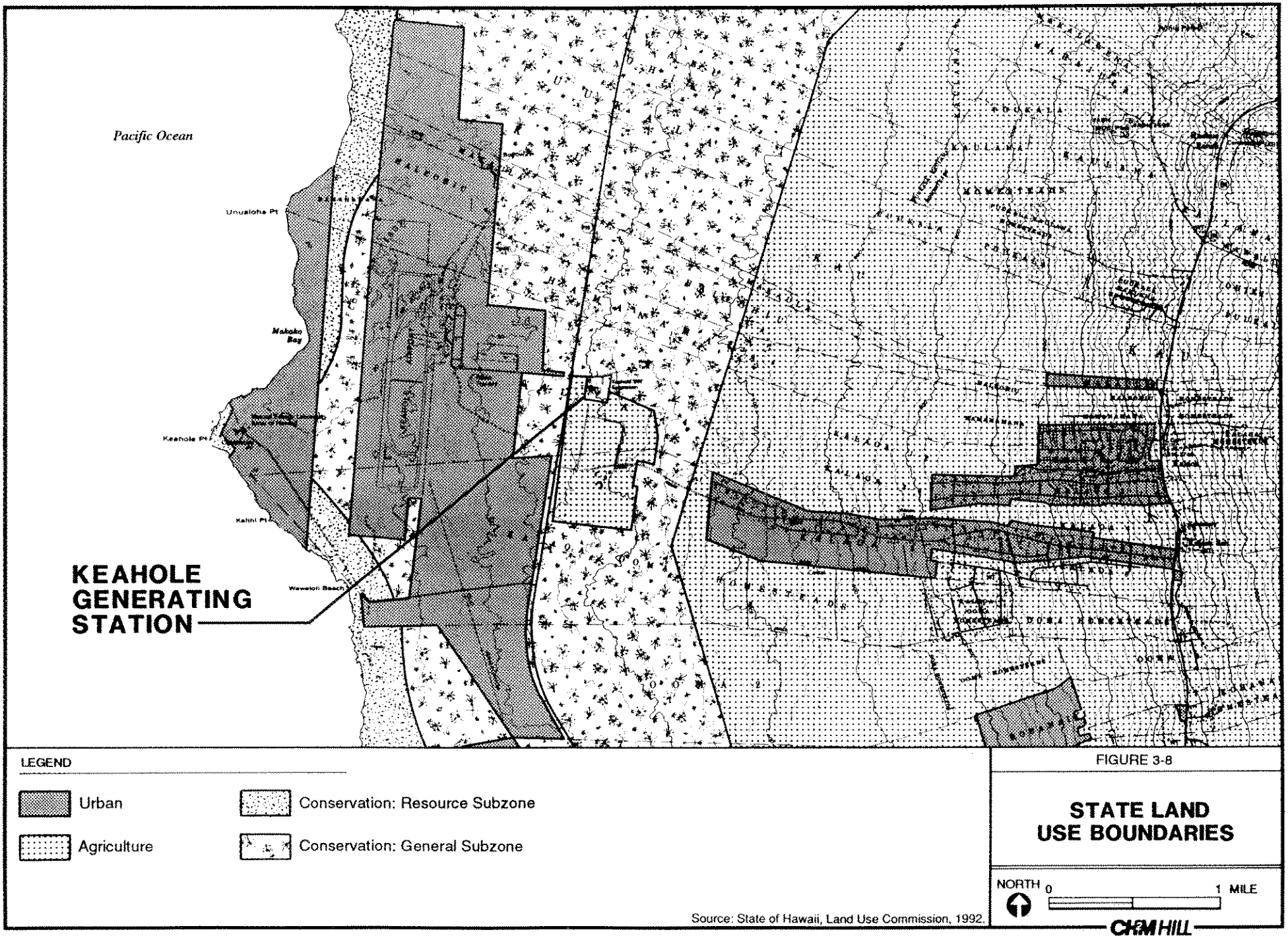
State and County Designations. The following land use designations apply to the Keahole Generating Station and surrounding properties.

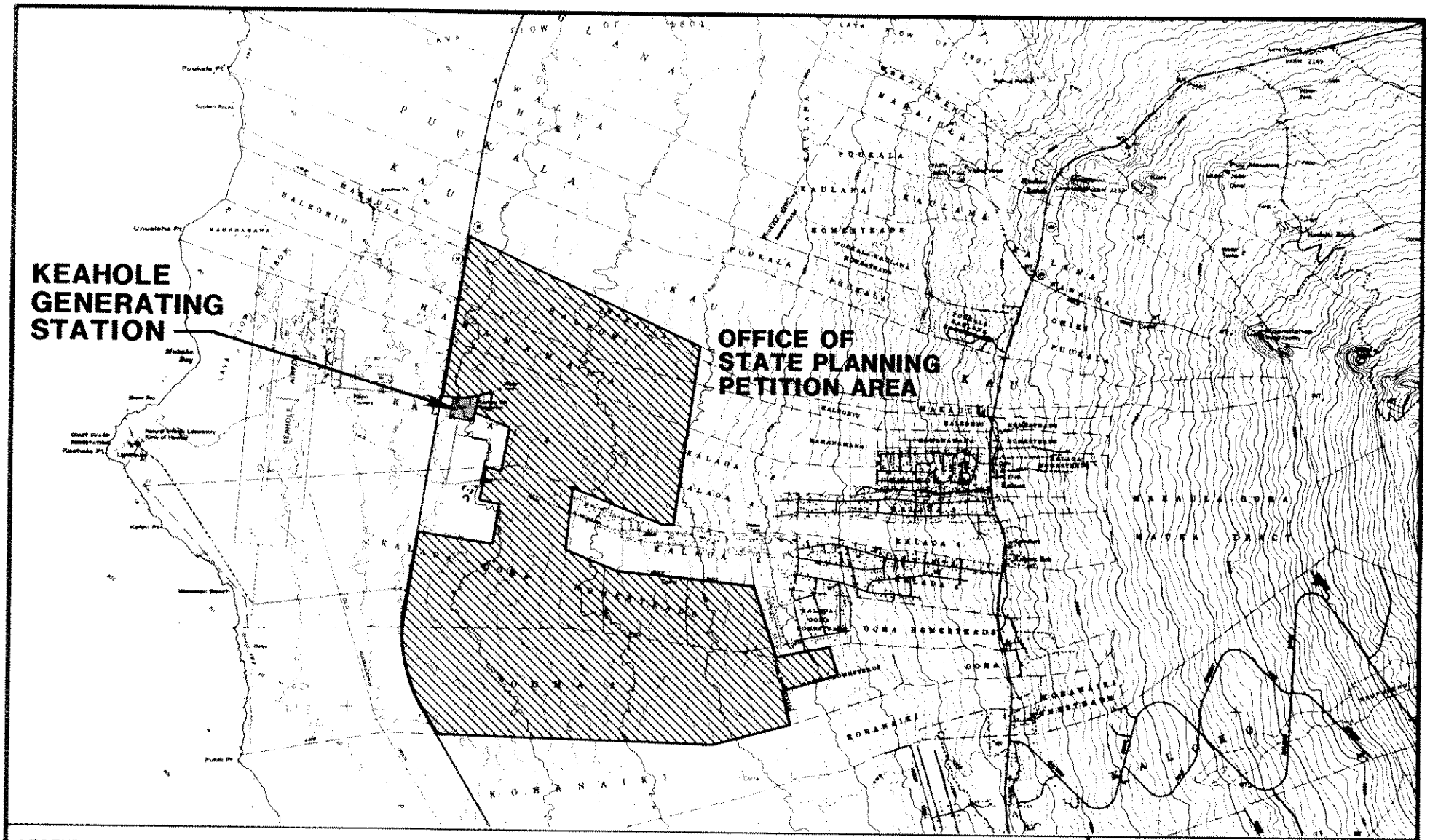
State Land Use. The State Land Use classifications for the study area are shown in Figure 3-8. The major classifications within the study area are Urban, Agriculture, and Conservation-General Subzone. Small portions of the coastline within the study area are classified Conservation-Resource Subzone.

The areas classified as Urban include industrial uses such as Keahole Airport, commercial uses, and residential development. The land under the Agriculture classification is currently undeveloped. Most of the Conservation-General Subzone is undeveloped land, with the exception of the Keahole Agricultural Park and the project site.

Because the project site is located in the Conservation-General Subzone, it will require approval of an amendment to the site's Conservation District Use Permit (CDUP) by the State Board of Land and Natural Resources. A CDUP was granted by the Board in 1973 to locate the generating station at Keahole, and three amendments (in 1984, 1987, and 1988) were subsequently approved for additional generating capacity. The proposed 56-MW expansion will be the fourth amendment to the original CDUP.

The Office of State Planning (OSP) has submitted a petition to amend the Conservation and Agriculture Land Use District Boundaries for approximately 2,640 acres of State-owned lands mauka of Queen Kaahumanu Highway (Land Use Commission [LUC] Docket No. A92-685). The State lands bordering the generating station along the northern and eastern boundaries of the project site have been recommended for reclassification to the Urban District (Figure 3-9) through the Five-Year Boundary Review prepared by OSP.


Pacific Ocean
Unuaioha Pt
Makaka Bay
Keahole Pt
Kahini Pt
Waiaioli Beach
KEAHOLE GENERATING STATION
LEGEND
Urban
Agriculture
Conservation: Resource Subzone
Conservation: General Subzone
Source: State of Hawaii, Land Use Commission, 1992.
FIGURE 3-8
STATE LAND USE BOUNDARIES
NORTH
0
1 MILE
CH2M HILL


KEAHOLE
GENERATING
STATION
OFFICE OF
STATE PLANNING
PETITION AREA
LEGEND
Proposed Urban District
Source: Department of Business, Economic Development and Tourism - Land Use Commission
FIGURE 3-9
PROPOSED
RECLASSIFICATION
AREA
NORTH
0
1 MILE
CH2M HILL

County Zoning. The County of Hawaii zoning designations are shown in Figure 3-10. Three designations cover most of the study area: Industrial, Open, and Unplanned. The Industrial zone corresponds with most of the state's Urban District designations; Agriculture zoning covers the Agricultural Park. Open and Unplanned zoning designations occupy most of the lands mauka of the project site. The County has zoned the area of the Kona Palisades subdivision as Residential.

The Keahole Generating Station site is designated as Open. County land use approvals will not be required for the proposed unit addition to the generating station. The project site is outside the County's Special Management Area (SMA) that limits development in the coastal zone. The boundary of the SMA is from the Queen Kaahumanu Highway west to the Pacific Ocean.

Proposed Land Use. The proposed land uses in the study area are the University of Hawaii-West Hawaii campus, the University Heights Subdivision, the Ooma Resort, and expansions to Keahole Airport, Keahole Agricultural Park, and the Natural Energy Laboratory of Hawaii (Figure 3-11).

University of Hawaii, West Hawaii Campus. After a site search for a West Hawaii Campus, the University of Hawaii selected a 500-acre parcel approximately 0.75 mile mauka of the Keahole Generating Station site and immediately north of the Kona Palisades Subdivision. The University of Hawaii will request a 65-year lease from the State Land Board and will submit a budget request to the State Legislature for construction funding.

Preliminary site plans are for commercial, university-related, high-density residential, university buildings and university related residential development. A new mid-level arterial road about 1 mile mauka of and parallel to the Queen Kaahumanu Highway will form the western boundary of the site.

OSP Reclassification Petition. The makai portion of the proposed University of West Hawaii Campus is part of the district boundary amendment petition submitted by OSP for reclassification from Conservation and Agricultural Districts to Urban District. Other uses for the remainder of the petition area have yet to be defined, although a mix of urban uses is expected, including but not limited to housing, parks, commercial uses, light industrial uses, roadways, and public facilities.

University Heights Subdivision. The Land Use Commission has approved a proposed residential development called "University Heights" (LUC Docket A92-679). The approximately 24-acre development, proposed by White Hat Development Corporation, will consist of single-family residences.

Ooma Resort. The Kahala Capital Corporation plans to develop approximately 314 acres southwest of the project site that extends makai of Queen Kaahumanu Highway to the Pacific Ocean. Site plans call for a 600-unit resort hotel, a 300-unit multifamily residential development, a marine park/visitor center, an office park, a high technological area, and an 18-hole golf course with clubhouse.

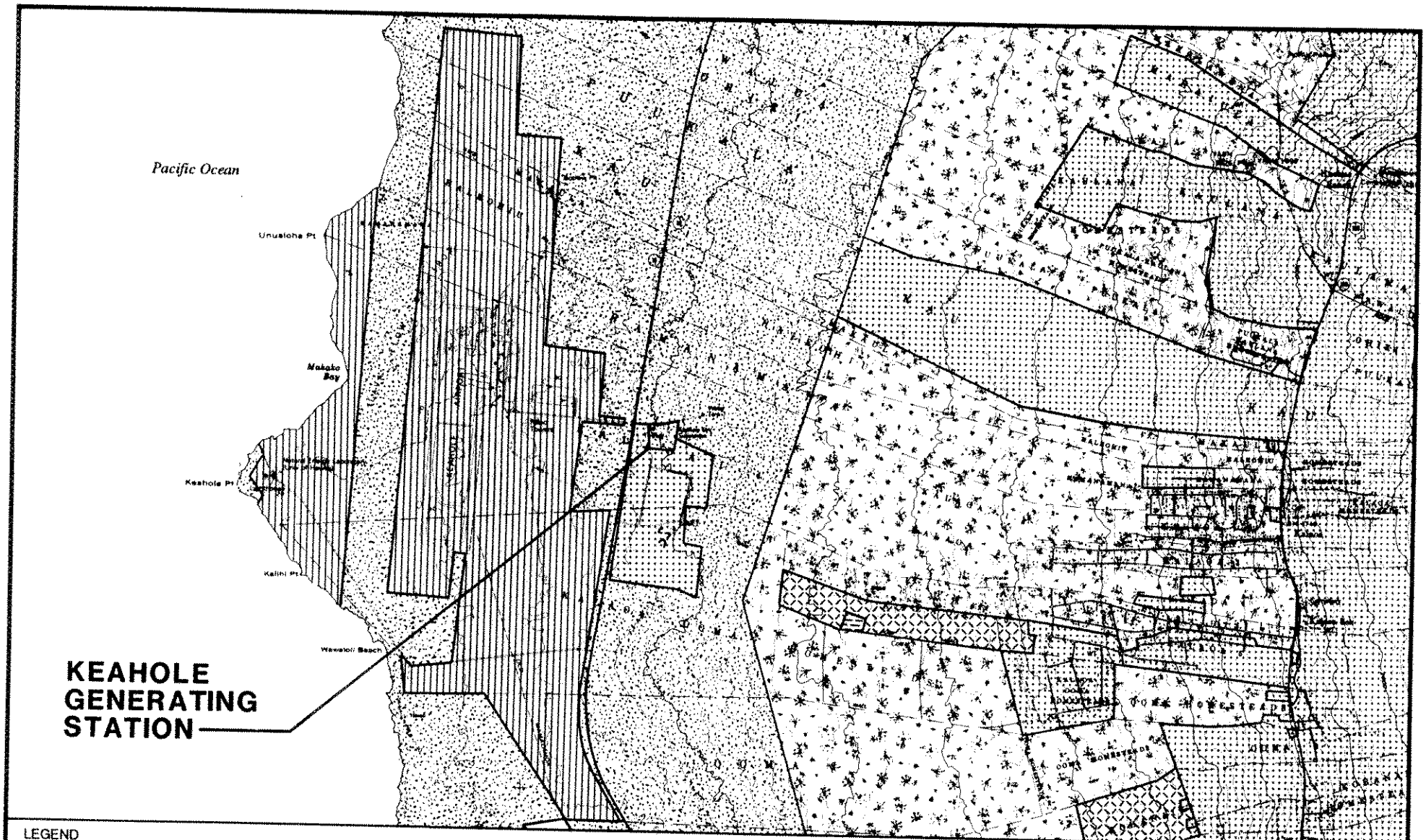


FIGURE 3-10

HAWAII COUNTY ZONING

LEGEND

Planned/Proposed (No permits or approvals granted)

* NELHA = Natural Energy Laboratory of Hawaii Authority

Source: CH2M HILL, 1992

FIGURE 3-11

PROPOSED LAND USE

CH2M HILL

Keahole Airport. An airport facility expansion is planned to improve runway instrumentation, increase runway pavement strength, extend the runway length from 6,500 to 11,000 feet, and expand the passenger terminal, freight, and parking facilities. The runway improvements are scheduled to be completed in early 1994, with terminal improvements completed in 1995. These expansions are needed to accommodate the projected year 2005 passenger volumes of 4,160,000 arrivals/departures per year.

A second runway parallel to the existing runway is planned, but no schedule has been established. Also, a heliport is planned to be located on the eastern portion of the site, close to the Queen Kaahumanu Highway. The heliport's approach and departure will follow a north-south orientation.

Keahole Agricultural Park. The Department of Agriculture is seeking to expand the park by 200 acres along its southern boundary. The expansion would accommodate the strong and unmet demand for agricultural park lots at Keahole.

Natural Energy Laboratory of Hawaii Authority. NELHA is proposing to expand the Natural Energy Laboratory of Hawaii. NELHA has requested reclassification of approximately 83 acres of land north of the proposed Ooma Resort from Conservation District to Urban District (LUC Docket A91-669). The proposed use of the reclassification area is research and commercialization of ocean-related technologies.

Project Impacts

Expansion of the generating station is consistent with the existing use of the site. Because the site is classified as State Conservation lands, an amendment to the existing Conservation District Use Permit will be necessary for implementation of the proposed project.

The generating station does not conflict with surrounding existing and proposed residential, university campus, industrial, or resort land uses. Preliminary plans indicate that the proposed University of Hawaii-West Campus 500-acre site would be separated from the project site by open space, an arterial roadway, and high-density commercial and residential development.

Because there are no plans to develop the OSP reclassification petition area in the vicinity of the Keahole Generating Station, there will be no conflicts with uses in that area. HELCO submitted comments on the proposed amendment during the Notice of Preparation response period and indicated that HELCO may be interested in additional State land to the north and east of the Keahole facility to serve as a buffer between the station and potential development.

Mitigation Measures

No mitigation measures are required.

3.3.3 Population and Growth

Existing Conditions

The population of the Island of Hawaii has been increasing since 1960, as shown in Table 3-10, and growth is expected to continue into the next century. The population of the County of Hawaii, according to the 1990 census, was 120,317.

Table 3-10
Population of Hawaii County—1930-1990

Year	Population	Change in Population	Percentage of Change
1930	73,325	NA	NA
1940	73,276	-49	-0.1
1950	68,350	-4,926	-6.7
1960	61,332	-7,018	-10.3
1970	63,468	2,136	3.5
1980	92,053	28,585	45.0
1990	120,317	28,264	30.7

Note: NA=not available
Sources:
The General Plan. Hawaii County. November 1989.
U.S. Census, 1990 Data from State Department of Economic Development and Tourism.

The growth of West Hawaii has been a significant factor in the increase in the County's population. In 1970, West Hawaii had a population of 14,472 residents. By 1980, it had grown to 27,518, a 90.1 percent increase. In 1990, the population reached 43,373, an increase of approximately 57.6 percent over 1980.

Forecasts of population and visitor data for the Island of Hawaii used by HELCO in its demand projections were prepared by the Consumer Advocate's Office in conjunction with the Integrated Resource Plan. These data are shown in Table 3-11.

These population and visitor forecasts are two of a number of forecasts used to calculate power demand. The projections used by HELCO are also significantly lower than State DBEDT Series M-K projections or the County's General Plan projections; these estimated population on the Island of Hawaii in 2005 to be 180,000 and 217,000, respectively.

Table 3-11 Forecast Population and Visitor Census		
Year	**Population**	**Visitors**
1992	129,610	14,715
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874
Source: HELCO. Long Term Sales and Peak Forecast. March 1993.		

Hawaii's growth in terms of employment, population, income, and economic activity has been closely tied to the visitor industry. The principal visitor destination area of the Big Island is the South Kohala-North Kona region in West Hawaii. Resort developments are planned for the Kohala-Kona coastal area and also for the district of Kau. The west side of the island has dominated the visitor market, and this trend is expected to continue into the future.

The proposed project would be located in the North Kona district. Twenty-five percent of the island's population in the year 2005 is expected to be located in the North Kona district, and 46 percent will be living in West Hawaii.

Project Impacts

The proposed expansion will generate new construction jobs and approximately 10 permanent operations/maintenance jobs at the facility. This increase in employment will not be significant on a regional basis. The expanded Keahole facilities, however, will improve system voltage and overall system reliability, which is expected to have a significantly beneficial impact on Island residents and businesses. In addition, the proposed project will serve the projected population growth of the island.

Mitigation Measures

No mitigation measures are required.

3.3.4 Visual Resources

Existing Conditions

Visual Environment. Visual resources in the vicinity have been evaluated in terms of the background, middleground, and foreground views from the project site. The existing facilities occupy 3.1 acres of a 14.998-acre parcel owned by HELCO. The existing facilities (Figure 1-4) are completely enclosed by a fence with one gate.

The facility has paved and unpaved areas. The unpaved areas consist of a compacted gravel surface. The site is relatively flat, with the exception of a depressed berm area for the fuel oil storage tanks. The developed portion of the site consists of 3.1 acres. Palm trees and shrubs that have been planted along the fence on the western portion of the facility visually screen the lower portion of the existing facilities.

The undeveloped portion, approximately 12 acres, remains in its natural condition, which consists of lava flows and intermittent clumps of grasses and low brush. Adjacent to and makai of the generating parcel is the Keahole Substation.

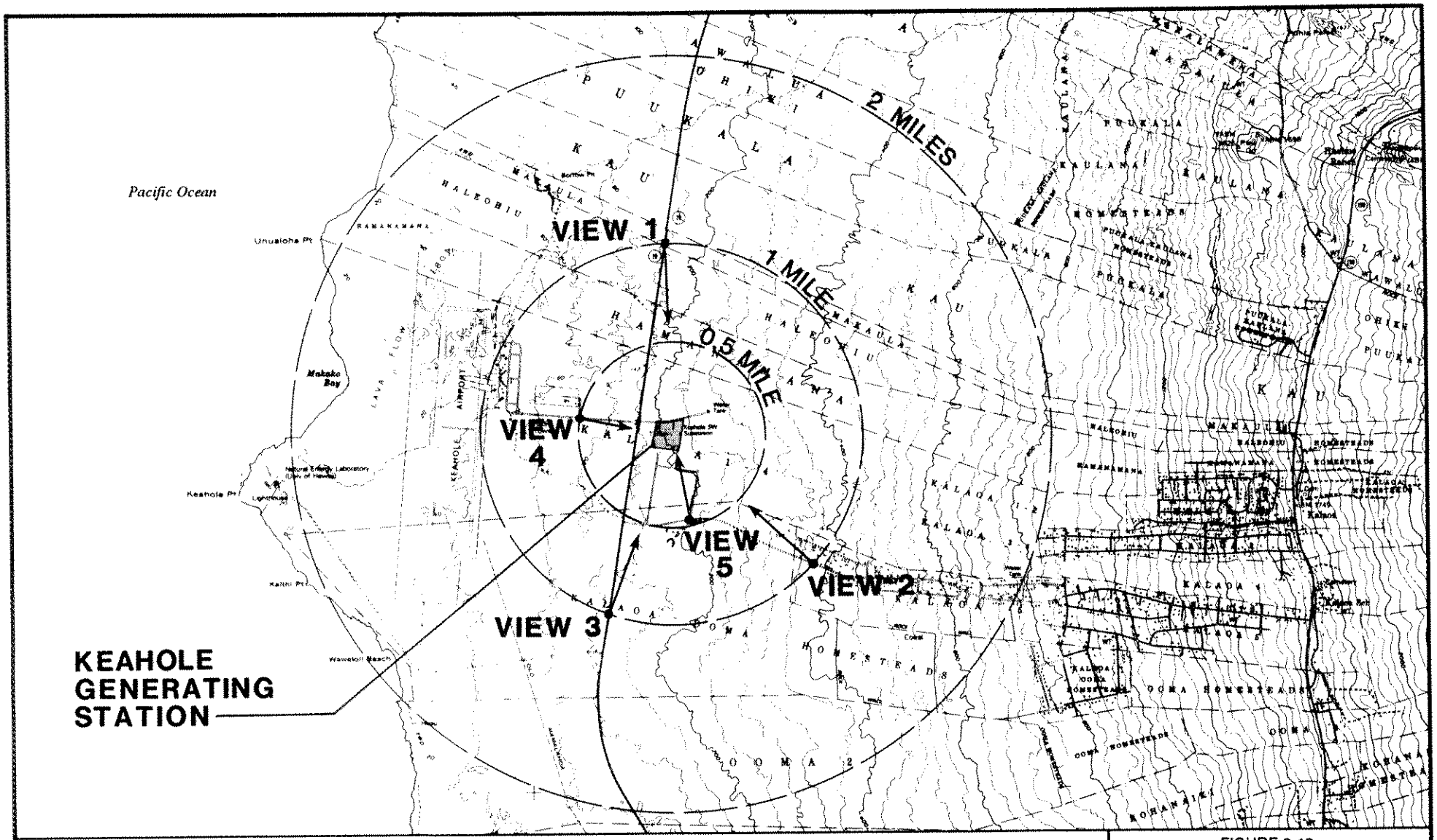
Foreground views, from the project site to 0.5 mile from it, include Keahole Agricultural Park, undeveloped land, four 90-foot-high radio towers, Queen Kaahumanu Highway, and the entrance to Keahole Airport. The terrain of the foreground views slopes gently toward the ocean.

Kona Highlands, Kona Wonder View, and Kona Coast View. Background views, between 5 miles from the site and the horizon, include Hualalai, Mauna Loa, and the Pacific Ocean. Middleground views, between 0.5 mile and 5 miles from the project site, include Keahole Airport and the Pacific Ocean, residential subdivisions at higher elevations to the east, and undeveloped sloping land to the north and south. These subdivisions include Kona Palisades, Kona Acres, Dominant landforms include broad plains, gently sloping hills, and lava flows.

Viewers. Viewer groups are characterized by their exposure and sensitivity to a landscape. Viewer exposure can be quantified in terms of viewer location, number of viewers, and duration of view. Viewer sensitivity is the receptivity of different viewers to their visual environment and is strongly affected by viewer activities, expectations, and preferences. The most sensitive viewer groups are those engaged in recreational activities, such as at a resort, followed by those in residential areas.

Generally, recreationists and residents are more sensitive to their surrounding environment than are persons en route to a destination by either car or airplane. Residents in the project vicinity and persons traveling on the Queen Kaahumanu Highway and the access road to Keahole Airport represent the principal viewers of the proposed facility expansion.

Key Views. Figure 3-12 presents the locations of five views of the project site. The views are discussed in terms of the dominance of the facility in each view as follows:



LEGEND

Viewer Location

FIGURE 3-12

VIEWER LOCATIONS

NORTH 0 1 MILE

CH2M HILL

- **Dominant**. The viewer's attention will be focused on the facility.

- **Codominant**. The viewer's attention will be divided among other features in the landscape of equal interest to the viewer.

- **Subordinate**. The facility will constitute a minor component of the landscape. The viewer will not be aware of the presence of the facility unless specifically looking for the facility.

Views of the existing facilities are as follows:

- **View 1** (Figure 3-13). The photograph was taken approximately 1 mile north of the site on the Queen Kaahumanu Highway, looking south. Principal features in this view include the highway and lava fields. The top of the existing 70-foot-high exhaust stack is the only feature of the facility that is visible. The facility is characterized as codominant from this viewing location.

- **View 2** (Figure 3-14). The photograph was taken approximately 1 mile east of the site along Kaiminani Drive near the Kona Palisades residential subdivision. The principal features in this photo are the grass and shrubs in the foreground, the gently sloping terrain, and the ocean in the background.

  The 70-foot-high exhaust stack from the combustion turbine and the six 40-foot-high stacks from the diesel engines are visible. The existing stacks are not visible above the horizon. The facility is characterized as codominant in the landscape from this viewing location.

- **View 3** (Figure 3-15).The photograph was taken approximately 1 mile south of the site on Queen Kaahumanu Highway, looking north. The dominant features visible are the highway, transmission line poles adjacent to the highway, and the gently sloping terrain. The only portion of the generating station that is visible is the top of the 70-foot-high exhaust stack. The exhaust stack is subordinate to the other landscape features from this viewing location.

- **View 4** (Figure 3-16). The photograph was taken from the airport access road, looking east toward the site. The principal features in the view are the roadway and streetlights, lava flows, and Keahole Generating Station. Vegetative landscaping successfully screens the ground-level structures of the facility. The stacks are a dominant feature in the landscape from this viewing location.

- **View 5** (Figure 3-17). The photograph was taken approximately 0.4 mile southeast of the site at the corner of Kaiminani Drive and Laui Street in Keahole Agricultural Park. The principal features of this view are the 70-foot-high stack at the facility site, the palm trees, gently sloping terrain, and the ocean. The existing facility is a dominant feature in the landscape from this viewing location.

FIGURE 3-13 **VIEW 1 OF EXISTING CONDITIONS SOUTHBOUND ON QUEEN KAAHUMANU HIGHWAY**

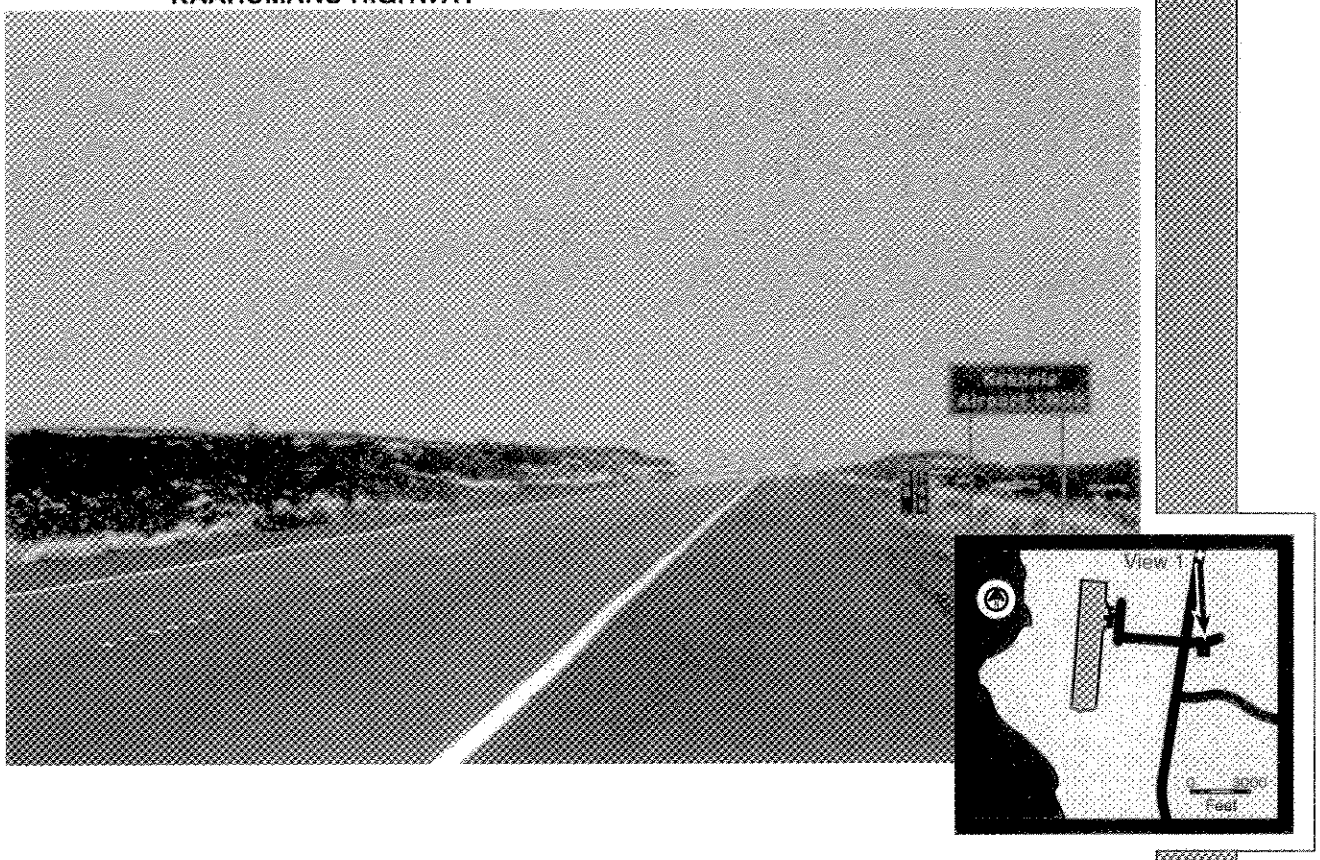


FIGURE 3-14 **VIEW 2 OF EXISTING CONDITIONS WESTBOUND ON KAIMINANI DRIVE**

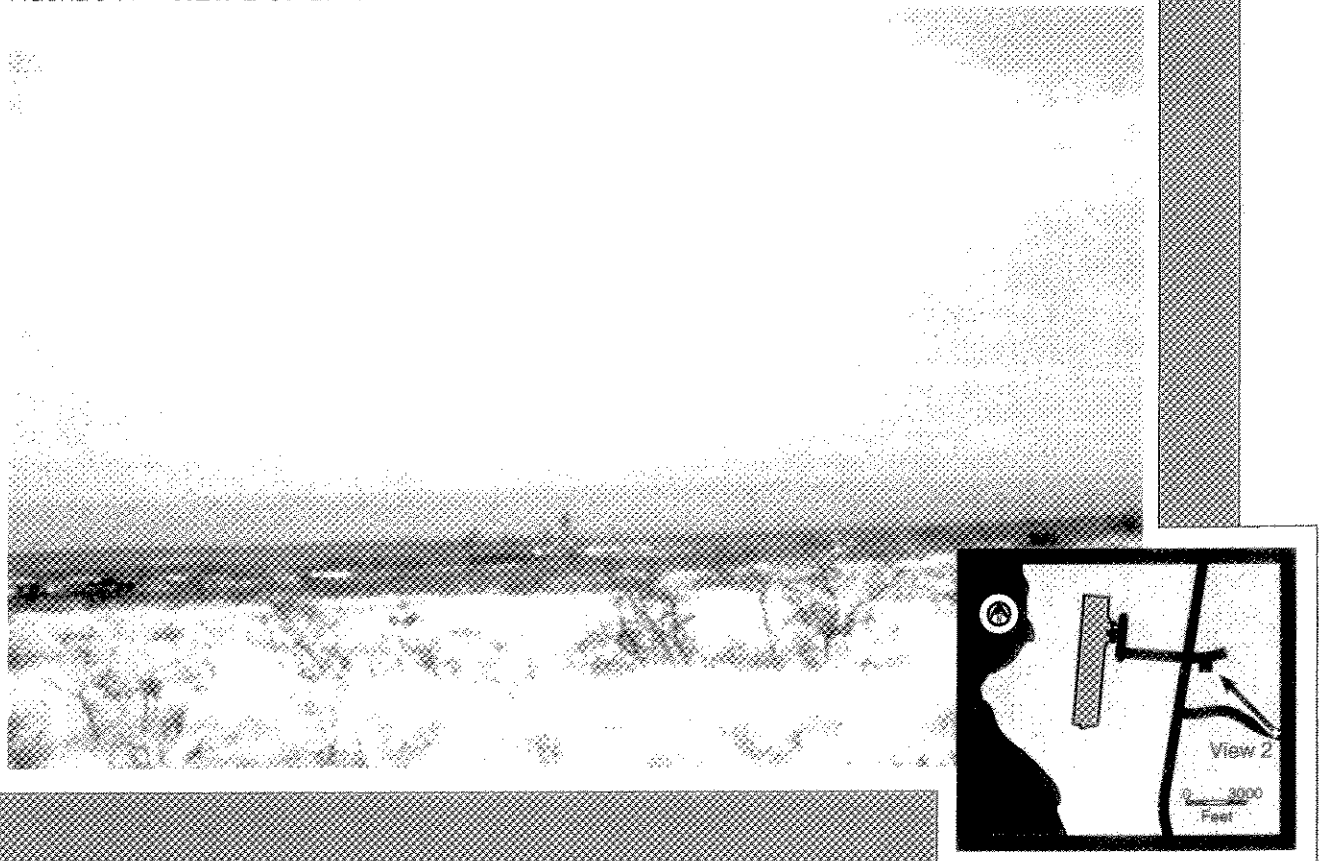


FIGURE 3-15 **VIEW 3 OF EXISTING CONDITIONS NORTHBOUND ON QUEEN KAAHUMANU HIGHWAY**

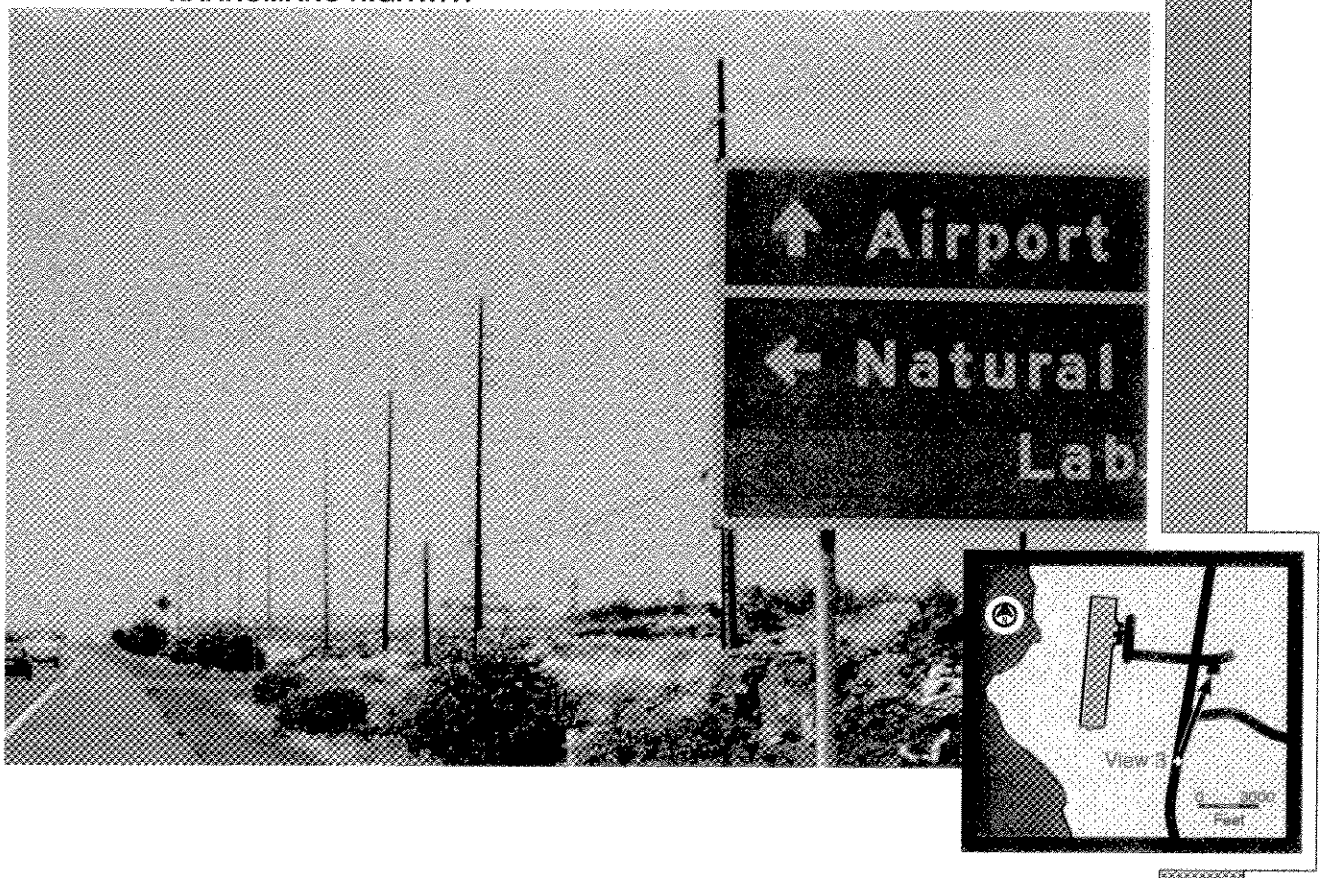
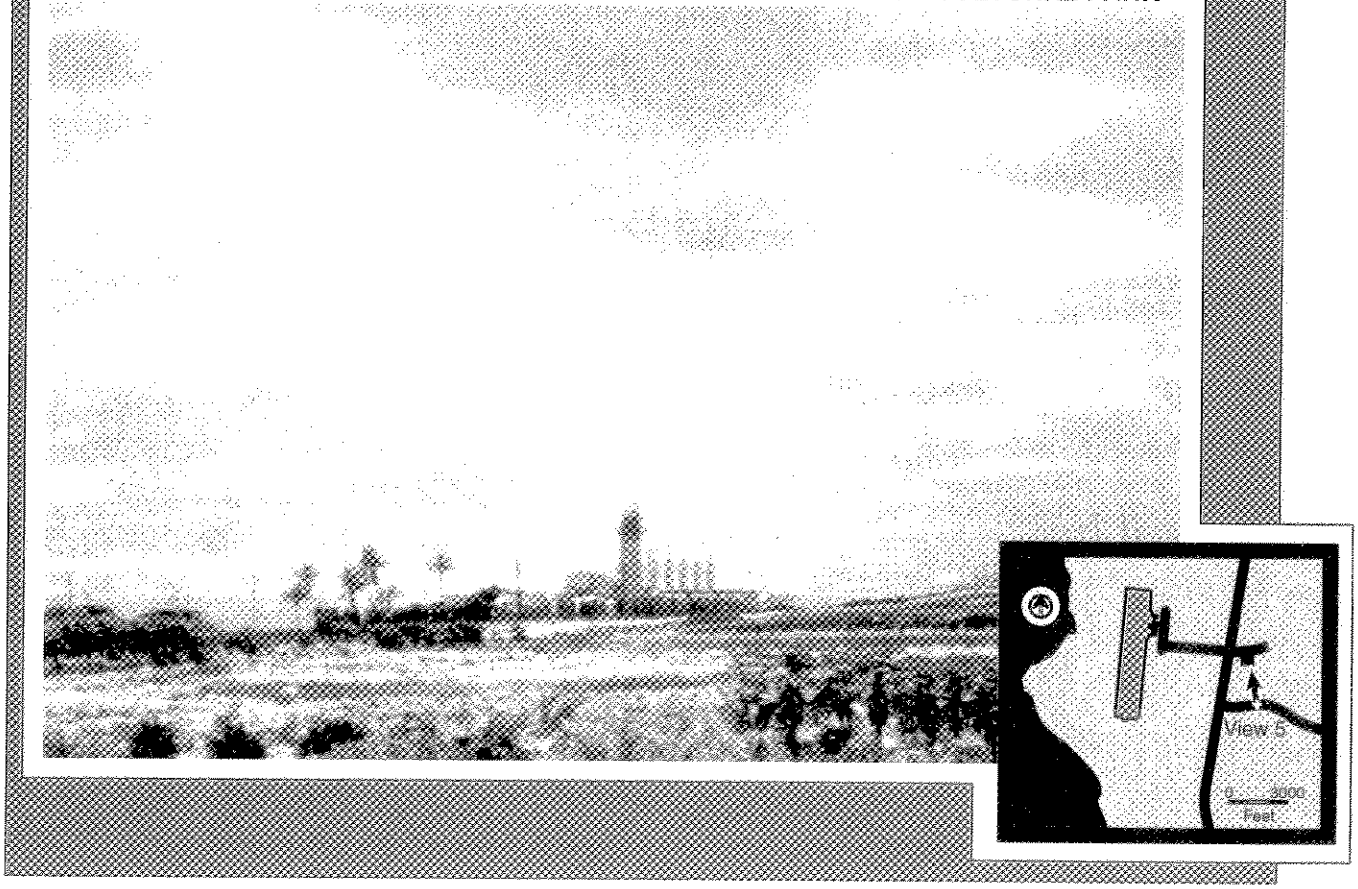


FIGURE 3-16 **VIEW 4 OF EXISTING CONDITIONS EASTBOUND FROM KEAHOLE AIRPORT**

FIGURE 3-17 **VIEW 5 OF EXISTING CONDITIONS FROM KEAHOLE AGRICULTURAL PARK**



Project Impacts

The proposed expansion of Keahole Generating Station will add a 56-MW DTCC unit to the existing facility and will include one 104-foot-high exhaust stack with a diameter of 24.4 feet. Because of the proximity of Keahole Airport to the generating station, FAA lighting requirements for the stack are expected to include installation of nonflashing red lights near the top of the stack for nighttime illumination. Other features of the proposed project include control houses, an office, a warehouse and shop, a transmission switching station, fuel oil storage tanks, an air-cooled condenser, and other associated power generation equipment. Existing vegetation, which serves to visually screen the existing facilities, will be displaced by the proposed expansion.

Visual Impact Analysis. The visual impacts of the proposed project were analyzed in terms of distance, screening such as vegetation, and backdrop, which consists of mountains and the Pacific Ocean. These features affect the degree of visual impact that an object in the landscape will have. Depending on the viewer's location, the project site will be viewed looking downslope, upslope, or across a broad plain. Figure 3-18 presents the effect of distance on the apparent size of the object being viewed.

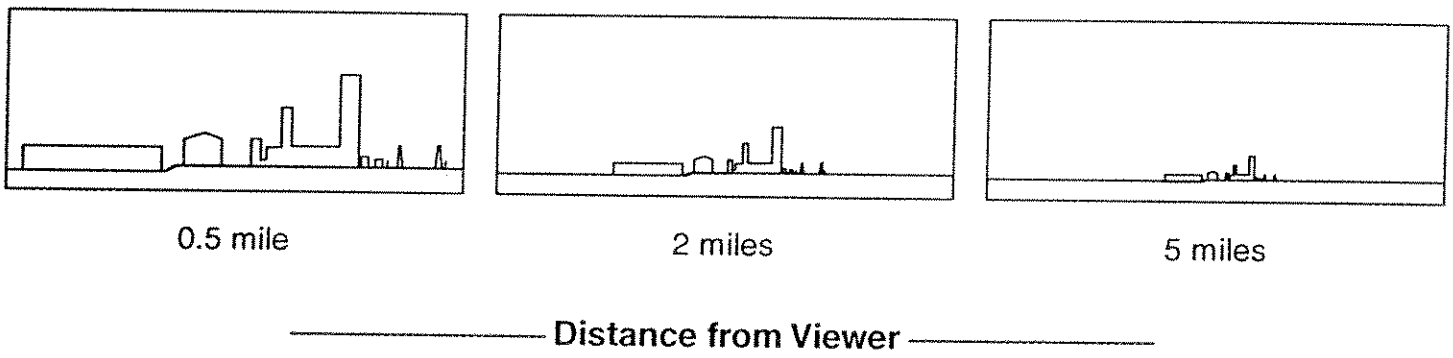


FIGURE 3-18
EFFECT OF DISTANCE ON THE APPARENT SIZE OF THE PROPOSED FACILITY EXPANSION

Photosimulations present the viewer with a computer-generated image of the proposed facility based on site plans and existing photographs of the facility. The following set of photosimulations presents the features of the proposed facility superimposed over the same views presented earlier. An evaluation of the proposed project in terms of visual resources is as follows:

- **View 1** (Figure 3-19). The photosimulation presents the view looking south on Queen Kaahumanu Highway. The facility will remain a codominant feature in the landscape from this viewing location.

- **View 2** (Figure 3-20). The photosimulation presents the view from Kona Palisades residential subdivision along Kaiminani Drive. The facility will remain a codominant feature of the landscape from this viewing location.

- **View 3** (Figure 3-21). The photosimulation presents the view looking north on Queen Kaahumanu Highway. The facility will remain subordinate to other landscape features from this viewing location.

- **View 4** (Figure 3-22). The photosimulation presents the view looking east from Keahole Airport Road. The facility exhaust stack(s) will continue to be a dominant feature in the landscape from this viewing location.

- **View 5** (Figure 3-23). The photosimulation presents the view from the corner of Kaiminani Drive and Laui Street in Keahole Agricultural Park. The facility exhaust stack(s) and related structures will continue to be dominant features in the landscape from this viewing location.

Summary of Impacts. A summary of impacts is presented in Table 3-12, which compares visual impacts of the existing facility with the expected impacts from the proposed expansion of Keahole Generating Station.

Table 3-12
Summary of Visual Impacts for the Proposed Expansion of Keahole Generating Station

Location	Existing Facilities	Proposed Project
View 1	Codominant	Codominant
View 2	Codominant	Codominant
View 3	Subordinate	Subordinate
View 4	Dominant	Dominant
View 5	Dominant	Dominant

FIGURE 3-19 **VIEW 1 OF PROPOSED PROJECT SOUTHBOUND ON QUEEN KAAHUMANU HIGHWAY**

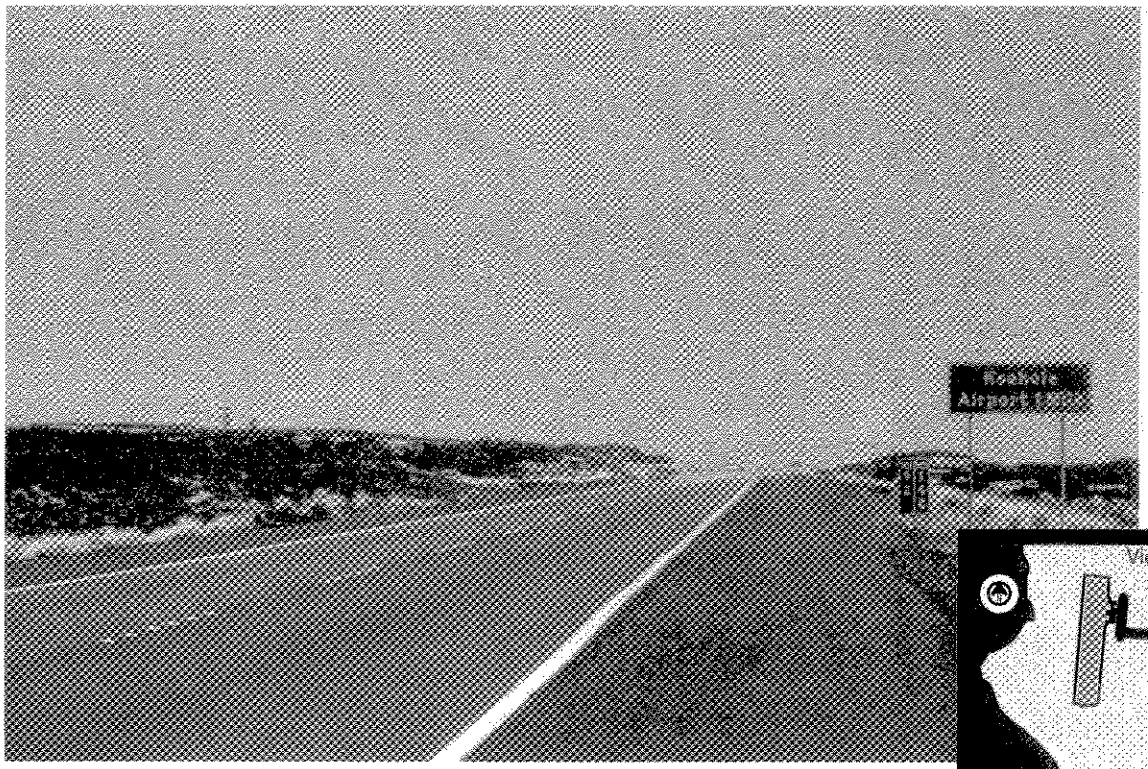


FIGURE 3-20 **VIEW 2 OF PROPOSED PROJECT WESTBOUND ON KAIMINANI DRIVE**

FIGURE 3-21 **VIEW 3 OF PROPOSED PROJECT NORTHBOUND ON QUEEN KAAHUMANU HIGHWAY**

FIGURE 3-22 **VIEW 4 OF PROPOSED PROJECT EASTBOUND FROM KEAHOLE AIRPORT**

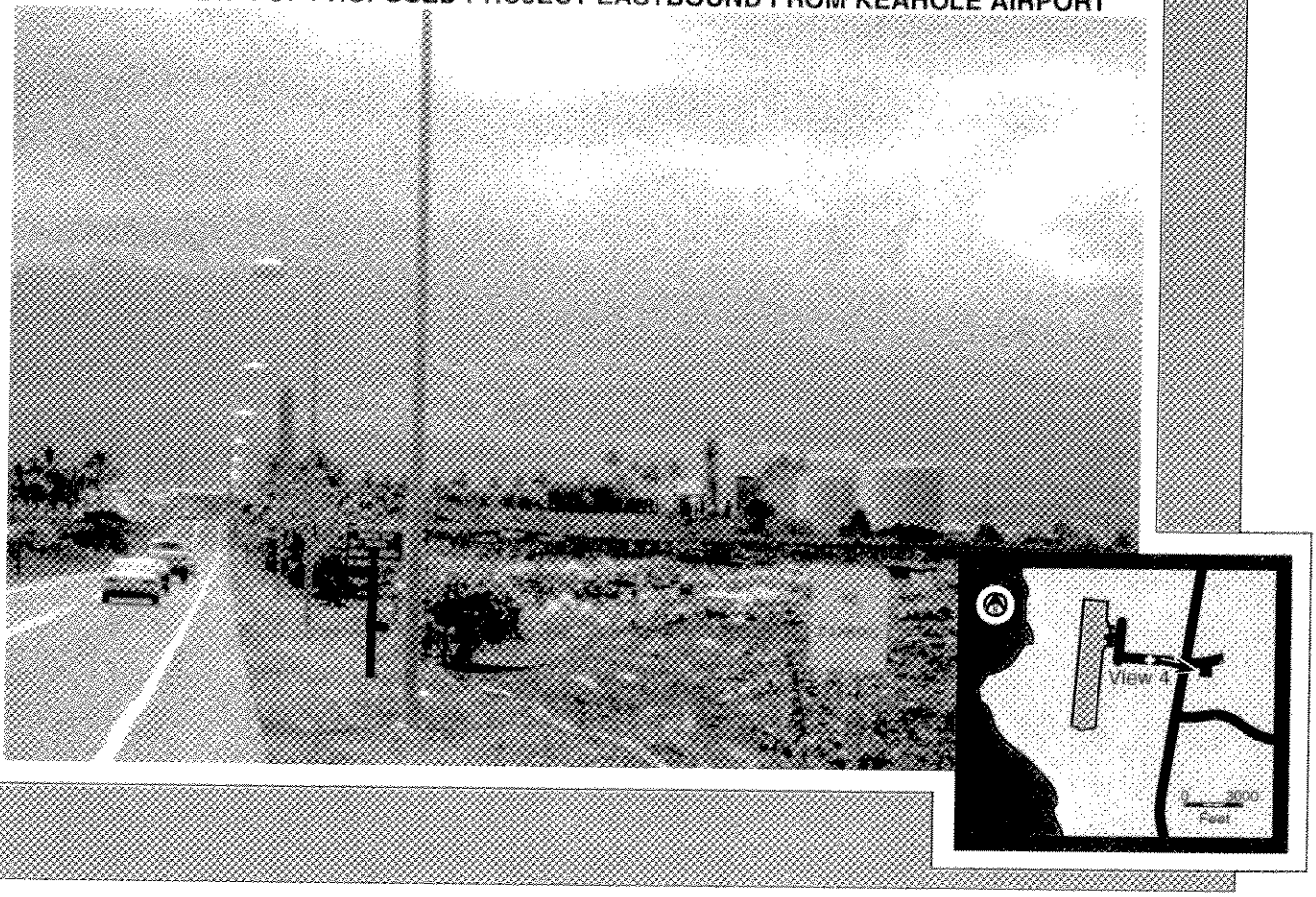
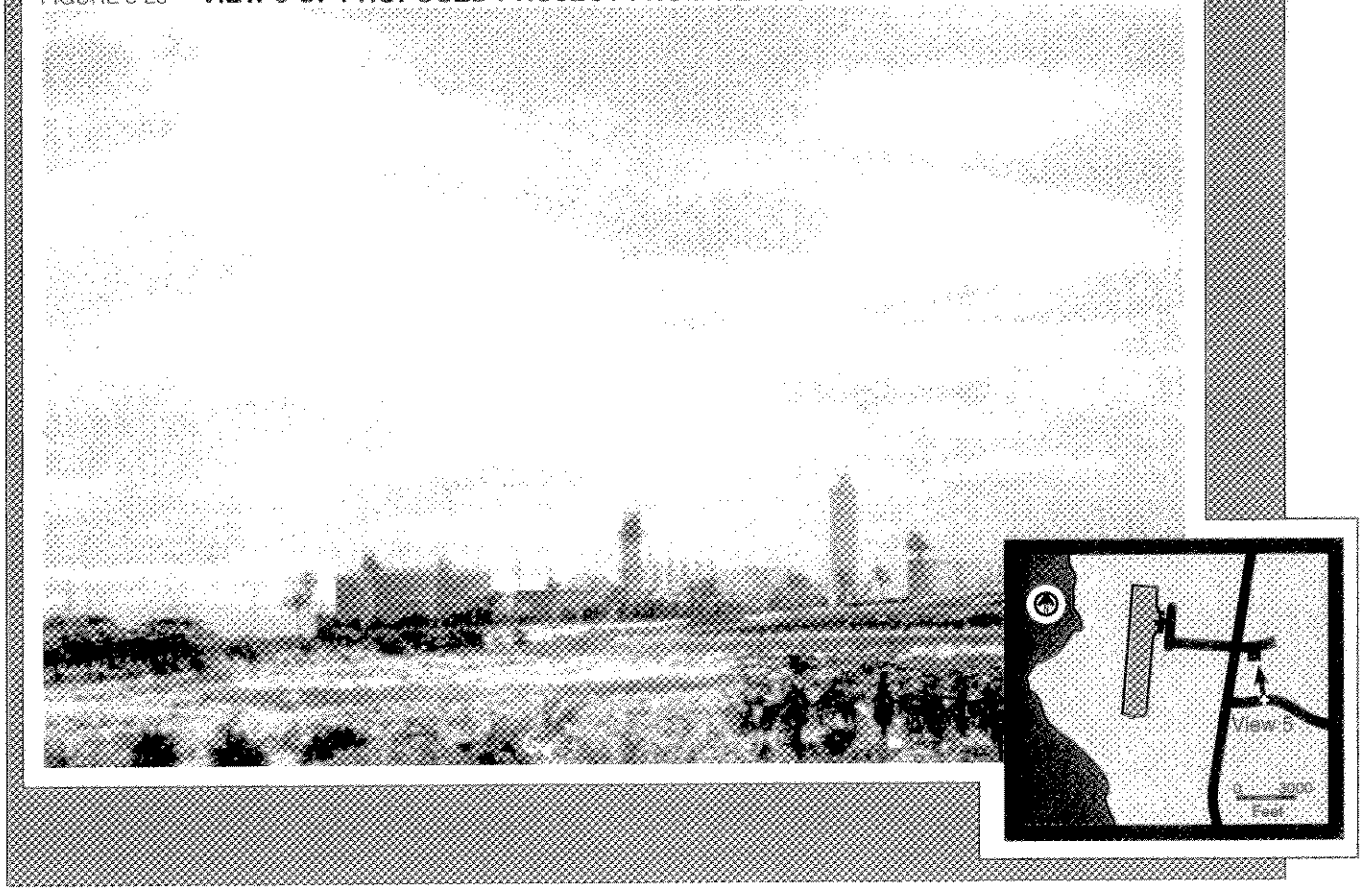


FIGURE 3-23 **VIEW 5 OF PROPOSED PROJECT FROM KEAHOLE AGRICULTURAL PARK**



On the basis of the analyses of distance, screening, and backdrop of the environment surrounding Keahole Generating Station, the following visual impacts have been assessed:

- Views from within 1 mile of Keahole Generating Station will be affected, although the impact may not be significant. Affected viewers include motorists leaving Keahole Airport, motorists on the Queen Kaahumanu Highway, residents of Keahole Agricultural Park, and residents of Plat 42 of the Kona Palisades subdivision.

- Views from within 1 to 2 miles of Keahole Generating Station may be affected, although the impact will not be significant. Residents in subdivisions at higher elevations looking downslope at the facility will have intermittent views of the exhaust stack because of the presence of houses and vegetation within the sight line of the facility. The related facilities of Keahole Generating Station will not be discernible at this distance. The visual impact at this distance will not be significant.

- Beyond 2 miles from the facility, views will not be adversely affected.

The project is not expected to have an adverse impact on the tourism industry, because land uses surrounding an airport are not likely to affect vacation destination planning. In general, it is not uncommon to encounter industrial land uses adjacent to airports. These encounters are short-term and have no bearing on the end-destination experience.

Mitigation Measures

Earth-tone construction materials and paint will be used to minimize the visibility of the project. A conceptual landscape plan and landscape sections are presented in Figures 3-23A and 3-23B. A detailed landscaping plan is being developed that will be designed to screen the project from viewers. Landscaping will be installed during Phase 1 and will also serve to partially screen construction activities. Plantings will be irrigated to provide maximum growth of the vegetative screen. Renderings of the landscaping plan are shown in Figures 3-23C through 3-23F.

3.3.5 Property Values

The potential impacts of the proposed expansion of Keahole Generating Station on property values have been assessed for Keahole Agricultural Park and for nearby residential subdivisions. A copy of the report *Assessment of Potential Property Value Impacts*, which specifically addresses impacts to residential subdivisions, can be found in the Draft EIS, Volume II, Appendix H and is summarized in this section. In response to public comments, an additional study was conducted to specifically address potential impacts to property values within the Keahole Agricultural Park. The study is provided in Section 10 and is summarized in this section.

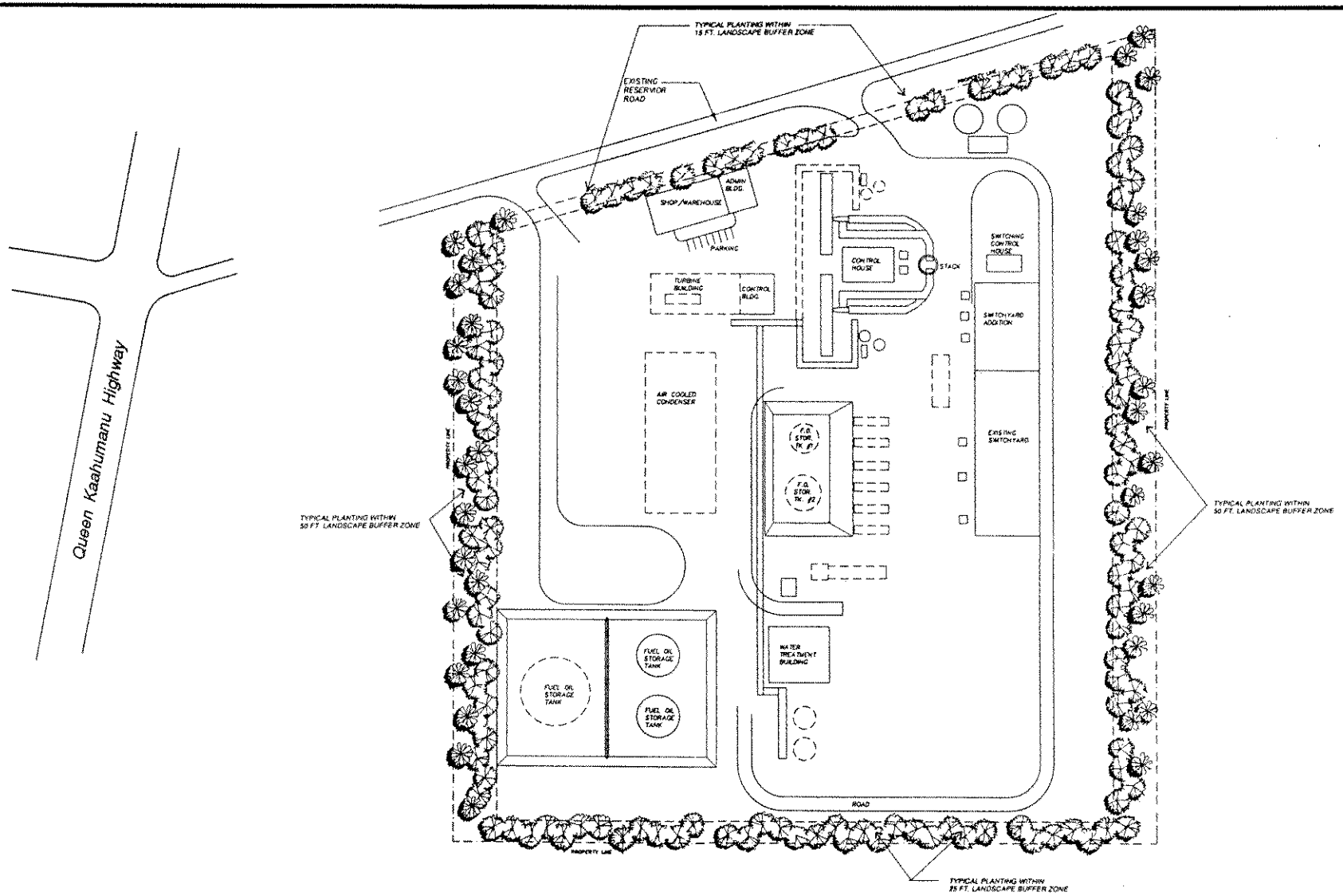


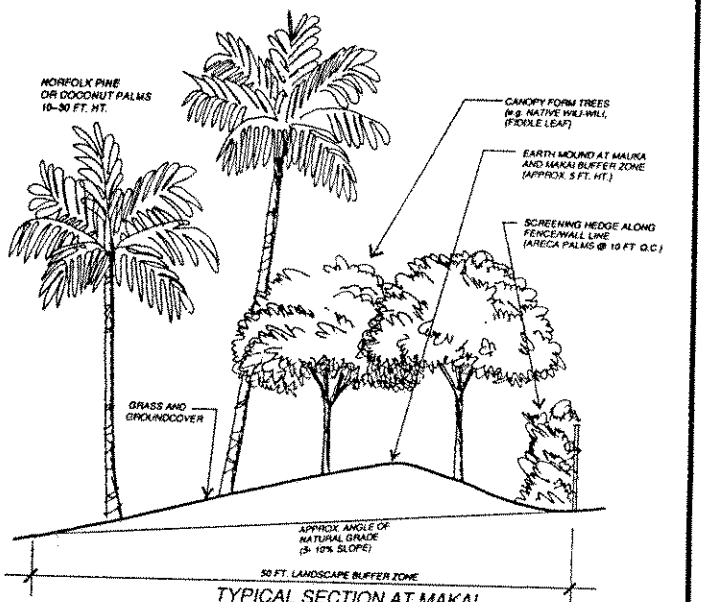
FIGURE 3-23A

SCHEMATIC LANDSCAPE PLAN

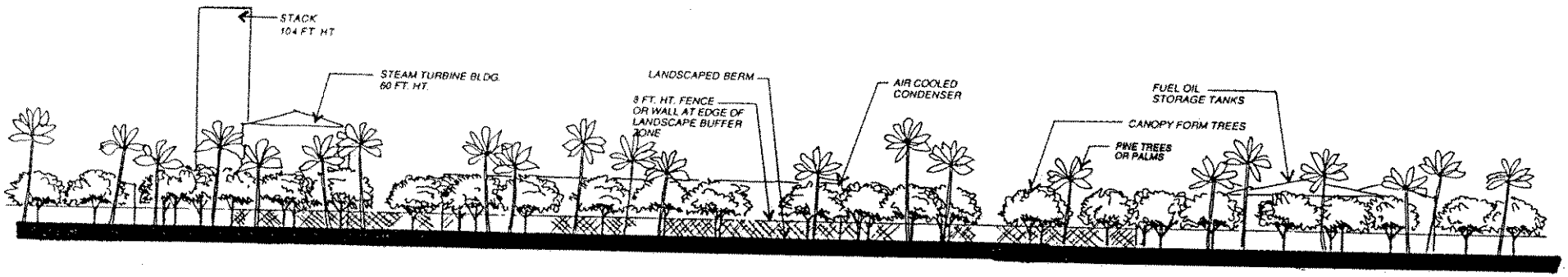
NORTH

0 100 200 FEET

CH2M HILL



TYPICAL SECTION AT MAKAI LANDSCAPE BUFFER ZONE



MAKAI ELEVATION

NOTE: Specific plant species unknown at this time.

FIGURE 3-23B

CONCEPTUAL LANDSCAPE SECTIONS

CH2M HILL

Research Methods

Keahole Agricultural Park. To assess the potential impacts of the proposed project on future agricultural park property values, the following information was reviewed: applicable land use and development ordinances, long-term ground leases between the State of Hawaii and leasehold owners at the Keahole Agricultural Park, Agricultural Park Program Rules, and leasehold sale records. Interviews were also conducted with buyers for sales that occurred since 1985, the broker of a current listing at the agricultural park, and representatives of the Hawaii State Department of Agriculture responsible for administering the Agricultural Park Program and, specifically, the Keahole Agricultural Park.

Residential Subdivisions. To assess the potential impacts of the proposed project on future residential subdivision property values, historical property values were evaluated. This evaluation addressed whether residential subdivisions near the existing Keahole Generating Station were significantly different from similar properties approximately 5 miles from the station. Two statistical methods were used to evaluate whether there were any significant differences between the two locations. Future impacts were subsequently assessed based on existing property value trends within the region.

The statistical analyses were complemented by a review of literature that presents findings from other studies of impacts to property values and by discussions with professionals knowledgeable about the local real estate market.

Existing Conditions

Keahole Agricultural Park. Keahole Agricultural Park (Figure 3-24) is located adjacent to Keahole Generating Station and has 34 parcels ranging in size from approximately 4.5 to 7 acres. Twenty-two of the lots contain dwelling units. The land is owned by the State of Hawaii and leased for 55-year terms. The leases are given out by lottery; more than 1,000 names are currently on the waiting list for the next lottery.

Keahole Agricultural Park was managed by the Department of Land and Natural Resources until 1988. Since 1988, it has been managed by the Department of Agriculture.

In the agricultural park, the land belongs to the State of Hawaii and is rented to leaseholders. Leasehold sales must have the approval of the Board of Agriculture. Leasehold interests may be sold only to a buyer who has a minimum of 2 years of full-time or 4 years of part-time agricultural experience. The improvements on the lots are owned by the leaseholder. The State's policy is to discourage speculation involving agricultural park lots. Therefore, improvements are typically sold for a price reflecting out-of-pocket costs for the improvements.

FIGURE 3-23C

CONCEPTUAL VIEW SITE FROM SOUTH WITH INITIAL LANDSCAPING

CH2M HILL

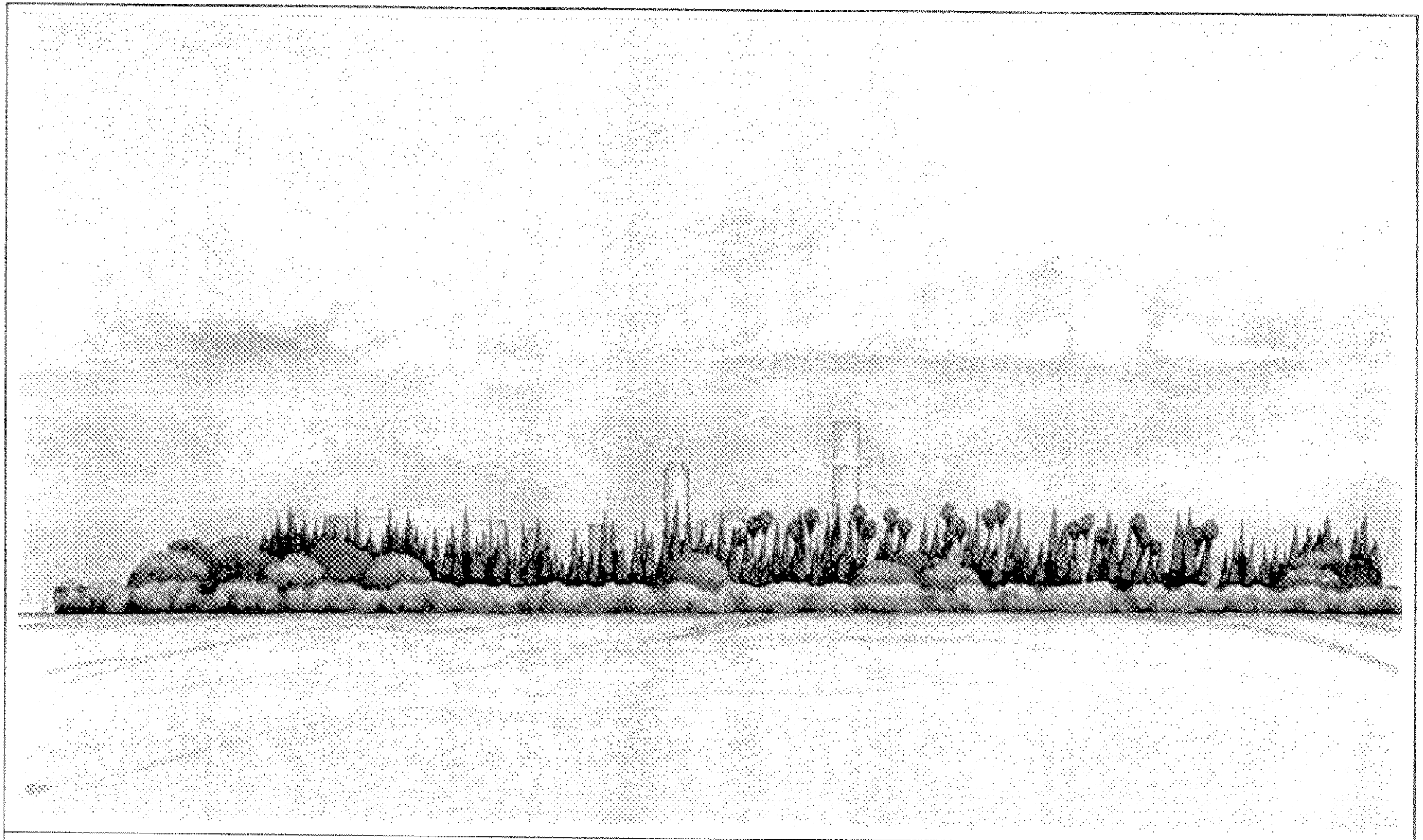


FIGURE 3-23D

CONCEPTUAL VIEW SITE FROM SOUTH WITH MATURE LANDSCAPING

CH2M HILL

FIGURE 3-23E

CONCEPTUAL VIEW MAKAI OF SITE FROM QUEEN KAAHUMANU HIGHWAY WITH INITIAL LANDSCAPING

CH2M HILL

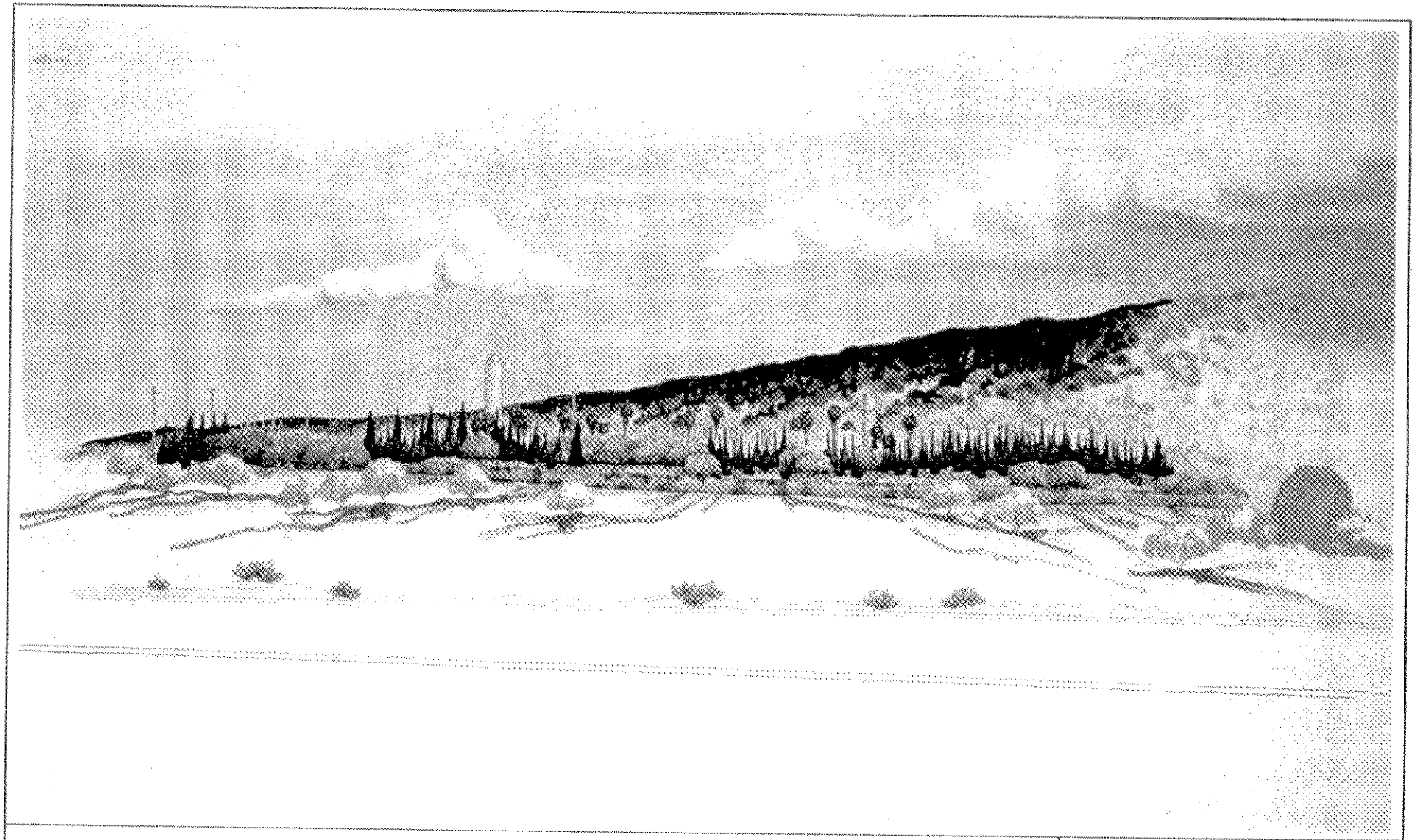
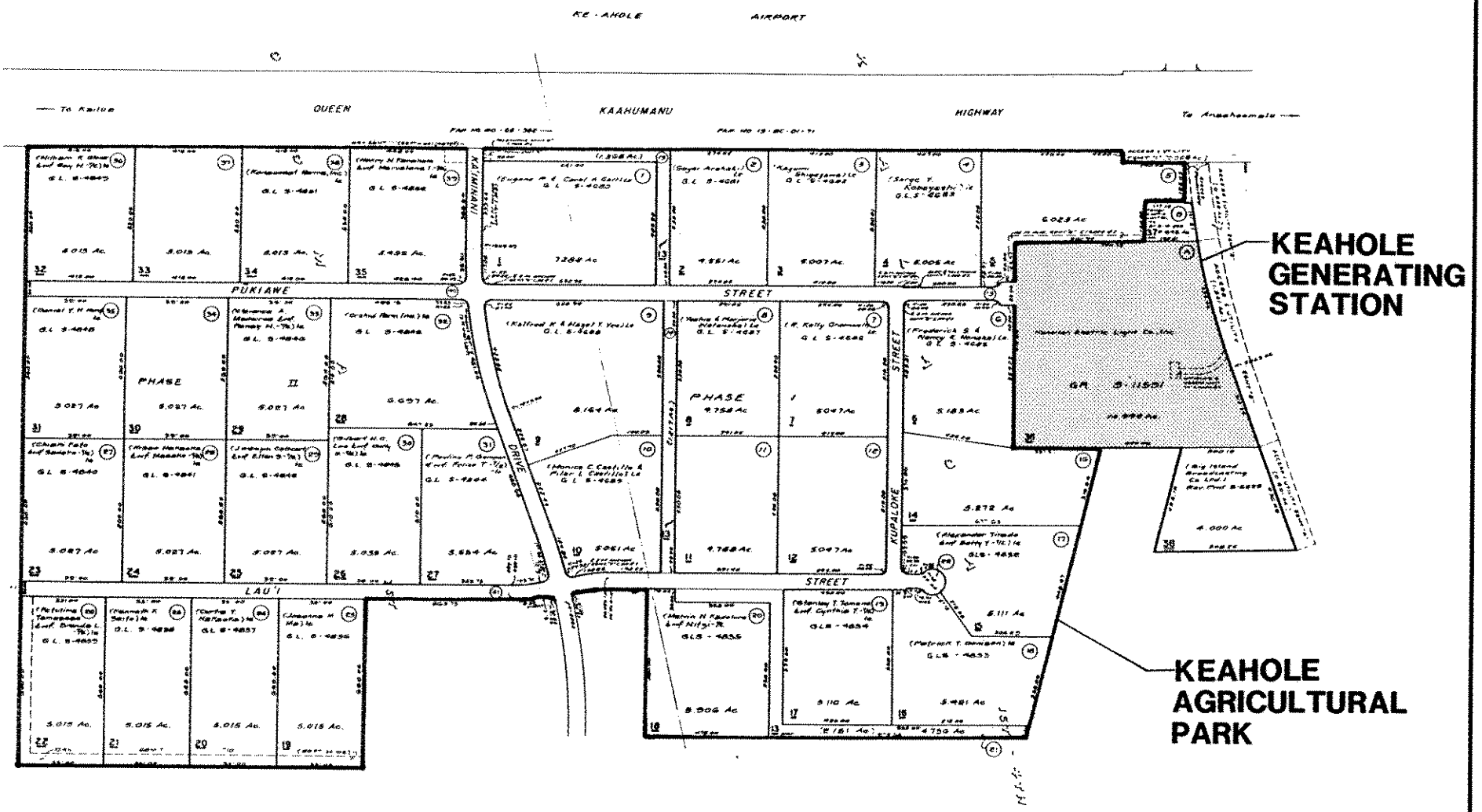


FIGURE 3-23F

CONCEPTUAL VIEW MAKAI OF SITE FROM QUEEN KAAHUMANU HIGHWAY WITH MATURE LANDSCAPING

CH2M HILL



NOTE: Tax Map Key Number - Zone 7 Section 3 Plat 49

Source: State of Hawaii, Department of Taxation, 1992

FIGURE 3-24

KEAHOLE AGRICULTURAL PARK

NORTH 0 500 FEET

CH2M HILL

Residential Subdivisions. The regional area for the study of the potential impacts to residential subdivisions is the North Kona District (Figure 3-25). The residential subdivision nearest Keahole Generating Station is Kona Palisades, which consists primarily of single-family homes (Figure 3-26). The only properties in the Kona Palisades Subdivision that were evaluated in this study were Plats 39, 40, 41, and 42 (Zone 7). Plat 42 of Kona Palisades begins approximately 1 mile from Keahole Generating Station (Figure 3-27). The Kona Palisades subdivision, however, extends up to Mamalahoa Highway. Keahole Generating Station and Keahole Airport are intermittently visible from locations within these plats.

The control area is located 5 miles southeast of Keahole Generating Station and 3.2 miles south of Kona Palisades and comprises a portion of Kealakehe Homesteads and all of the adjacent Chocho Estates subdivision (Figure 3-26). Plats 14, 16, and 18 (Zone 7) were evaluated as the control area (Figure 3-28). From Kealakehe Homesteads/Chocho Estates, Keahole Airport represents a subordinate element in the landscape, and Keahole Generating Station is not visible. The subdivisions of Kealakehe Homesteads/Chocho Estates have single-family homes and vacant properties that are comparable to those in Kona Palisades. Both Kona Palisades and Kealakehe Homesteads/Chocho Estates are similar in attributes such as size, materials, age of dwelling units, lot sizes, views of the Pacific Ocean, residential desirability, proximity to schools, shopping and employment, tax rates, quality of the school district, and zoning.

Project Impacts

Depending on the compatibility of the surrounding land use, industrial facilities may adversely affect nearby resources. Associated with the potential to generate noise and to affect air quality and visual resources is the potential to affect property values of nearby residences. Such an impact may be reflected in lower market values. Potential impacts to the property values of Keahole Agricultural Park and Kona Palisades subdivision are discussed below.

Keahole Agricultural Park. The project is not expected to adversely affect property values at the Keahole Agricultural Park for the following reasons:

- The agricultural park lots were developed primarily for agricultural use. Industrial projects of this type typically have less effect on the value of properties used primarily for agricultural purposes than on properties used primarily for residential purposes.

- The terms of the ground leases are very favorable for lessees. The sale price of leases allows lessees to recoup their out-of-pocket costs or current value of improvements. Because the ground rents are substantially below market rents, it may not be difficult to find a purchaser willing to pay the leaseholder's out-of-pocket expenses or current value for improvements, regardless of the presence of the proposed unit addition.

LEGEND

- - - - District Boundary

North Kona Study Area

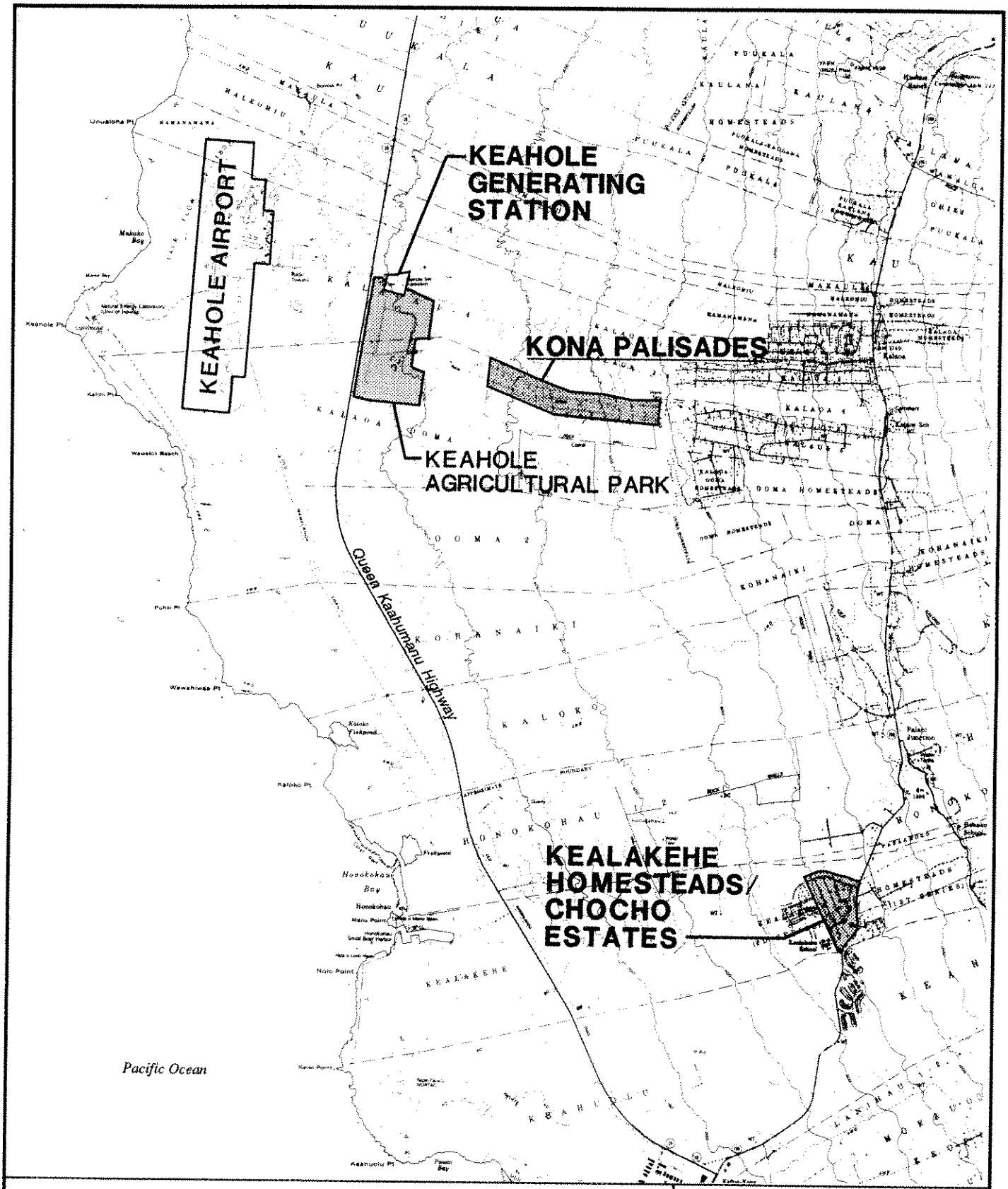
FIGURE 3-25

REGIONAL STUDY AREA FOR PROPERTY VALUES

NORTH

0 5 10 MILES

CH2M HILL



LEGEND

Properties Evaluated

FIGURE 3-26

LOCATIONS OF RESIDENTIAL PROPERTIES EVALUATED

NORTH

0 1 MILE

CH2M HILL

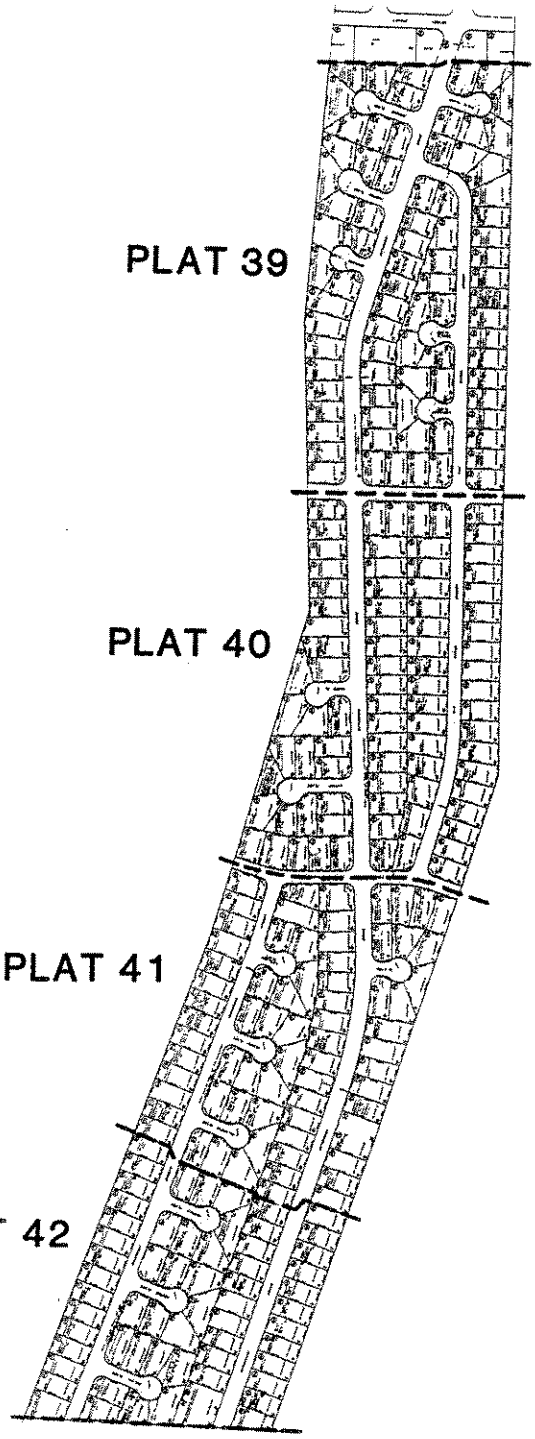


FIGURE 3-27

KONA PALISADES
ZONE 7, SECTION 3

NORTH

0 500 1000

FEET

CH2M HILL

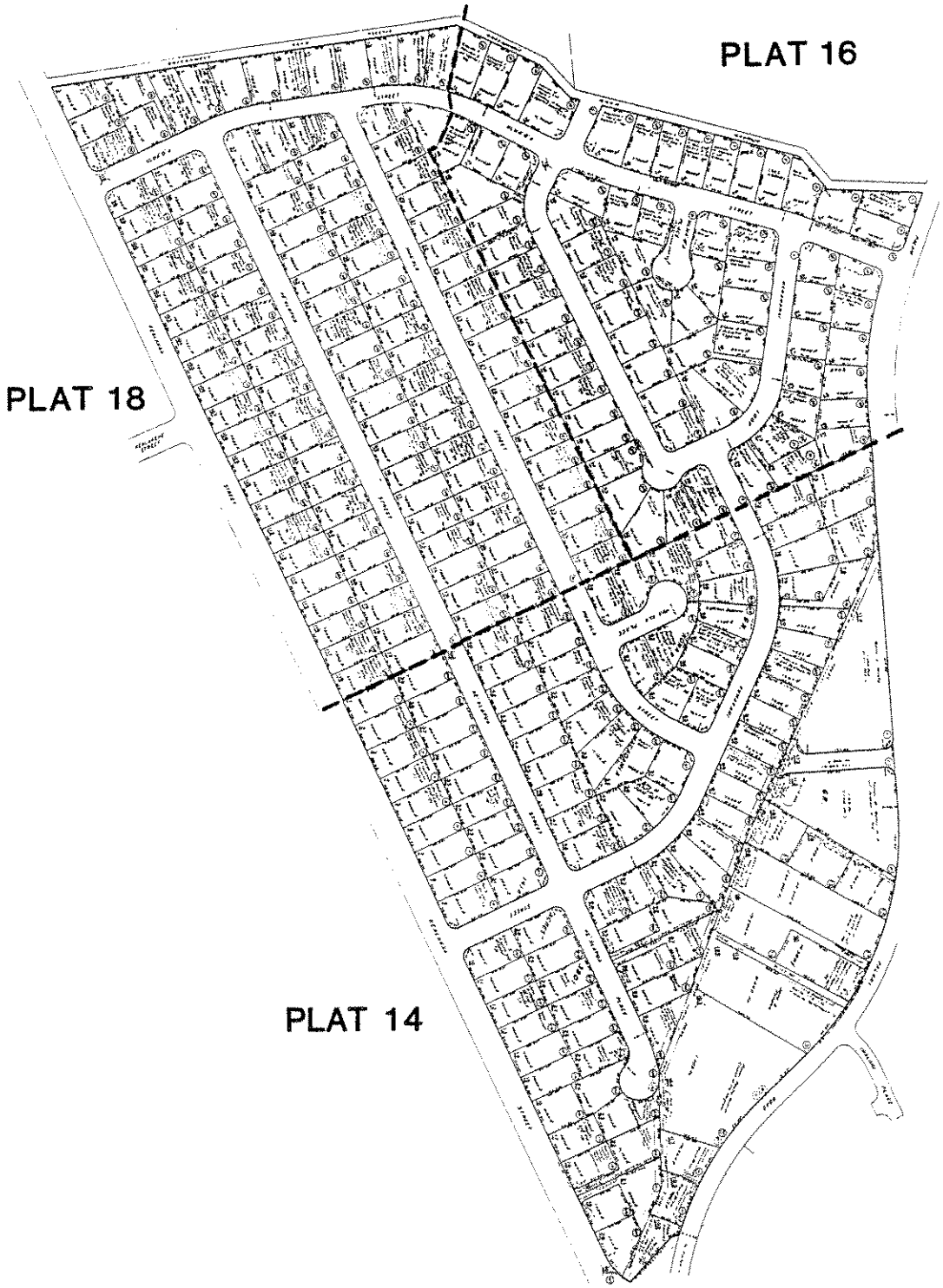


FIGURE 3-28

KEALAKEHE HOMESTEADS/ CHOCHO ESTATES ZONE 7, SECTION 4

NORTH

0 500 FEET

CH2M HILL

- Because there are more than 1,000 people on the waiting list for a lease, the proposed unit addition is not expected to affect the demand for agricultural leases at the Keahole Agricultural Park.

Residential Subdivisions. Analysis of trends of property values using statistical methods showed that property values near the existing Keahole Generating Station are not significantly different from property values in the control area, except that those in Kona Palisades are generally higher (see the Draft EIS, Volume II, Appendix H). These findings, combined with the results of the literature review, the opinions of local real estate appraisers, the marginal visual change for views from residential subdivisions, and the factors determining the value of residential properties along the Kona coast, indicate that the proposed action is not expected to have a significant impact on nearby residential subdivisions.

Mitigation Measures

Because no significant impacts to property values have been identified, no mitigation measures are proposed.

3.3.6 Transportation

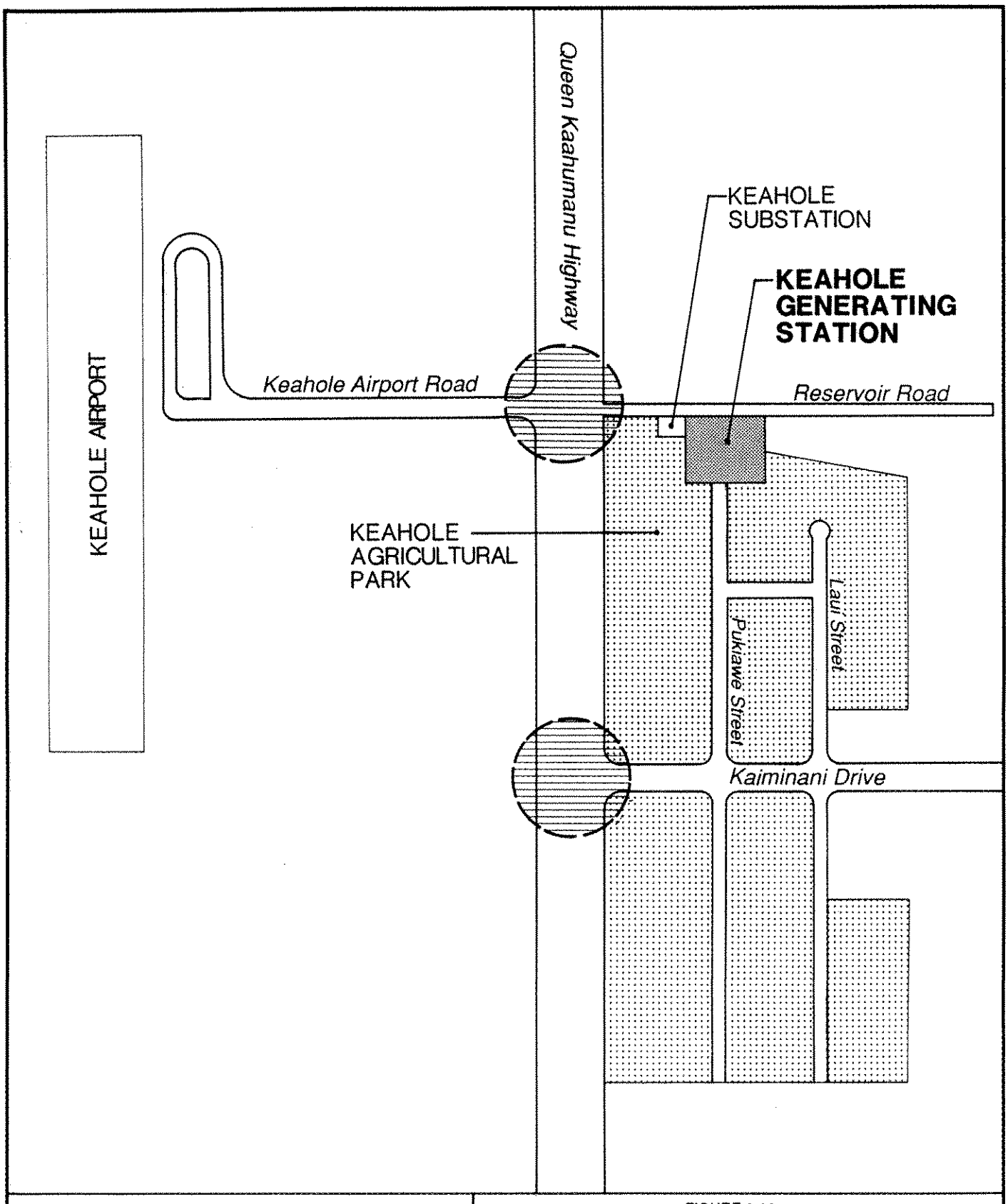
A traffic impact analysis report of the proposed expansion of Keahole Generating Station was prepared by The Traffic Management Consultant. This section of the EIS summarizes the report. The complete report is included in the Draft EIS, Volume II, Appendix I. Since this report was prepared, HELCO has decreased its estimate of the number of trucks anticipated for daily fuel delivery. Numbers in this Revised Final EIS reflect this decrease. Fewer trucks entering and exiting the site would be anticipated to have a smaller impact.

A field investigation, which included a site inspection of the road and traffic conditions and a traffic count survey, was conducted in August 1992 to establish baseline traffic conditions.

In response to public comments, a traffic accident study was also performed to evaluate safety issues associated with the Keahole Airport Access Road and the Kaiminani Drive intersections with Queen Kaahumanu Highway. A copy of the study is provided in Section 10 of the Revised Draft EIS, Volume II (July 30, 1993).

Existing Environment

Queen Kaahumanu Highway is the primary arterial highway in the region. It is a high-quality, two-lane, two-way highway between Kawaihae and Kailua. Queen Kaahumanu Highway is unsignalized at its intersections with the Keahole Airport Access Road and Kaiminani Drive. Mamalahoa Highway is a secondary arterial highway serving the region located mauka of Queen Kaahumanu Highway. The only connection between the two arterials in the project vicinity is Kaiminani Drive, a residential collector roadway. The posted speed limit on Queen Kaahumanu Highway in the vicinity of the project is 55 miles per hour (mph). The locations of these roadways relative to the project are shown in Figure 3-29.



LEGEND

Intersections Evaluated

FIGURE 3-29

ROADWAY INTERSECTIONS EVALUATED FOR THE PROPOSED EXPANSION OF THE KEAHOLE GENERATING STATION

NORTH

Not to scale

CH2M HILL

Level of service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream. LOS A, B, and C are considered satisfactory levels of service. LOS D is generally considered a desirable minimum level of service. LOS E is an undesirable condition, and LOS F is an unacceptable condition.

The morning peak hour of traffic in the study area occurs between 6:45 a.m. and 7:45 a.m. The left-turn movement from the Keahole Airport Access Road to northbound Queen Kaahumanu Highway operates at LOS B during the a.m. peak hour of traffic. No vehicles were observed entering or exiting Reservoir Road during the a.m. peak period. The left-turn movement from northbound Queen Kaahumanu Highway to the Keahole Airport Access Road operates at LOS A. The left-turn movement from Kaiminani Drive to southbound Queen Kaahumanu Highway operates at LOS C during the a.m. peak hour of traffic.

The afternoon peak hour of traffic in the study area occurs between 4 p.m. and 5 p.m. The left-turn movement from the Keahole Airport Access Road to northbound Queen Kaahumanu operates at LOS D during the p.m. peak hour of traffic. The left-turn movement from northbound Queen Kaahumanu Highway to the Keahole Airport Access Road operates at LOS A. No vehicles were observed entering Reservoir Road during the p.m. peak period. One vehicle was observed exiting Reservoir Road during the p.m. peak hour. The left-turn movement from Kaiminani Drive to southbound Queen Kaahumanu Highway operates at LOS D during the p.m. peak hour of traffic.

Between 1986 and 1990 (the most recent year for which data are available), there were 18 collisions at the Keahole Airport Access Road intersection, eight of which occurred in 1990. In 1990, the accident rate at this intersection was 1.87 accidents per million vehicles entering the intersection (MEV). Fifteen collisions occurred between 1986 and 1990 at the Kaiminani Drive intersection, with seven occurring in 1990 alone. Because traffic data are not available for this intersection, an accident rate cannot be calculated. The *Manual on Uniform Traffic Control Devices for Streets and Highways* (U.S. Department of Transportation) indicates that installation of traffic signals is warranted when five or more reported accidents involving personal injury or property damage have occurred within a 12-month period, provided that the accidents are the types that could have been corrected by traffic signal control. This condition is met at both intersections for the most recent year (1990).

Future Highway Improvements. DOT intends to install a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway before the end of 1993.

Queen Kaahumanu Highway is currently being master planned by the State Department of Transportation (DOT). The two-lane highway is proposed to be widened to a four-lane divided freeway between Kailua and Kawaihae. An interchange is proposed for Keahole Airport Access Road, north of the existing access. Frontage roads would provide access between properties fronting Queen Kaahumanu Highway and adjacent interchanges. Ultimately, access to the Keahole Generating Station would be provided by the frontage road system to the Airport Interchange.

The four-lane widening of Queen Kaahumanu Highway between Kailua and Keahole may be completed by completion of Phase 1 of the project in 1995. The installation of an airport interchange and frontage road has not been scheduled by the DOT to date.

Site-Generated Traffic. The proposed Keahole Generating Station expansion will include a total of 15 employees at build-out. The proposed project will generate a total of 14 vehicles per hour (vph) during the a.m. peak hour—7 vph entering and 7 vph exiting the project site. The proposed project will generate a total of 12 vph during the p.m. peak hour—6 vph entering and 6 vph exiting the project site. Approximately 7 to 8 fuel tanker trucks per day are expected to be needed to provide fuel to the generating station. Fuel is currently trucked to the Keahole Station from Hilo Harbor via Route 19, through Waimea to the Queen Kaahumanu Highway. This route will remain until 1995, when HELCO expects to be trucking fuel from Kawaihae Harbor. If the fuel cannot be trucked from Kawaihae by the time the proposed unit addition is completed, fuel will continue to be trucked from Hilo.

In addition, travel forecasts prepared by the DOT, Hawaii County, and Pacific Planning and Engineering were interpolated to project 1998 external traffic demands in the study area, both with and without the project. Site-generated traffic was superimposed over 1998 traffic projections without the project to obtain the cumulative peak-hour traffic projections.

Three access alternatives were analyzed in the study:

- Alternative A. At the existing access driveway opposite the Keahole Airport Access Road.
- Alternative B. At the existing access driveway after the Keahole Airport Access Road is relocated to a grade-separated interchange.
- Alternative C. On Kaiminani Drive via an existing easement.

The projected LOS for these alternatives is discussed below.

Alternative A. The left-turn movement from Keahole Airport Access Road to northbound Queen Kaahumanu Highway would operate at LOS D during the projected a.m. peak hour of traffic. The left-turn movement from northbound Queen Kaahumanu Highway to Keahole Airport Access Road would operate at LOS A. The left-turn movement from southbound Queen Kaahumanu Highway to the project site would operate at LOS A, while Reservoir Road at Kaahumanu Highway would operate at LOS D. The northbound traffic on Queen Kaahumanu Highway, north of Keahole Airport Access Road, would operate at LOS B.

The left-turn movement from the Keahole Airport Access Road to northbound Queen Kaahumanu Highway would operate at LOS F during the p.m. peak hour of traffic. The left-turn movement from northbound Queen Kaahumanu Highway to Keahole Airport Access Road would also operate at LOS F. Reservoir Road at Queen Kaahumanu Highway would operate at LOS F. The southbound traffic on Queen Kaahumanu Highway would operate at LOS B.

Alternative B. The left-turn movement from Reservoir Road to southbound Queen Kaahumanu Highway would operate at LOS C during the a.m. peak hour of traffic. The left-turn movement from southbound Queen Kaahumanu Highway to Reservoir Road would operate at LOS A during the a.m. peak hour.

The left-turn movement from Reservoir Road to southbound Queen Kaahumanu Highway would operate at LOS B during the p.m. peak hour of traffic. The left-turn movement from southbound Queen Kaahumanu Highway to Reservoir Road would operate at LOS B during the p.m. peak hour.

Alternative C. The left-turn movement from Kaiminani Drive to southbound Queen Kaahumanu Highway would continue to operate at LOS E during the projected a.m. peak hour of traffic. The remaining traffic movements would operate at satisfactory LOS during the a.m. peak hour.

The left-turn movement from Kaiminani Drive to southbound Queen Kaahumanu Highway would continue to operate at LOS F during the p.m. peak hour of traffic. The left-turn movement from southbound Queen Kaahumanu Highway to Kaiminani Drive would operate at LOS D. The remaining traffic movements would operate at satisfactory LOS during the p.m. peak hour.

Project Impacts

The proposed Keahole Generating Station unit addition would not adversely affect projected peak-hour traffic conditions. The proposed generating station expansion is expected to increase traffic on Queen Kaahumanu Highway by less than 1 percent during both the a.m. and p.m. peak hours of traffic. The increases in peak hour traffic are not considered significant. The trips generated by the proposed expansion would not change the operating LOS in the study area.

The unit addition is expected to generate 16,790 vehicles per year. On the basis of the 1990 accident rate and projected annual traffic entering the intersection of Queen Kaahumanu Highway and the Keahole Airport Access Road, the proposed project could increase the number of accidents by 0.034 per year.

The installation of a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway will precede Phase 1 of the proposed unit addition to the Keahole Generating Station. This improvement, along with long-term improvements that include widening of the Queen Kaahumanu Highway and developing a separate interchange and frontage roads, is expected to mitigate traffic safety problems currently associated with the Keahole Airport Interchange. HELCO will coordinate its planning efforts with the DOT Highways Division to ensure that roadway improvements will accommodate fuel tanker trucks.

Mitigation Measures

No additional mitigation measures are proposed at this time.

3.3.7 Noise

Y. Ebisu & Associates prepared a revised acoustic study of existing and anticipated noise conditions at and adjacent to Keahole Generating Station. This section summarizes the report, which is provided in Section 10.

Introduction

All noise levels in this section are stated as sound pressure levels measured in decibels A-weighted (dBA). Noise levels stated in dBA approximate the response of the human ear by filtering out the higher and lower frequencies in a manner similar to the human ear. A 10-dBA change in noise level is judged by most people to be a twofold change in loudness (e.g., an increase from 50 to 60 dBA is perceived as a doubling of loudness). A 3-dBA increase is a barely perceptible increase.

While all noise levels in this report are stated in dBA, additional noise qualifiers (or descriptors) are also used. The 1-hour equivalent sound level (L_{eq}) and the day-night sound level (L_{dn}) take into account the variability of noise over time.

The hourly L_{eq} is the level of a constant sound for 1 hour that has the same sound energy as a fluctuating noise over the same period of time.

The day-night sound level (L_{dn}) is a 24-hour L_{eq}, with an additional 10 dBA added to the nighttime sound levels occurring between 10:00 p.m. and 7:00 a.m. The L_{dn} noise descriptor is typically used for assessing noise level impacts in residential neighborhoods to account for the greater annoyance of noise at night.

The relationship among dBA, L_{eq}, and L_{dn} can be explained through the following example. Assume that noise levels near an industrial operation were measured for 1 hour and found to vary between 50 and 60 dBA. The maximum noise level would be 60 dBA. If it were determined that the average sound level (on an energy basis) is 55 dBA, the noise environment near the industrial operation could be characterized as having an L_{eq} of 55 dBA for that particular hour. If noise levels were measured continuously for 24 hours, an L_{eq} of 55 dBA were recorded after every hour, and 10 dBA were applied to the nighttime period, an L_{dn} of 61 dBA would be computed based on the logarithmic average of noise levels over that period. Therefore, the noise environment near the industrial operation could be characterized as having a 61 L_{dn} for that particular 24-hour period.

Evaluation Criteria

Three different noise level regulations are available for assessing noise impacts from the proposed unit addition at the Keahole Generating Station. The three different regulations are:

- The amendment to the Conservation District Use Application (CDUA) dated March 10, 1987.

- Title 11, Chapter 43 Community Noise Control for Oahu adopted by the State Department of Health (DOH), November 6, 1981. This regulation does not currently apply to the Island of Hawaii or to the Keahole Generating Station but can be used as a guideline.

- The U.S. Department of Housing and Urban Development (HUD)—This agency has established regulations that define the degree of acceptability of exterior noise levels for residential housing developments that have been constructed with financial assistance from the U.S. Government. This regulation does not apply to the Keahole Agricultural Park located adjacent to the Keahole Generating Station but can be used as a guideline.

The CDUA, DOH, and HUD noise regulations are discussed below.

CDUA Noise Level Limits. The State Department of Land and Natural Resources (DLNR) established a noise level limit of 70 dBA at the Keahole Generating Station property line during both daytime and nighttime periods. This limit was established as a CDUA condition in DNLR's CDUA amendment for the Keahole Generating Station.

DOH Noise Regulations. On the Island of Oahu, DOH regulates noise from onsite activities. However, the DOH noise regulations do not currently apply to the Island of Hawaii or to the Keahole Generating Station. For the purposes of this study, it was assumed that DOH regulations may apply in the future on the Island of Hawaii. Title 11, Chapter 43 Community Noise Control for Oahu establishes maximum allowable noise limits that are applied at the property line between two zoning districts. The *Allowable Noise Levels Table* as given in Title 11, Chapter 43, Section 3, is shown in Table 3-13.

The project site and surrounding areas are located on lands designated as Unplanned and Agricultural. To the south and west of the project site is Keahole Agricultural Park, a subdivision of approximately 5-acre lots used for diversified agriculture. Single-family dwelling units have been developed on 22 of the 34 lots. According to note (b) in Table 3-13, the lower allowable level between two different zoning districts shall be used. However, note (c) defines the exceptions to note (b). Note (c) states that the allowable noise level limits applied at the boundary between, for example, agricultural and residential uses shall be the higher limit (i.e., agricultural limit) if the agricultural operations were initiated before the building permit was obtained for the residence. Because the operation of the generating station predates development of the agricultural lots containing the single-family residential uses, the allowable noise level limits for agricultural zoning (70 dBA daytime and 70 dBA nighttime) would apply. These limits correspond to the CDUA noise level limits, which were, in fact, based on the DOH limits.

Table 3-13
Allowable Noise Levels
(dBA)

Zoning Districts	Allowable Noise Levels in dBA	
	Daytime (7 a.m. - 10 p.m.)	**Nighttime (10 p.m. - 7 a.m.)**
Residential (R-1 through current R-70)	55	45
Preservation (P-1)	55	45
Apartment (A-1 through current A-5)	60	50
Hotel (H-1 and H-2)	60	50
Business (B-1 through current B-5)	60	50
Agricultural (AG-1 and AG-2)	70	70
Industrial (I-1 through current I-3)	70	70

Notes:
(a) Noise levels shall not exceed the allowable noise levels for more than ten per cent of the time (2 minutes) within any twenty-minute period, except by permit issued under §11-43-6.
(b) Where the allowable noise level between two adjacent zoning districts differ, the lower allowable noise level shall be used. For example, the allowable noise level for the residential district shall be used at the property line between residential and business districts.
(c) The limits specified in the allowable noise levels table shall apply subject to the order of precedence in which uses were initiated after the effective date of this rule; provided that a new order of precedence is established when any use is discontinued. The initiation of use shall be measured by the date of rezoning. For example, if agricultural or industrial operations are conducted next to a lot used as residence, the agricultural or industrial limits would apply if the building permit for the residence was obtained after agricultural or industrial operations had been initiated after he effective date of this rule. Residential limits would apply if the building permit for the residence was obtained before agricultural or industrial operations had been initiated.
(d) The allowable noise levels for impulsive noise shall be ten dBA above the allowable noise levels in the above table. [Eff. Nov. 6, 1981] (Auth: HRS §§342-3, 342-42) (Imp: HRS §§342-41, 342-42)

HUD Regulations. HUD has established noise abatement and control regulations that affect the approval of new buildings and rehabilitated buildings constructed with financial assistance from the U.S. Government. According to the HUD regulations, an exterior day-night noise level of 65 L_{dn} or less is considered normally acceptable for residential housing developments. Because the housing developments located within the Keahole Agricultural Park were not constructed using federal funds, the HUD noise regulations do not apply. Therefore, the HUD regulations can be used only as a guideline.

Summary of Noise Regulations. The CDUA noise level limit of 70 L_{eq} for the Keahole Generating Station property line during both daytime and nighttime periods is currently the only regulation that applies to the generating station and adjacent lands. Although the DOH limits do not apply to the generating station, they confirm the CDUA noise limit of 70 L_{eq}. The HUD residential limit of 65 L_{dn} does not apply to the residential dwellings located within the Keahole

Agricultural Park, but this can be used as a guideline for assessing impacts from the proposed unit addition to the generating station.

Existing Conditions

Noise sources at and in the vicinity of Keahole Generating Station include six diesel generators and one 13.75-MW combustion turbine, vehicular traffic on Queen Kaahumanu Highway, and aircraft at Keahole Airport.

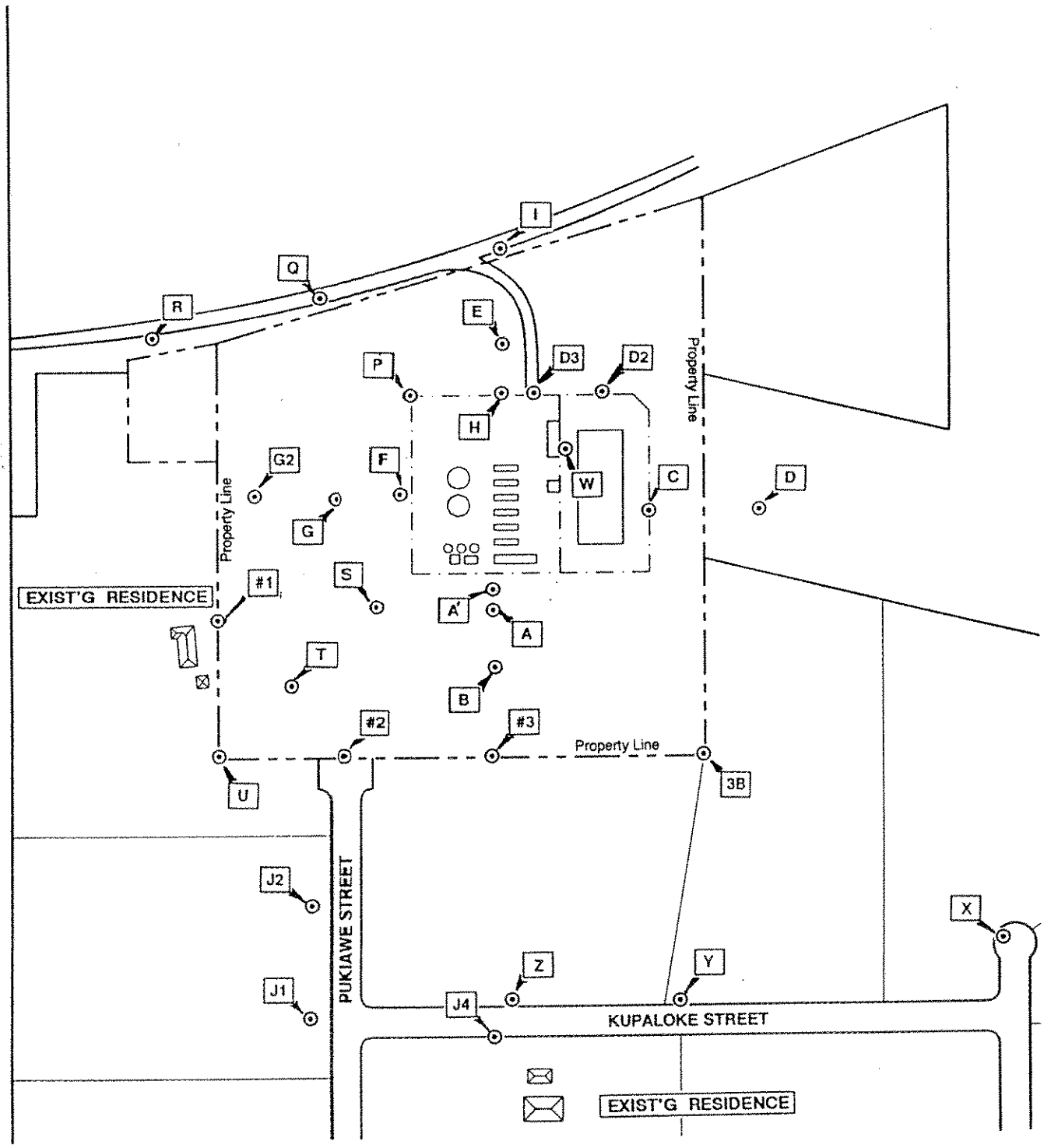
The CDUA 70 L_{eq} limit is currently being met along all boundaries. The noise level at the closest dwelling, approximately 600 feet west of the station center, is estimated to be 58 L_{dn}. This day-night sound level of 58 L_{dn} is below the HUD 65 L_{dn} guideline. The generating station is the dominant source of external noise at this dwelling unit. All other dwelling units in the agricultural park are exposed to noise levels of less than 55 L_{dn} from the generating station.

Noise monitoring was conducted in May 1990 at Site No. 1 adjacent to a residence west of the station (Figure 3-30), which is the closest sensitive receptor. During the late morning through early afternoon hours, noise levels from the generating station are typically 5 to 10 dBA lower than during the nighttime peak period. The lower noise levels are caused by the combined effects of fewer diesel generators operating, higher ground temperatures, and southerly winds during the midday period, which all tend to reduce station noise levels at Site No. 1. During 3 days of monitoring at the site, the generating station noise levels ranged between 58 and 59 L_{dn}.

Noise associated with jet aircraft departures from Keahole Airport represent the louder noise events at Site No. 1. Noise levels during the p.m. peak hour ranged from 61 to 62 L_{eq} at that site. Over a 24-hour period, aircraft noise at Site No. 1 was estimated to be 50 L_{dn}.

In July and August 1992, additional noise measurements were obtained at 28 other locations around the generating station (Figure 3-30). Measurements were taken at various hours of the day under different operating conditions. In some instances, no diesel generators were operating, and in others, five diesel generators were operating. Hourly noise levels at these sites ranged between 41 and 77.4 L_{eq}. At Site Z when the generating station was operating, the louder noise events and dominant noise sources were associated with aircraft operations at Keahole Airport, with generating station noise levels ranging between 40 and 50 L_{eq}.

The existing p.m. peak-hour L_{eq} noise contours for the Keahole Generating Station are shown in Figure 3-31. The corresponding day-night sound level, L_{dn}, is also shown. These contours assume that the station is operating with the existing combustion turbine online for approximately 17 to 18 hours per day, and with each of the six diesel generators operating approximately 5 to 6 hours per day.



LEGEND

◉ Noise Monitoring or Measurement Location

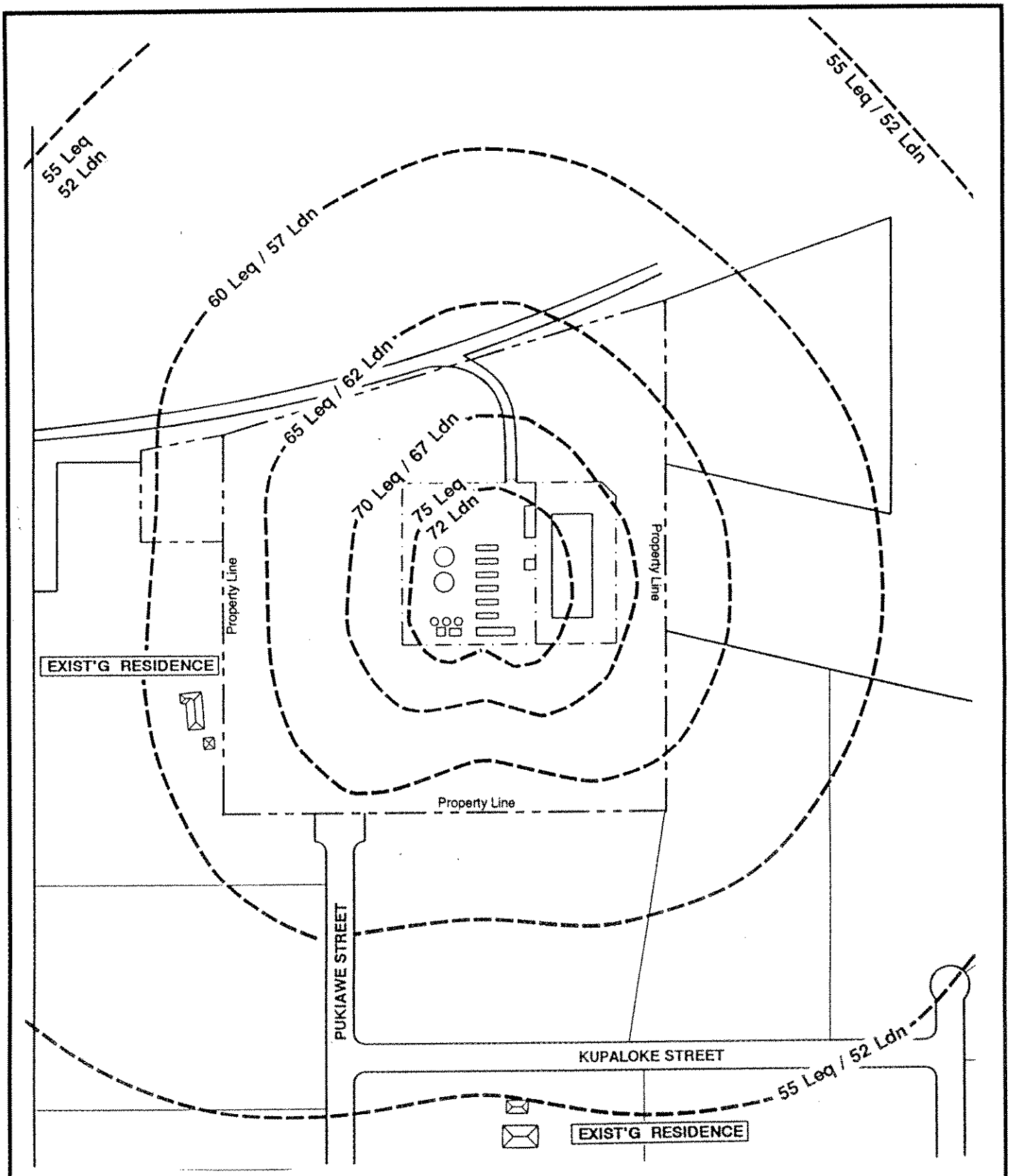
Source: Y. Ebisu and Associates, 1992

FIGURE 3-30

LOCATION OF NOISE MONITORING AND MEASUREMENT SITES

NORTH 0 300 FEET

CH2M HILL



LEGEND

Noise Contour

Source: Y. Ebisu and Associates, 1992

FIGURE 3-31

EXISTING NOISE CONTOURS

NORTH 0 300 FEET

CH2M HILL

Project Impacts

Construction Noise. Construction noise will likely be unavoidable during plant expansion periods. Noise levels associated with operating diesel equipment typically range from about 57 to 67 dBA, measured 600 feet from the noise source. Because equipment will likely be moving from one location on the project site to another during construction, the duration and intensity of construction noise at a particular receptor location will vary.

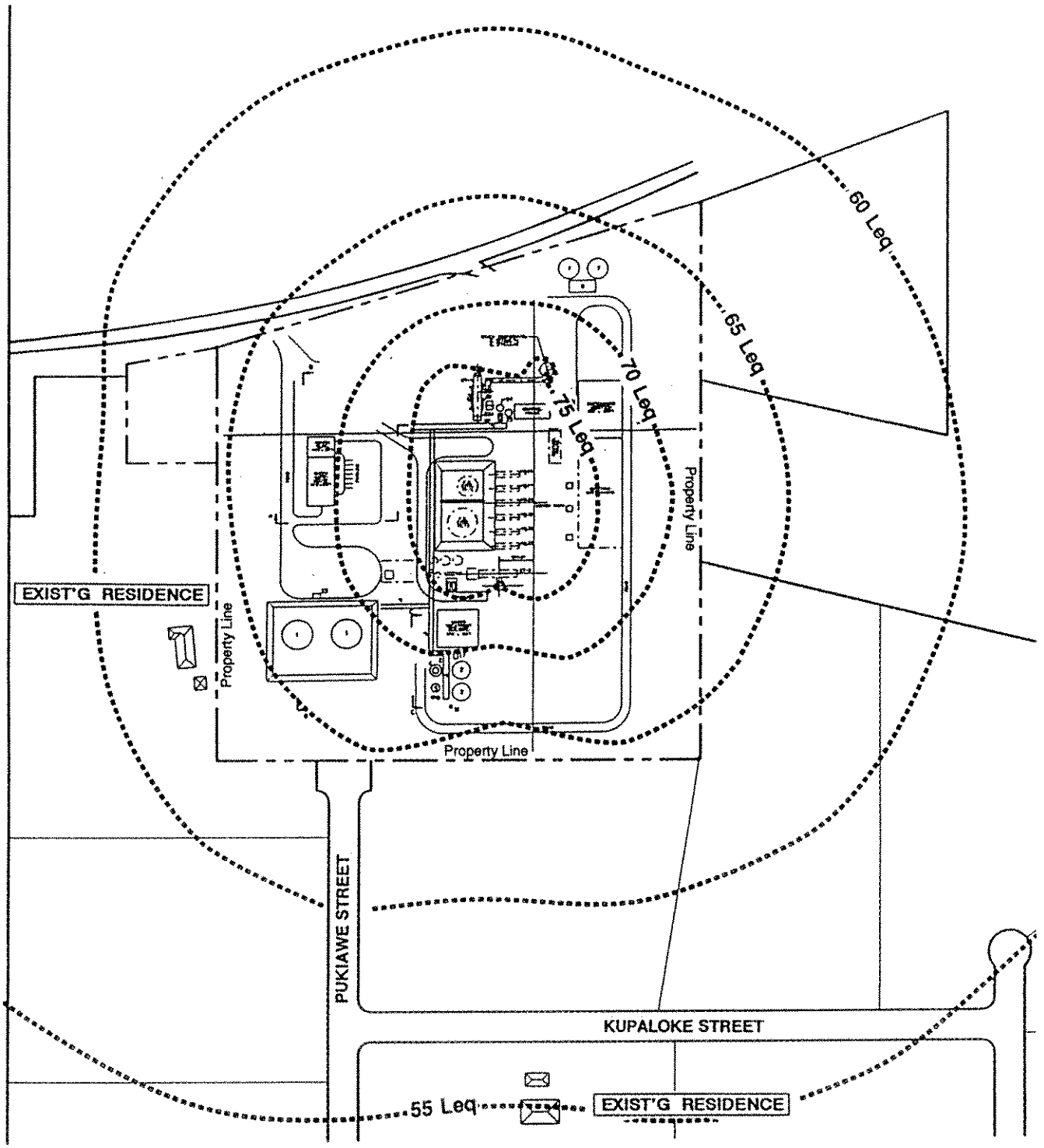
The properties that are predicted to experience the highest noise levels during construction activities on the project site are the agricultural lots west and south of the project site. However, significant adverse impacts from construction noise are not expected to occur because of the temporary nature of the work and the controls available for noise impact mitigation.

Phase 1. The site layout has been designed so that the proposed unit addition is located in the northeast corner of the property, away from sensitive receptors. Phase 1 will include the operation of a 20-MW combustion turbine (CT), in addition to the existing 13.75-MW CT and six diesel generators. The six diesel generators will be online during the p.m. peak hour. Worst-case noise conditions, with all units and diesels operating, would occur no more than 500 hours per year. Figures 3-32 and 3-33 show the projected L_{eq} and L_{dn} noise level contours, respectively, under Phase 1, without the use of noise mitigation. Adverse noise impacts are not expected to result from Phase 1 of the project because the 70-L_{eq} limit at the property line will continue to be met following the Phase 1 expansion.

Generating station noise levels are expected to remain unchanged, compared with existing conditions, at the agricultural lots around the station. Therefore, current land use compatibility conditions can be maintained within surrounding areas, and additional noise mitigation measures are not required beyond those planned for the new 20-MW CT.

Phase 2. In Phase 2, a second 20-MW CT will be added. After installation of this CT, one of the six diesel generators will not be used. The remaining diesel generators are projected to be used for about 1 to 3 percent of their Phase 1 usage rate. Because of the reduced use of the diesel generators, noise levels in Phase 2 will be less than those in Phase 1.

Phase 3. The second 20-MW CT, installed during Phase 2, will be operational, and under Phase 3, Keahole Generating Station will be converted to a base load unit that operates 24 hours per day. In this phase, the two simple-cycle combustion turbine units will be converted to a dual-train, combined-cycle (DTCC) unit by adding two heat recovery steam generators and a steam turbine generator. The proposed facility will also include an air-cooled condenser. For noise mitigation purposes, the air condenser noise level will not exceed 55 dBA at 300 feet; noise levels for the CTs also will not exceed 55 dBA at 300 feet. The six diesel generators are scheduled to be retired by 2001. Only two of the six diesel generators will be used for peaking purposes between 1996 and 2000, and this usage is expected to be negligible. The existing 13.75-MW CT unit will be used sparingly as a peaking and backup unit.



LEGEND

Noise Contour

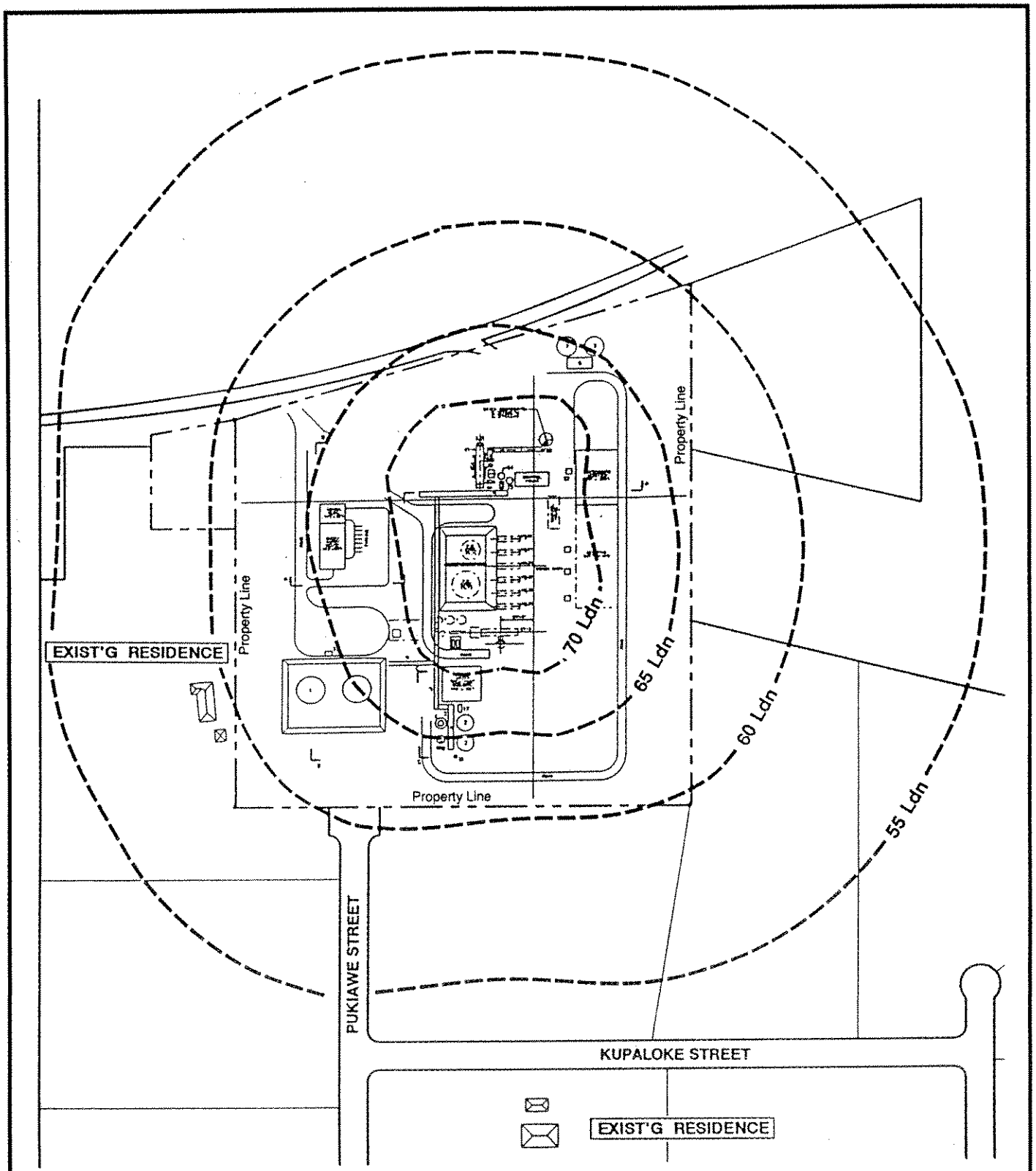
Source: Y. Ebisu and Associates, 1993

FIGURE 3-32

PROJECTED NOISE CONTOURS (L_{eq}) PHASE 1

NORTH 0 300 FEET

CH2M HILL



LEGEND

Noise Contour

FIGURE 3-33

PROJECTED NOISE CONTOURS (L_{dn}) PHASE 1

NORTH 0 300 FEET

Source: Y. Ebisu and Associates, 1993

CH2M HILL

The 70-L_{eq} limit is expected to be met along the station's property boundary at the completion of Phase 3 (Figure 3-34). The HUD 65-L_{dn} guideline should not be exceeded at dwelling units or agricultural lots near the station. Figure 3-35 shows the projected L_{dn} noise level contours under Phase 3.

During the periods of operation, actual noise levels at Keahole Agricultural Park properties will be 7 to 10 dBA lower than current noise levels. The noise reduction is due to reduced operation of the diesel generators and the 13.75-MW combustion turbine. Noise levels at the nearest residence (to the west of the station) will be 18 dBA lower than current noise levels because of the planned construction of a warehouse and soundwall located to block noise.

When averaged over a 24-hour period, there will be essentially no change in noise levels at most agricultural park properties. There will be a 10 L_{dn} decrease at the adjacent residence to the west.

Mitigation Measures

Construction Noise. Mitigation of construction noise will be undertaken and will include the following measures to maintain noise levels below 70 L_{eq} at the property line:

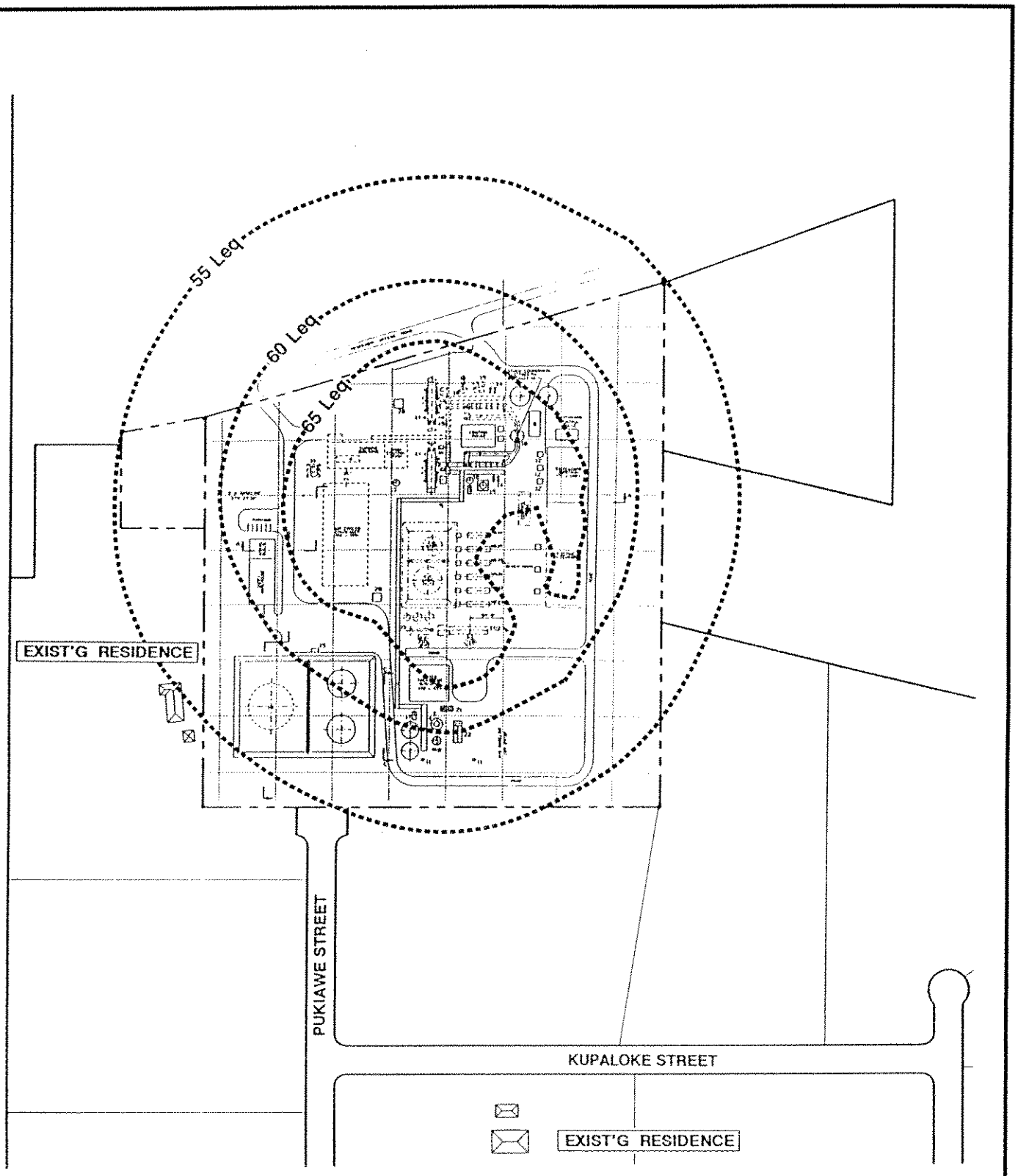
- Properly muffled construction equipment will be used at the job site.
- If 24-hour well drilling operations are required during the construction period, drill equipment noise levels could be limited to approximately 65 L_{dn} at residences near the generating station. This would require that rotary well drilling equipment be located at least 600 feet from any residence, or that cable drilling equipment be located at least 200 feet from any residence. Some adjustments to these setback distances could be made for rotary drilling equipment if the air compressor could either be quieted or separated from the well hole with air hose extensions.

Phase 1. No mitigation measures will be required.

Phase 2. No mitigation measures will be required.

Phase 3. The following mitigation measures will be implemented to maintain noise levels at or below existing levels at the property line:

- As shown in the site plan for Phase 3 (Figure 1-6), the proposed warehouse will be relocated between the air condenser and the western property line so the warehouse can serve as a noise barrier. The 30-foot-high, 210-foot-long building with an adjacent 10-foot-long by 30-foot-high soundwall should reduce Phase 3 noise levels by 18 dBA during the p.m. peak period at the existing residence west of the station. This reduction would reduce noise levels at the west residence to 49 L_{dn}, or 10 L_{dn} less than existing levels.



LEGEND

------ Noise Contour

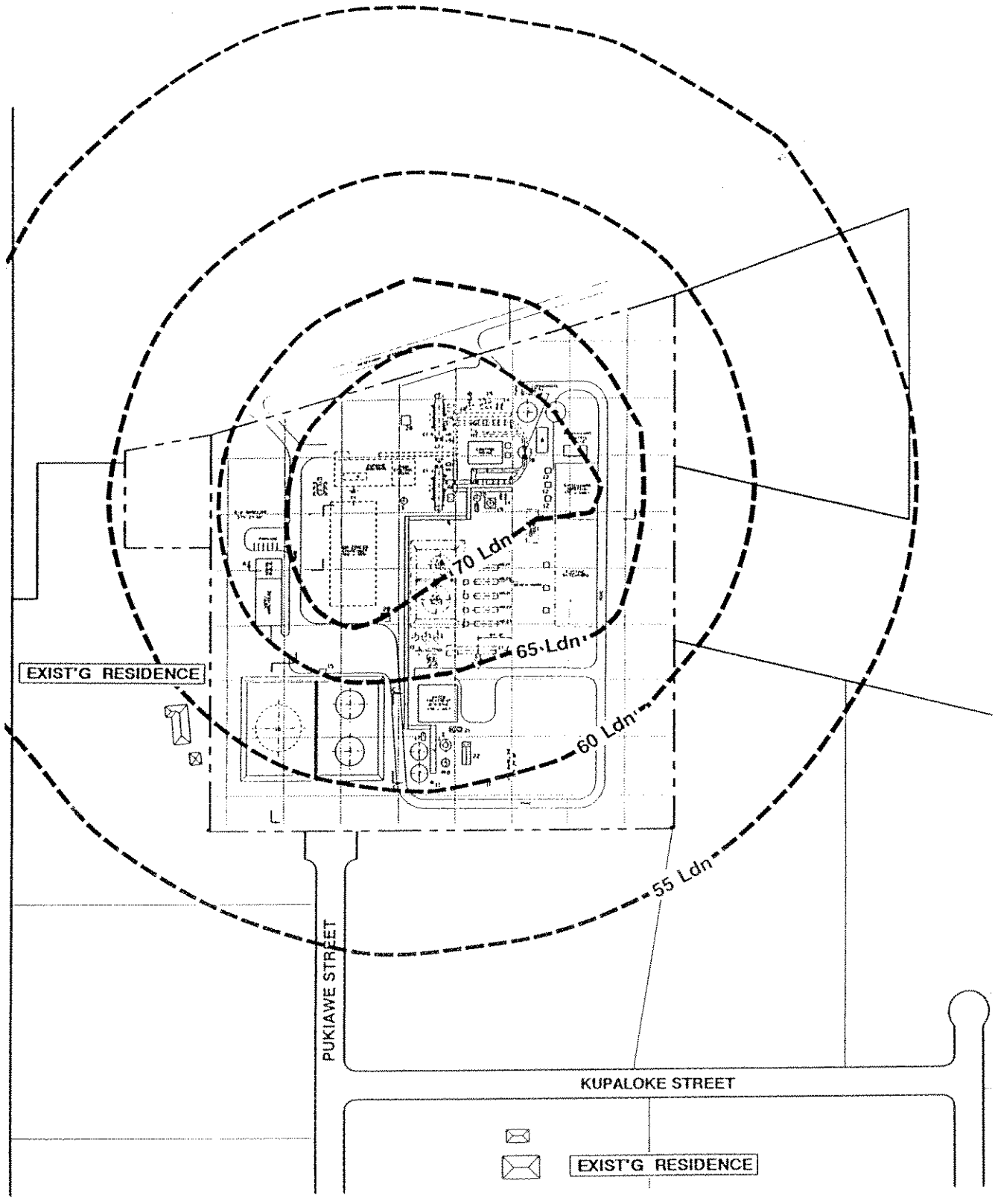
FIGURE 3-34

PROJECTED NOISE CONTOURS (Leq) PHASE 3

NORTH 0 300 FEET

Source: Y. Ebisu and Associates, 1993

CH2M HILL



LEGEND

Noise Contour

Source: Y. Ebisu and Associates, 1993

FIGURE 3-35

PROJECTED NOISE CONTOURS (L_{dn}) PHASE 3

NORTH 0 300 FEET

CH2M HILL

- The equipment for the expansion (e.g., heat recovery steam generators) will have specifications that are specifically designed to reduce noise levels, including attenuation of low- and high-frequency (tonal) sources.

- Special design features in the interior finishes and ventilation openings of the Steam Turbine Building will be incorporated to minimize or attenuate noise emissions toward the west and south property boundaries.

- Quiet air-cooled condensers, with sound attenuation devices, will be installed. Noise levels will not exceed 55 dBA at 300 feet.

- Quiet combustion turbines will be installed. The noise level of each unit will not exceed 55 dBA at 300 feet.

- New equipment procurement specifications will require that low- and high-frequency tonal sources be attenuated or masked.

- Noise-producing activities will be minimized during nighttime hours and early-morning hours of probable thermal inversion. When feasible, prior notice of anticipated, but unavoidable, loud noise events will be given to nearby residents.

These mitigation measures will prevent adverse noise impacts of the proposed unit addition by maintaining noise levels at or below existing levels. However, to prevent future conflicts due to the perception of impacts, HELCO recommends that future land development for residential use adjacent to the station be discouraged; that development of commercial, industrial, or other, less-noise-sensitive uses be encouraged; and that adequate disclosure of the expected noise levels from Keahole Generating Station be provided in all real estate transactions and rental or lease agreements involving lands near the station.

3.3.8 Public Safety and Community Services

Existing Conditions

Communications. Keahole Generating Station has electrical, telephone, radio, and microwave systems in place.

Health Care. The emergency care facility serving the site is Kona Hospital, which is located in Kealakekua, approximately 16 miles south of the site.

Keahole Generating Station is equipped with appropriate first aid equipment. Safety training, as well as training in procedures for operating a combustion turbine safely, occurs regularly.

Police Protection. The Hawaii County Police Department has a staff of 60 officers for the North Kona District. The North Kona District police station is located on Queen Kaahumanu Highway approximately 5 miles south of Keahole Generating Station.

The perimeter of Keahole Generating Station is fenced. The station has its own security system.

Fire Protection. The fire station serving the North Kona District is the Kailua Station, located on Palani Road mauka of Queen Kaahumanu Highway, and approximately 7 miles south of Keahole Generating Station. The station has a staff of 33 and has the following equipment: one ladder truck, one fire engine, one tanker, one rescue boat, and one ambulance unit.

The fire protection plan for the generating station specifies the procedures to be followed in the event of a fire or fuel spill. The fire protection system onsite consists of fire extinguishers, a chemical extinguisher tank on wheels, and fire hydrants at two locations. A carbon dioxide fire protection system is used on the existing combustion turbine in the event of a fire.

Solid Waste. The solid waste disposal facility for the West Hawaii area is a County-operated landfill in the Kealakehe area near Kailua. A new 300-acre sanitary landfill is planned approximately 7.5 miles northeast of Keahole Generating Station. The new County landfill will include recycling and resource recovery facilities and serve the North and South Kona, South Kohala, and Kamuela districts. The proposed landfill is expected to begin operation in 1993 or 1994 and is projected to accommodate an initial solid waste volume of 70,300 tons per year. By the year 2015, the landfill is projected to receive 134,000 tons of solid waste annually.

Hazardous Waste. Hazardous wastes generated at the existing generating station are identified, handled, and transported in accordance with state and federal laws and regulations. Hazardous wastes generated on the Island are transported to Oahu and eventually shipped to the mainland for disposal at an approved hazardous waste landfill.

Electric and Magnetic Fields (EMF). A spot electric field measurement of 0.001 kilovolts per meter (kV/m) was obtained at the boundary of the station. For comparison, typical electric field values for household appliances are shown in Table 3-14. Measurements taken along the western and southern perimeter of the station indicate that magnetic fields ranged from about 0.1 to 0.9 milligauss (mG). As a comparison, a study for the Electric Power Research Institute (Silva et al., 1989) found that the average magnetic field in homes is about 0.9 mG.

Table 3-14
Typical Electric Field Values for Appliances, at 12 Inches

Appliance	Electric Field (kV/m)
Electric Blanket	0.25*
Broiler	0.13
Stereo	0.09
Refrigerator	0.06
Iron	0.06
Hand Mixer	0.05
Phonograph	0.04
Coffee Pot	0.03

*1 to 10 kV/m next to blanket wires.

Project Impacts

Communications. Telephone service is provided by Hawaiian Telephone Company. HELCO will link the facility to its own existing microwave communication and radio system. The supervisory control and data acquisition (SCADA) system controls the transmission grid and monitors generation.

Health Care. Operation of the expanded power facility will involve storing and handling flammable and hazardous materials, as well as using heavy equipment and machinery. All personnel will continue to be trained in the procedures for the safe operation of a combustion turbine. The facility will also continue to be equipped with the appropriate first aid equipment. Safety training will continue to occur regularly. Local health care facilities are adequately equipped to provide emergency care to station employees, if needed.

Because of the sealed case design of the BESP battery cells, operators will not normally be exposed to toxic substances. Eye wash stations and safety showers will be strategically located within the battery room in the event of accidental rupture of a battery cell case and exposure of personnel to the gel electrolyte.

Police Protection. The existing facility is fenced and protected by a private security system. Police protection services will not be significantly affected by the proposed project.

Fire Protection. Fire protection services and procedures will be revised to accommodate the proposed unit addition. Fire/service water tanks will hold approximately 240,000 gallons of water for fire suppression. Pump capacities for primary and secondary fire suppression pumps will accommodate 2,000 gpm. The fire/service water tanks can be replenished from the brackish supply well in 8 hours. A carbon dioxide fire protection system will be used on the combustion turbines in the event of a fire. All federal and state regulations regarding the operation of a generating facility and worker safety will continue to be followed.

Operation of the valve regulated lead acid (VRLA) battery system does not produce gas emissions during normal operation. The battery cells will be of the sealed case design with a gel electrolyte and not the flooded cell type which has open venting and liquid electrolyte. With the sealed case and gel electrolyte design no gassing occurs during normal operation. In the event of abnormal operation of the battery system, such as an uncleared electrical fault or accidental overcharge, hydrogen and oxygen may be emitted. The BESP building will be designed with sufficient natural ventilation to maintain hydrogen levels in the building to less than 1/10th of a 1 percent by volume. The lower range of hydrogen to air mixture for flammability is 4 percent hydrogen by volume. In addition, a water sprinkler system will be provided in the BESP building.

Solid Waste. Solid waste generated by the Keahole Generating Station expansion will consist of the following:

- Construction waste
- Materials associated with plant operation, administration, housekeeping, and maintenance operations
- Parts, materials, and equipment replaced during maintenance
- BESP battery cells that are replaced will be returned to the battery manufacturer for disposal

Construction waste will be disposed of at an approved landfill by the construction contractor. If possible, parts, materials, and equipment will be salvaged or recycled. The remaining wastes will be disposed of at the West Hawaii Sanitary Landfill northeast of the proposed project.

Hazardous Waste. The use, storage, and transportation of hazardous materials are subject to State and federal laws and regulations. No hazardous wastes will be disposed of either onsite or within the State. Any hazardous waste will be disposed of in compliance with all applicable State and federal regulations.

Electric and Magnetic Fields. No increase in electric fields at the station perimeter is expected because the proposed unit addition will be surrounded by trees, bushes, fences, and buildings, which effectively shield electric fields. Magnetic fields along the perimeter of the station will not be affected by the proposed unit addition, with the possible exception of those perimeter locations affected by the switching station or transmission lines. The BESP will be designed so that there will be no increase in EMF levels at the property boundary.

There will be changes in transmission line magnetic fields that result from the change in the flow of electricity (i.e., amperage) in the lines from Keahole Generating Station. The magnetic field will depend on the number of lines in the alignment, the configuration of those lines, and the demand for power at various locations served by the Keahole unit addition.

Calculations were made of magnetic fields along the 69 kV transmission line adjacent to Queen Kaahumanu Highway. The full report of these calculations is provided in Section 10. With a 56-MW unit addition at Keahole Generating Station, magnetic fields immediately under the line will increase from about 7.7 mG in 1993 to about 11.3 mG in 1997 under anticipated peak load conditions.

As a separate project, HELCO is planning to install an additional 69 kV line along Queen Kaahumanu Highway. If the second line is installed on the same poles as the existing line such that maximum cancellation of magnetic fields occurs, the field strength under the lines would be reduced to about 3.4 mG.

A summary of these magnetic field calculations is provided in Table 3-15.

Electric fields along transmission lines will not be affected by the unit addition at the generating station because electric fields are a function of line voltage only. If a second transmission line is added as described above, electric fields will be reduced due to cancellation effects.

Mitigation Measures

Current regulations will be adhered to during project construction and operation. No mitigation measures are required.

Table 3-15
Magnetic Field Changes for the Keahole-Kailua 69 kV Transmission Line at Anticipated Peak Loads

Distance from Centerline (feet)	Single Circuit 1993	Single Circuit with 56-MW Unit Addition	Double Circuit with 56-MW Unit Addition
0	7.65	11.28	3.39
50	2.85	4.20	0.75
100	0.94	1.39	0.16
150	0.44	0.65	0.06

Section 4

Public Plans and Policies

4.1 Introduction

The following plans apply to Keahole Generating Station:

- *Hawaii State Plan*, Hawaii Revised Statutes (HRS) 226
- *State Energy Functional Plan*
- State of Hawaii, *West Hawaii Regional Plan*
- County of Hawaii, *The General Plan*
- *Keahole to Kailua Development Plan*

The State and County have adopted these plans to guide the physical, social, and economic development of the Islands. These plans contain general goals, objectives, and policies that encourage the controlled development of the natural resources. The policies within these plans and their applicability to the proposed project are discussed below. The proposed project conforms with these five plans.

4.2 Hawaii State Plan

The *Hawaii State Plan*, Chapter 226, "Hawaii Revised Statutes, 1991," is a guide for future long-range development. It identifies the goals, objectives, policies, and priorities for the State; allocates limited resources; improves coordination among federal, state, and county agencies; and establishes a system for integrating all major state and county activities.

Section 226-14 of the State Plan, Objectives and Policies for Facility Systems applies, in general, to the proposed project and states the following:

a. *Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.*

b. *To achieve the general facility system objective, it shall be the policy of this State to:*

   1. *Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans*

2. *Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities*

3. *Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user*

4. *Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.*

The proposed facility expansion is designed to improve system reliability. Keahole Generating Station can accommodate changing public demands by operating either as a peaking or baseload facility. The 56-MW, dual-train, combined-cycle unit is economical in terms of both initial and long-term costs.

Section 226-18 of the *Hawaii State Plan*, "Objectives and Policies for Facility Systems—Energy/ Telecommunications," applies specifically to the project and states the following:

a. *Planning for the State's facility systems with regard to energy/telecommunication shall be directed towards the achievement of the following objectives:*

   1. *Dependable, efficient, and economical statewide energy and telecommunication systems capable of supporting the needs of the people*

   2. *Increased self-sufficiency*

b. *To achieve the energy/telecommunication objectives, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable power and telecommunication services to accommodate demand.*

c. *To further achieve the energy objectives, it shall be the policy of this State to:*

   1. *Support research and development as well as promote the use of renewable energy sources;*

   2. *Ensure a sufficient supply of energy to enable power systems to support the demands of growth;*

   3. *Promote prudent use of power and fuel supplies through conservation measures including:*

      A. *Development of cost-effective demand-side management programs;*

      B. *Education; and*

C. Adoption of energy-efficient practices and technologies; and

4. Ensure that the development or expansion of power systems and sources adequately consider environmental, public health, and safety concerns, and resource limitations.

The proposed project, in the context of HELCO's integrated approach to energy production and conservation, conforms with these objectives and policies. The purpose of the Keahole Generating Station expansion is to provide a system that meets the projected electrical demand, increases system reliability, and provides dependable electrical service to its customers. The project is needed while other renewable energy projects are being developed.

Resource limitations and environmental, public health, and safety concerns were considered in selecting the site and technology for the power facility.

4.3 State Energy Functional Plan

The *Hawaii State Plan* requires the development of State Functional Plans (SFPs). While the *Hawaii State Plan* establishes long-term objectives for Hawaii, the SFPs delineate the specific strategies and prioritize actions that need to be addressed in the short term.

The objectives of the *State Energy Functional Plan* (1991) are to achieve dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people and to increase energy self-sufficiency.

The major issues identified in the Plan that apply to the proposed project are discussed below. The proposed Keahole unit addition meets the first three objectives; however, it does not address the objective of furthering energy self-sufficiency.

4.3.1 Energy Conservation and Efficiency

Energy conservation and efficiency can reduce the dependence on imported fossil fuels and overall energy demand. To help achieve this, an Integrated Resource Plan (IRP) was developed and submitted to the PUC for approval in October 1993. Integrated Resource Planning is the process of developing, implementing, monitoring, and evaluating a utility resource plan that identifies an optimum mix of energy resources for meeting forecasted levels of consumer energy needs. Demand-Side Management (DSM) programs, which are a component of the IRP, were designed to influence customer consumption of electricity in a manner that will produce changes in the utility's demand. Potential programs include conservation, energy efficiency, load management, and fuel substitution.

The policy and action items pertaining to HELCO are as follows:

Policy A(1): Promote and Stimulate Greater Energy Efficiency and Conservation in Non-Transportation Sectors

Action A(1)(a): Provide Technical Support and Assistance to the State Government, County Governments, the PUC, and The Energy Utilities in Developing the Integrated Resource Planning (IRP) Process and Carrying Out Demand-Side Management (DSM) Assessments.

Action A(1)(b): Advance the Use of Demand-Side Management (DSM) by Creating Pilot Programs and Promoting Education of Local Energy Producers and Users.

HELCO is a participant in Integrated Resource Planning. On May 22, 1992, the Public Utilities Commission issued Decision and Order No. 11630, requiring energy utilities in Hawaii to develop IRPs. HELCO submitted its Integrated Resource Plan to the PUC for approval in October 1993. Through the IRP process, HELCO has developed a long-range energy plan for the Island of Hawaii by considering not only the traditional supply-side resources but also the customer (demand-side) resources that are available.

The following four tasks were included in the IRP process:

- The *forecasting* task develops a 20-year forecast with high-, medium-, and low-growth scenarios.
- The *supply-side* report lists and characterizes the available supply-side resource options.
- The *demand-side* report develops programs whose benefits and costs can be weighed against supply-side options.
- The *integration* phase then combines these three areas into a "least-cost" plan for the utility. The result is a 20-year, long-range plan combined with a 5-year action plan.

Integrated Resource Planning has brought about significant changes in the way utilities conduct their business, not only by including demand-side options as a resource but also by having the public participate in the planning process through advisory groups. HELCO formed an advisory group of 32 members representing business, government, environmental, cultural, and community groups. Those groups with a special interest in energy issues, as well as individuals who could lend special expertise to the process, were included.

The advisory group met several times during the plan development process. The meetings covered such areas as organizational issues, forecasting, demand-side resources, supply-side resources, and the IRP objectives and principles. The first public forum was held in December 1992. The agenda included a review of the draft supply-side report, forecast scenarios, IRP objectives and planning criteria, and the status of demand-side program options.

HELCO is undertaking two pilot programs for DSM. The Pilot Commercial Lighting Program was approved by the PUC in March 1992 and was operating by May. The purpose of the program was to reduce the amount of electricity used in commercial buildings by replacing existing lighting with new, high-efficiency lights. This program was popular, but funding has been exhausted. HELCO continues to receive inquiries about extending the program.

A Pilot Residential Lighting Program has been submitted to the PUC for approval. The purpose of the program is to increase customer awareness of energy-saving residential lighting products that can make their homes more energy efficient and reduce their energy payments. HELCO proposes to promote the sale, installation, and use of energy-efficient compact fluorescent lamps in customers' homes.

Energy conservation is also being promoted through education. Efforts include the following:

- **Schools.** Classroom programs are presented to help students learn more about electricity, energy sources, electrical safety, conservation, and the energy situation on the Island. HELCO's audio-visuals, teacher's guides, and student handouts are distributed at these presentations.

- **Energy Fairs.** HELCO displays exhibits at energy fairs. The exhibits feature load management posters, videos, games, and handouts on conservation and safety.

- **What's Watt Programs.** These energy education programs, held at community centers, present "Changing Your Water Heating Habits" and "HELCO's Conservation Alert, 3R's" to encourage using energy wisely and deferring electrical usage to off-peak hours.

- **Electrical Appliance Dealers.** HELCO assists appliance dealers in resolving customers' problems. The appliance dealers also hand out HELCO's energy-related literature and What's Watt Program fliers to their customers.

- **Media.** Activities are publicized in newspapers and on radio stations. Radio spots ("HELCO's Here for You") encourage consumers to use electricity efficiently, economically, and safely. "HELCO's Conservation Alert" leaflet encourages the 3R's (remember, reduce, and reschedule).

- **Seminars.** HELCO holds a Hotel Lighting Seminar on efficient lighting for hotel engineers, facilities managers, controllers, and general managers. Lighting manufacturers' representatives discuss improved efficient lighting applications.

- **Residential Customer Assistance.** Home energy audits are made, and meters are loaned when inquiries are received regarding high electric bills. Energy-related brochures, leaflets, and other handouts are available.

- **Commercial and Industrial Customer Assistance.** HELCO assists commercial and industrial customers with energy audits and consumption estimates by appliance or equipment. All high-demand customers are encouraged to shift loads away from the evening peak period.

4.3.2 Alternative and Renewable Energy

The State is encouraging development of alternative and renewable energy sources as Hawaii's primary energy source. These resources include geothermal, ocean thermal (OTEC), solar photovoltaic, biomass, wind, and hydropower. Although the State has made progress in alternative energy technologies, only geothermal currently provides a potential for firm, reliable electricity. It is the only commercially mature, indigenous resource available in large quantities that can be converted to baseload (24-hour-per-day) electricity. Other alternative energy resources, such as solar and wind technologies, do not provide firm, baseload power and are not economically feasible at this time.

HELCO has contributed to and constructed facilities for alternative and renewable energy resources, such as wind and hydroelectric power. It also has a number of power purchase contracts with independent power producers. Many of these power purchase contracts are based on alternative and renewable technologies. Examples include sugar cane bagasse, biomass-fueled steam turbine generators, and geothermal facilities. While extensive dependence on such contracts can increase supply risks, HELCO has evaluated and continues to evaluate IPP alternative and renewable energy power supply offers.

After examining the alternatives to this project (including coal, non-firm renewable energy sources such as wind or hydro power, increased DSM programs, and IPP proposals), HELCO determined that a unit addition to the Keahole Generating Station is the only reasonable way to meet its PUC obligations of providing high-quality, reliable service at the least cost to the customer within the necessary time frame.

HELCO acknowledges that, in making the decision to expand with an additional oil-fired unit, it is contradicting the objective of energy self-sufficiency. As the project comes on-line, however, it will be possible to retire less fuel efficient units, and the overall ratio of fuel consumption to megawatts produced should improve. In addition, HELCO continues to pursue long-term conservation measures and alternative fuel sources that will lessen the dependency on imported fossil fuels.

4.4 West Hawaii Regional Plan

The *West Hawaii Regional Plan* (1989), prepared by the Office of State Planning, is intended to complement the County of Hawaii's plans and provide guidelines for the development of the West Hawaii area. The section that applies to this project is "Energy and Power Facilities." It states that the West Hawaii area is expected to have a large amount of growth, primarily from resort developments, and that "for each resort development, total electricity requirements are typically 5 to 10 MW, or about the same as the entire Island of Molokai."

The following strategies and actions in the *West Hawaii Regional Plan* apply to this project:

Strategies

- *Minimize the impact of new power plant construction on energy self-sufficiency.*

Actions

- *Devise a long-term integrated resource plan that provides for the energy needs of West Hawaii residents, workers, guests and businesses in the most economical and environmentally acceptable manner.*

- *Encourage early communication between the electric utility and potentially affected communities regarding power plant siting, power line corridors, likely emission levels, and other concerns in planning for the region.*

HELCO's proposed addition to the Keahole Generating Station is consistent with the *West Hawaii Regional Plan* strategies and actions. The proposed 56-MW DTCC technology provides a number of advantages:

- First, it is fuel efficient.

- Second, the 56-MW facility is economical in both the short and long term.

- Third, the modern technology and high fuel efficiency result in lower air emissions and reduced environmental impacts.

Similarly, the high efficiency means that the DTCC technology is an economical technology. In an economic analysis of several different generating technologies, HELCO has found that the 56-MW DTCC unit is the most economical type of unit based on the lowest accumulated present worth of revenue requirements for capital, operation and maintenance, and fuel. The 28-MW STCC unit is the next most economical type of unit because of lower capital and fuel costs. Both types of combined-cycle units have high fuel efficiency and use combustion turbines similar to what is proposed for Keahole Generating Station.

An important aspect of high efficiency is that, as the amount of fuel per kilowatt-hour of electricity is reduced, so is the amount of combustion products released to the atmosphere. A 56-MW, high-efficiency DTCC facility emits fewer air pollutants than other 56-MW, diesel-fueled power facilities. Furthermore, a higher fuel efficiency means that less waste heat is rejected to the atmosphere.

The proposed 5 MW, 3-hour (10 MW maximum, 1.5 hour) BESP will provide system voltage and frequency stabilization capability to enhance the power quality and the reliability of the isolated HELCO system. The BESP installation will also result in cost savings to HELCO on a 20-year present worth revenue requirements basis.

In addition to the DTCC and BESP technology, site-related advantages include locating power generation near the demand and using existing utility infrastructure, all of which result in savings to the consumer.

4.5 County of Hawaii General Plan

The County *General Plan* (1989) has goals, policies, and standards for 13 issues: economic, energy, environmental quality, flood control and drainage, historic sites, natural beauty, natural resources and shoreline, housing, public facilities, public utilities, recreation, transportation, and land use. The following are the goals, policies, and standards that apply to this project:

Energy

Policies

- *The County shall strive to assure a sufficient supply of energy to support present and future demands.*

Standards

- *New power plants shall incorporate devices which minimize pollution*

Public Utilities

Goals

- *Ensure that adequate, efficient and dependable public utility services will be available to users*
- *Maximize efficiency and economy in the provision of public utility services*
- *To have public utility facilities which are designed to fit into their surroundings or concealed from public view*

Policies

- *Public utility facilities shall be designed so as to complement adjacent land uses and shall be operated so as to minimize pollution or disturbance.*
- *Provide utilities and service facilities which minimize total cost to the public and effectively service the needs of the community*
- *Utility facilities shall be designed to minimize conflict with the natural environment and natural resources.*
- *Improvement of existing utility services shall be encouraged to meet the needs of users.*
- *The County shall develop short- and long-range capital improvement programs and plans for public utilities within its jurisdiction and which are consistent with the County General Plan.*

Electricity

Policies

- *The County should encourage electrical utility companies to develop a comprehensive plan for the generation, transmission, and distribution of electrical power to the various parts of the Island.*

Standards

- *There shall be a minimization of obstruction of scenic views and vistas by electrical facilities.*

The General Plan Land Use Pattern Allocation Guide (LUPAG) Map is a broad-brush statement of land uses that is subject to interpretation by the County Planning Director. It is a guide for the direction of future developments, and it indicates the general location of various land uses in relation to each other.

The LUPAG Map shows the area immediately around (and including) the Keahole Generating Station as Extensive Agricultural (i.e., pasture and rangelands). The surrounding area is designated as Urban Expansion, which is intended to allow for a mix of high-, medium-, and low-density residential uses along with industrial and/or open designations.

HELCO believes that its plan to expand Keahole Generating Station is consistent with the goals, policies, and standards of the 1989 Hawaii County *General Plan*. The proposed project is designed to provide adequate, efficient, and dependable electric power to the public. It maximizes efficiency and has been shown to minimize cost. The facility will be landscaped to minimize visual impacts.

4.6 Keahole to Kailua Development Plan

The *Keahole to Kailua Development Plan* (1991), prepared by the County of Hawaii, is a plan for implementing future development. The area covered in the Development Plan is bounded by the coastline on the west, the northern boundary of the Kau Ahupuaa on the north, Mamalahoa Highway on the east, and Palani Road and Kailua Village on the south. The total project area includes approximately 17,000 acres, of which about 14,000 are undeveloped.

The plan was prepared because the Keahole to Kailua area was recognized as a major future urban growth area, and a plan was needed to serve as an implementing tool for the General Plan of the County of Hawaii. The goal of the *Keahole to Kailua Development Plan* is "to develop a mixed residential, commercial, resort, industrial and recreational community, with approximately 8,000 or more residential units, in a functional, attractive, and financially viable manner. The community will include appropriate shoreline uses, public facilities, and infrastructure and will be built out over the next 20 years."

The following major growth assumptions were used in developing the plan:

- The area will be the location for a new "civic and business center" with civic and commercial uses.
- The area will receive approximately 4,500 new residential units between 1990 and 2010.
- The area is the logical location for a number of regional facilities, including a municipal golf course, a regional sports complex, and West Hawaii University.
- The area will have resort development of about 1,500 visitor units.

Under these assumptions, a Land Use Plan was developed. Its purpose is to provide the following:

- A framework for future growth and development
- A framework for infrastructure plans and cost estimates for rational and cost-effective development
- A basis for coordinated public-private implementation of major infrastructure projects
- A framework for State and County action on designating lands for urban development

The land uses in the plan and the acreage for each use are shown in Table 4-1.

Table 4-1
Land Use Summary

Zone	Description	Acres
Coastal		
1	Commercial/Industrial	100
2	Waterfront Parks	250
3	Wastewater Treatment Plant	50
4	Civic and Business Center	100
5	Harbor Complex	100
6	National Cultural Park	540
7	Resort/Recreation	625
8	Ocean Research Commercial/Industrial	620
9	Ocean Research (NELHA)	320
10	Keahole Airport	1,675
11	General Industrial	180
12	Open/Recreation	1,300
13	Open	365
Subtotal		6,225
Lowland Urban		
1	Municipal Golf Course	200
2	Kealakehe Planned Community (portion)	200
3	Limited Industrial	300
4	Urban Expansion	1,100
5	Open/Recreation	800
Subtotal		2,600
Upland Residential		
1	Kealakehe Planned Community (balance)	500
2	Other Residential Areas (including parks)	1,830
3	Schools: Elementary (2), Middle, and High Schools	85
4	Private Golf Course	200
5	University	500
6	University-Related Residential	610
7	Lands of Kau	800
Subtotal		4,525
Total Acreage		**13,350**

Infrastructure plans and cost estimates were developed for the Land Use Plan for the following systems: roadways, water supply, sewage, drainage, solid waste, regional parks and open space, and landscaping. An expansion of services would also be required for electricity and telephone services. According to the plan, "the Hawaii Electric Light Company estimated that full development could entail an additional 100 megawatts of power. Currently, power is brought into the area by three lines: the line along the Queen Kaahumanu Highway, a line along the Mamalahoa Highway, and a line from the south. Should full development occur, one or two additional 69 kV lines would be required within the planning area."

4.7 State Environmental Policy

This report is being prepared pursuant to the Hawaii Revised Statutes, Chapter 343, and in accordance with Chapter 200 of Title 11, Administrative Rules of the Department of Health, Environmental Impact Statement Rules. This project is a privately owned site located in an area that is currently designated as part of the State Conservation District. An EIS is required, and the Department of Land and Natural Resources (DLNR) is the accepting authority for this EIS.

4.8 National Flood Insurance Program

In 1988, the Federal Emergency Management Agency (FEMA) prepared for the County of Hawaii Flood Insurance Rate Maps (FIRMs) to delineate flood hazard zones and base flood elevation lines. The proposed project site is located 1.6 miles inland from the shoreline and is defined on the FIRM as being an area that is outside the 500-year floodplain. For this reason, flood requirements and restrictions do not apply to this project.

4.9 State Underground Injection Control Program

In 1984, the State Department of Health established the underground injection control (UIC) program, Administrative Rules, Title 11, Chapter 23, "Underground Injection Control." The purpose of the program is to protect the groundwater resources from pollution by subsurface wastewater disposal. Maps have been established that delineate a boundary line known as the "UIC line." Land that is makai of the UIC line is not restricted from disposal by underground injection. This project site is makai of the UIC line, as shown in Figure 1-3. Injection wells are permitted in this area by the Department of Health.

4.10 Agricultural Lands of Importance to the State of Hawaii

The U.S. Department of Agriculture, Soil Conservation Service, has classified the agricultural lands of the Hawaiian Islands. The area of the proposed project is not designated for agriculture nor is the project area designated as Prime Agricultural Land according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) classification.

4.11 Hawaii Coastal Zone Management Program and Special Management Area

The purpose of the Hawaii Coastal Zone Management Program (HCZMP) is to establish guidelines for the use, protection, and development of resources in the coastal zone. Development activities in the coastal zone must conform to the HCZMP objectives and policies, as outlined in Chapter 205A of the Hawaii Revised Statutes. The HCZMP is supplemented by the County's Special Management Area (SMA) that controls development along the shoreline. Activities in the SMA generally require a permit from the County. Because the proposed project site is not located in the SMA, a permit for the proposed project will not be required.

Section 5

Short- and Long-Term Resource Commitments

5.1 Irreversible and Irretrievable Commitments of Resources

The development of the proposed project and resultant construction would result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Major resource commitments include the land on which the project is located and on which the facilities would be constructed, as well as money, construction materials, labor, and energy. The impacts of using these resources should be weighed against the expected positive socioeconomic benefits to be derived from the project versus the consequences of taking no action or of adopting another, less reliable alternative.

HELCO's decision to continue the use of fuel oil, rather than other fuel sources, is based on the economics of providing the required power within the necessary time frame. HELCO realizes that this decision will result in the continued use of petroleum. The addition of new generating units, which will allow the retirement of older, less fuel efficient units, will lower HELCO's use of fuel oil for power generation on a per-megawatt basis. HELCO remains committed to the development of feasible, cost-effective alternative fuels and power sources and increased conservation measures to lessen dependency on imported fossil fuels.

The exhaust stack and related facilities are not anticipated to have a significant impact on the visual resources of the surrounding area.

5.2 The Relationship Between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

Electrical energy is a resource that has become an indispensable part of life. Electric utility companies have the responsibility of providing reliable electric service at a reasonable cost to the consumer. Every effort should be made to conserve electricity, and new sources of energy production also need to be developed. As it becomes older, equipment runs less efficiently, uses more natural resources, and results in higher costs to the user. On the Island of Hawaii, population increases and retirement of older equipment are creating the need for additional electrical generating capacity.

The population of the Island of Hawaii has grown dramatically over the last two decades. The greatest rate of growth has occurred on the west side, with the population tripling during that time period. Growth on the Island of Hawaii is expected to continue to increase.

Many of the HELCO generating units on the Island of Hawaii will be retired over the next two decades, and alternative sources are still in a developmental stage. Expansion of Keahole Generating Station will provide more reliable electrical service and an additional source of power to the west side of the Island. Using the combustion turbine to generate electricity is an efficient, well-tested technology.

Section 6
Unresolved Issues

Unresolved issues are those that cannot be answered at the present time or are unanswerable. A long-term unresolved issue associated with the proposed project is the commercial development of alternative energy sources. While the development of technologies using renewable energy sources will eventually reduce our current reliance on fossil fuels for electricity generation, the timing of such a transition remains unclear.

HELCO is currently engaged in a long-range energy planning effort referred to as Integrated Resource Planning. This effort includes the evaluation of existing energy resources, alternative energy resources, and conservation programs that may ultimately lead to reduced reliance on nonrenewable resources for energy production. HELCO submitted their Integrated Resources Plan to the State Public Utilities Commission in October 1993.

HELCO is continuing to meet with the State Department of Agriculture and the Keahole Agricultural Park residents to discuss the results of the studies performed to assess the potential impacts to vegetation. HELCO remains committed to answering the concerns raised by the Agricultural Park residents to both their and the Department of Agriculture's satisfaction.

Section 7
Public Consultation

7.1 Consulted Parties

Following is a list of agencies, groups, and individuals who were consulted during the EIS preparation process. Sections 7.1.1 through 7.1.9 include consulted parties required by the Office of Environmental Quality Control. Listed in Section 7.1.10 are those who responded to the Preparation Notice, the Draft EIS, or the Revised Draft EIS, or who specifically requested to be a consulted party for this project. Section 7.1.11 is a list of the members of the Community Advisory Group for this project.

7.1.1 Federal Agencies

Commander
Naval Base Pearl Harbor
Attn: Base Civil Engineer
Box 110
Pearl Harbor, HI 96860-5020

Commander and Division Engineer
U.S. Army Corps of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, HI 96858-5440

Directorate of Facilities Engineer
U.S. Army Support Command Hawaii
Attn: Environmental Management Office
Fort Shafter, HI 96858-5000

Commander
U.S. Coast Guard
14th Coast Guard District
300 Ala Moana Blvd.
Honolulu, HI 96850

State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
P.O. Box 50004
Honolulu, HI 96850

Soil Conservationist
U.S. Department of Agriculture
Soil Conservation Service
Kealakekua Satellite Office
P.O. Box 636
Kealakekua, HI 96750

Pacific Islands Administrator
Department of the Interior
Fish and Wildlife Service
P.O. Box 50156
Honolulu, HI 96850

Station Leader
U.S. Department of the Interior
Fish and Wildlife Service
Hawaii Field Research Station
P.O. Box 44
Hawaii National Park, HI 96718

District Chief
Department of the Interior
Geological Survey
677 Ala Moana Blvd., Rm. 415
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U.S. Department of the Interior
Geological Survey
Water Research Division
Hilo Office
P.O. Box 1660
Hilo, HI 96721-1660

Pacific Area Coordinator
U.S. Department of Transportation
Federal Aviation Administration
Western-Pacific Region
P.O. Box 50109
300 Ala Moana Boulevard
Honolulu, HI 96825

Regional Administrator
U.S. Environmental Protection Agency
Region IX
75 Hawthorne St., 18th Floor
San Francisco, CA 94105

7.1.2 State Agencies

District Engineer
Department of Accounting and General Services
Hawaii District Office
75 Aupuni Street
Hilo, HI 96720

Comptroller
Department of Accounting and General Services
1151 Punchbowl Street
Honolulu, HI 96813

Director
Department of Agriculture
1428 S. King Street
Honolulu, HI 96814

District Office Manager
Department of Agriculture
Hawaii District Office
P.O. Box 1477
Hilo, HI 96721-1477

Director
Department of Business, Economic Development and Tourism
220 S. King St., Suite 1100
Honolulu, HI 96813-4541

Division Head
Department of Business, Economic Development and Tourism
State Energy Office
335 Merchant St., Rm. 10
Honolulu, HI 96813

Department of Business, Economic Development and Tourism
Hawaii Island Office
Hawaii Business Center
99 Aupuni St., Rm. 212
Hilo, HI 96720

Librarian
Department of Business, Economic Development and Tourism Library
220 South King St., 4th Floor
Honolulu, HI 96813

Director
Department of Defense
3949 Diamond Head Road
Honolulu, HI 96816-4495

District Supervisor
Department of Hawaiian Home Lands
West Hawaii District Office
Mamalahoa Highway
Waimea, HI 96743

Chairman, Hawaiian Homes Commission
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Hawaii District Health Services Administrator
Department of Health
Hawaii District Health Office
P.O. Box 916
Hilo, HI 96721-0916

Director
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Acting Chief
Department of Health
Environmental Management Division
Five Waterfront Plaza
500 Ala Moana Blvd., Suite 250
Honolulu, HI 96813

Chairperson
Department of Land and Natural Resources
Kalanimoku Building
1151 Punchbowl Street
Honolulu, HI 96813

Hawaiian District Land Agent
Department of Land and Natural Resources
Hawaii District Land Office
P.O. Box 936
Hilo, HI 96721-0936

State Historic Preservation Officer
Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813

Director
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Executive Director
Housing Finance and Development Corporation
677 Queen St., Suite 300
Honolulu, HI 96813

Director
Office of Environmental Quality Control
220 South King Street
Central Pacific Plaza, Fourth Floor
Honolulu, HI 96813

Director
Office of State Planning
State Capitol, Rm. 406
Honolulu, HI 96813

State Archivist
State Archives
Iolani Palace Grounds
Honolulu, HI 96813

7.1.3 County of Hawaii Agencies

Director
County of Hawaii
Department of Parks and Recreation
25 Aupuni Street
Hilo, HI 96720

Manager
County of Hawaii
Department of Water Supply
25 Aupuni Street
Hilo, HI 96720

Chief Engineer
County of Hawaii
Department of Public Works
25 Aupuni Street
Hilo, HI 96720

Director
County of Hawaii
Department of Research and Development
25 Aupuni Street
Hilo, HI 96720

Director
County of Hawaii
Planning Department
25 Aupuni Street
Hilo, HI 96720

7.1.4 University of Hawaii

Director
University of Hawaii
Water Resources Research Center
Holmes Hall, Rm. 283
2540 Dole Street
Honolulu, HI 96822

Director
University of Hawaii
Marine Programs
1000 Pope Road, Rm. 229
Honolulu, HI 96822

Director
University of Hawaii
Environmental Center
Crawford 317, 2550 Campus Road
Honolulu, HI 96822

Librarian
University of Hawaii
Hilo Campus Library
P.O. Box 1357
Hilo, HI 96720

7.1.5 News Media

Editor
Hawaii Tribune Herald
355 Kinoole Street
Hilo, HI 96720

City Editor
Honolulu Star Bulletin
P.O. Box 3080
Honolulu, HI 96813

Editor
Honolulu Advertiser
605 Kapiolani Blvd.
Honolulu, HI 96813

Editor
West Hawaii Today
P.O. Box 789
Kailua-Kona, HI 96740

7.1.6 Nongovernmental Agencies

Director of Environmental Health
American Lung Association
245 North Kukui Street
Honolulu, HI 96817

West Hawaii Liaison
Office of Hawaiian Affairs
Kailua-Kona Office
75-5706 Hanama Place, Suite 107A
Kailua-Kona, HI 96740

American Lung Association
73-4177 Kilapa
Kailua-Kona, HI 96740

Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

7.1.7 Libraries

University of Hawaii
Hamilton Library
Hawaiian Collection
2550 The Mall
Honolulu, HI 96822

Legislative Reference Bureau
State Capitol, Rm. 004
Honolulu, HI 96813

State Main Library
634 Pensacola Street
Honolulu, HI 96814

7.1.8 Regional Libraries

Hilo Regional Library
300 Waianuenue Avenue
Hilo, HI 96720

Kaimuki Regional Library
1041 Koko Head Avenue
Honolulu, HI 96816

Kaneohe Regional Library
45-829 Kamehameha Highway
Kaneohe, HI 96744

Kauai Regional Library
4344 Hardy Street
Lihue, HI 96766

Pearl City Regional Library
1138 Waimano Home Road
Pearl City, HI 96782

Wailuku Regional Library
P.O. Box B
Wailuku, HI 96793

7.1.9 Hawaii Libraries

Bond Memorial (Kohala) Library
P.O. Box 248
Kapauu, HI 96755

Holualoa Library
P.O. Box 214
Holualoa, HI 96725

Kailua-Kona Public Library
74-140 Hualalai Road
Kailua-Kona, HI 96740

Kealakekua Library
P.O. Box 768
Kealakekua, HI 96750

Thelma Parker Memorial Library
Waimea Area Library
P.O. Box 698
Kamuela, HI 96743

7.1.10 Other Consulted Parties

Steve Bowles
P.O. Box 326
Kamuela, HI 96743

Kenneth T. Ono
Community Organization for
Educational Development
West Hawaii
P.O. Box 1716
Kealakekua, HI 96750

William F. Mielcke, President
Kohala Coast Resort Association
HC02 Box 5300, Kohala Coast
Island of Hawaii, HI 96743

Nan Madson, President
Kona Outdoor Circle
76-6280 Kuakini Highway
Kailua-Kona, HI 96740

Gordon A. Chapman
Manager of Environmental Affairs
Mauna Lani Resort
P.O. Box 4959, HCR2
Kohala Coast
Island of Hawaii, HI 96743-4959

Albert S. N. Hee, President
Waimana Enterprises, Inc.
1001 Bishop Street, Suite 1520
Honolulu, HI 96813

Sandra-Ann Y. H. Wong
Waimana Enterprises, Inc.
1001 Bishop Street, Suite 1520
Honolulu, HI 96813

Jay Hanson, Program Chair
West Hawaii Sierra Club
78-6622 Alii Drive
Kailua-Kona, HI 96740

Peggy Ratliff, President
West Hawaii Orchid Growers
Association
73-4348 Laui Street
Kailua-Kona, HI 96740

Hawaii Island Chamber of Commerce
180 Kinoola Street, Room 118
Hilo, HI 96720

Nansay Hawaii, Inc.
P.O. Box 111222, Suite 727
Kamuela, HI 96743

Natural Energy Laboratory of
Hawaii Authority
P.O. Box 1749
Kailua-Kona, HI 96745

Mahi Cooper
P.O. Box 4961
Kailua-Kona, HI 96745-4961

Jerry Rothstein, CDCW
76-123 Royal Poinciana Drive
Kailua-Kona, HI 96740

Hawaii Island Economic
Development Board
First Federal Building
76-5737 Kuakini Highway, #206
Kailua-Kona, HI 96740

Colette Sakoda
R. M. Towill Corporation
420 Waiakamilo Road, No. 411
Honolulu, HI 96817

William R. Glover
Building N
74-5588 Pawai Place
Kailua-Kona, HI 96740

Lynn J. Lee
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813

Ms. Jody Allione
Enserch Development Corporation
3000 West MacArthur Blvd.
Santa Ana, CA 92704-6993

Ms. Barbara J. Shim-Kossow, President
Kona Outdoor Circle
76-6280 Kuakini Highway
Kailua-Kona, HI 96740

Ms. Donna Siebler
73-4179 Alaha Place
Kailua-Kona, HI 96740

Mr. Keichi Ikeda
73-1489 Ihumoe Street
Kailua-Kona, HI 96740

Mr. John Rosas
MATAW
P.O. Box 1687
Kealakekua, HI 96750

Dr. Nathalie D. Tucker, D.C.
Box 1510
Kailua-Kona, HI 96745

Ms. Jane Wilson
P.O. Box 2613
Kailua-Kona, HI 96745

Ms. Alice Goo
73-1444 Ihumoe St.
Kailua-Kona, HI 96740

Ms. Linda Bradley
P.O. Box 2685
Kailua-Kona, HI 96740

Mr. Kelly Moorhead
73-4445 Old Government Road
Kailua-Kona, HI 96740

Ms. Irma J. Gilger
c/o Tropical Breeze Orchid Farm
73-4348 Laui Street
Kailua-Kona, HI 96740

Mr. Russell Wertz
73-1246 Kukuna
Kailua-Kona, HI 96740

Ms. Dianne Fayette
73-4177 Alaha Pl.
Kailua-Kona, HI 96740

Mr. Jim Klieforth
P.O. Box 383857
Waikoloa, HI 96738

Ms. Bobbette Strauss, M.S.W.
73-1104 Mahiani Dr.
Kailua-Kona, HI 96740

Mr. Harold Manago
H. Manago Hotel
P.O. Box 145
Captain Cook, HI 96704

7.1.11 Community Advisory Group

Bill Akau
P.O. Box 44906
Kawaihae, HI 96743

Maitland Akau
P.O. Box 1134
Kamuela, HI 96743

Katherine Augustine
Board of Realtors, West Hawaii
75-5706 Kuakini, Suite 109
Kailua-Kona, HI 96740

Bohnett F. Newell
Puuwaawaa Ranch
P.O. Box 1536
Kailua-Kona, HI 96745

John Crouch
P.O. Box 1177
Kamuela, HI 96743

Fred Galdones
100 W. Lanikaula Street
Hilo, HI 96720

Bobby Lindsey
78-6831 Alii Drive
Kailua-Kona, HI 96740

Pete L'Orange
P.O. Box 635
Kailua-Kona, HI 96745

Harold Manago
P.O. Box 145
Captain Cook, HI 96704

Gordon Ogasawara
Kona Kohala Chamber of Commerce
P.O. Box 249
Hawi, HI 96719

Larry Okazaki
Department of Land and Natural Resources
P.O. Box 936
Hilo, HI 96721

Representative Mike O'Kieffe
P.O. Box 1596
Kamuela, HI 96743

Richard Poirier
Office of State Planning
P.O. Box 3540
Honolulu, HI 96811-3540

David Ramos
P.O. Box 458
Kamuela, HI 96743

Councilman James Rath
25 Aupuni Street
Hilo, HI 96720

Bonnie Rice
Kona Outdoor Circle
P.O. Box 1958
Kailua-Kona, HI 96745-1958

H. Monty Richards
P.O. Box 837
Kailua-Kona, HI 96704

George Robertson
75-5706 Kuakini, Suite 112
Kailua-Kona, HI 96740

Senator Leiomalama Solomon
235 S. Beretania Street, Room 505
Honolulu, HI 96913

Michael Tomich
Na Ala Hele Trails
72-3403 Mamalahoa Highway
Kailua-Kona, HI 96740

Michael Van Camp
Waikoloa Community Association
Waikoloa, HI 96738

Alan Wilcox
83-500 Keawaiki Road
Captain Cook, HI 96704

Wilton Wong
75-5742 Hualalai Road
Kailua-Kona, HI 96740

Tom Yamamoto
P.O. Box 1359
Kamuela, HI 96743

Mayor Stephen Yamashiro
25 Aupuni Street
Hilo, HI 96720

Charles Young
Box 25
Star Route
Captain Cook, HI 96704

Peter Young
P.O. Box 2665
Kamuela, HI 96743

Frank Zuzak
P.O. Box 1596
Kailua-Kona, HI 96745

7.2 Comments Received on the EIS Preparation Notice

The Preparation Notice for the Draft EIS was published in the *OEQC Bulletin* by the Office of Environmental Quality Control. During the 30-day review period from September 8 to October 8, 1992, eight letters were received from the following sources regarding preparation of the Draft EIS:

- State of Hawaii, Department of Land and Natural Resources
- Community Organization for Educational Development, West Hawaii
- Kohala Coast Resort Association
- Kona Outdoor Circle
- Mauna Lani Resort
- Waimana Enterprises, Inc.
- West Hawaii Sierra Club

7.3 Comments Received on the Draft EIS

The Draft EIS was distributed on December 8, 1992. During the 45-day review period, which ended on January 22, 1993, 26 letters were received regarding the Draft EIS. Four No Comment letters were received from the following agencies:

- U.S. Department of the Navy, Naval Base Pearl Harbor
- State of Hawaii, Department of Education
- State of Hawaii, Department of Accounting and General Services
- State of Hawaii, Office of Environmental Quality Control

The remaining 22 letters contained substantive comments from the following agencies and individuals:

- U.S. Department of Transportation, Federal Aviation Administration, Airports District Office
- State of Hawaii, Department of Agriculture
- State of Hawaii, Department of Business, Economic Development & Tourism
- State of Hawaii, Department of Business, Economic Development & Tourism (Jan. 14 attachment)
- State of Hawaii, Department of Health
- State of Hawaii, Department of Land and Natural Resources
- State of Hawaii, Office of State Planning
- State of Hawaii, Department of Transportation
- County of Hawaii, Planning Department
- County of Hawaii, Department of Water Supply
- Jerry Rothstein, CDCW
- Hawaii Island Chamber of Commerce
- Hawaii Island Economic Development Board
- Keahole Agriculture Park Community Association
- Kona Outdoor Circle
- Nansay Hawaii, Inc.
- Natural Energy Laboratory of Hawaii Authority
- Tropical Breeze Orchid Farm
- University of Hawaii at Manoa
- Waimana Enterprises, Inc.
- West Hawaii Orchid Growers Association
- The West Hawaii Sierra Club

The Preparation Notice, Draft EIS Notice, substantive comment letters, and responses are included in Volume II of the Revised Draft EIS.

7.4 Comments Received on the Revised Draft EIS

A Revised Draft EIS was distributed on July 30, 1993. During the 45-day review period, 34 letters were received regarding the Revised Draft EIS. Eight of these letters either stated concurrence with the document or made no comment:

- U.S. Geological Survey, Water Resources Division
- U.S. Department of the Army
- U.S. Department of Agriculture, Soil Conservation Service
- U.S. Department of the Navy
- State of Hawaii, Division of Public Works
- State of Hawaii, Department of Health

- State of Hawaii, Housing Finance and Development Corporation
- State of Hawaii, Office of Environmental Quality Control

The remaining 26 letters from the following agencies and individuals contained substantive comments:

- State of Hawaii, Land Use Commission
- State of Hawaii, Department of Land and Natural Resources
- State of Hawaii, Department of Business, Economic Development and Tourism
- State of Hawaii, Department of Agriculture
- University of Hawaii Environmental Center
- State of Hawaii, Department of Defense
- Waimana Enterprises, Inc.
- Enserch Development Corporation
- West Hawaii Sierra Club
- Kona Outdoor Circle
- Linda Bradley
- Dianne Fayette
- Irma J. Gilger
- Alice Goo
- Keichi Ikeda
- Jim Klieforth
- Harold Manago
- Kelly Moorhead
- Peggy Ratliff, Tropical Breeze Orchid Farm
- John Rosas
- Jerry Rothstein
- Donna Siebler
- Bobbette Strauss, M.S.W.
- Dr. Nathalie D. Tucker, D.C.
- Russell Wertz
- Jane Wilson

The comment letters on the Revised Draft EIS and response letters are included in this section.

United States Department of the Interior

GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
677 Ala-Moana Blvd., Suite 415
Honolulu, Hawaii 96813

August 23, 1993

Mr. Don Horiuchi
Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Mr. Horiuchi:

Subject: Keahole Generating Station Expansion, Revised Draft Environmental Impact Statement (DEIS), North Kona, Hawaii

We are in receipt of the subject DEIS. We regret that due to prior commitments, we are unable to review the subject DEIS by the October 7th deadline.

As requested, we are returning the DEIS to your office for your future use.

Sincerely,

William Meyer
District Chief

Enclosure

cc: Mr. Clyde Nagata
Hawaii Electric Light Company, Inc.
P.O. Box 1027
Hilo, Hawaii 96721

Mr. Al Lono Lyman
CH2M Hill
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814

State of Hawaii
Office of Environmental Quality Control
220 South King Street
Fourth Floor
Honolulu, HI 96813

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. William Meyer, District Chief
U.S. Department of the Interior
U.S. Geological Survey, Water Resources Division
677 Ala Moana Blvd., Suite 415
Honolulu, HI 96813-5412

Dear Mr. Meyer:

Thank you for your August 23, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\001.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

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

September 7, 1993

REPLY TO
ATTENTION OF:

Planning Division

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

Dear Mr. Horiuchi:

Thank you for the opportunity to review and comment on the Revised Draft Environmental Impact Statement for the Keahole Generating Station Expansion, North Kona, Hawaii (TMK 7-3-49: 36). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. The project does not include work in waters of the U.S.; therefore, a DA permit will not be required.

b. The flood hazard information provided on page 4-12 of the report is correct.

Sincerely,

Thomas Ushijima, P.E.
Acting Director of
Engineering

Copies Furnished:

Mr. Clyde Nagata
PO Box 1027
Hilo, Hawaii 96721-1027

Mr. Al Lono Lyman, CH2M Hill
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Thomas Ushijima, P.E.,
Acting Director of Engineering
U.S. Department of the Army
Planning Division
Building 230
Fort Shafter, HI 96858-5440

Dear Mr. Ushijima:

Thank you for your September 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\002.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

United States
Department of
Agriculture

Soil
Conservation
Service

P. O. Box 50004
Honolulu, HI
96850-0001

September 22, 1933

Department of Land and Natural Resources
Office of Conservation and Environmental Affaires
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Horiuchi:

Subject: REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT
Keahole Generating Station Expansion

We have completed review of the draft environmental impact statement and have the following comments to offer:

The land site is composed of Aa and Pahoehoe lava, therefore, erosion is not an issue. Potential impacts to the groundwater resource by injected Wastewater have been addressed adequately.

We appreciate the opportunity to provide comment. Should you have any questions, please do not hesitate to contact Michael C. Tulang at 541-2606.

Sincerely,

NATHANIEL R. CONNER
State Conservationist

cc: Sandra J. Higa, Team Leader, Kealakekua Satellite Office

RECEIVED
'93 SEP 24 AM 11:3
DLNR
OCEA

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Nathaniel R. Conner, State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 50004
Honolulu, HI 96850-0001

Dear Mr. Conner:

Thank you for your September 22, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono ~~Lyman~~
Senior Project Manager

NL89b\003.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

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

IN REPLY REFER TO:
11010
Ser N4(N42)/3634
19 OCT 1993

Mr. Don Horiuchi
Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, HI 96813

Dear Mr. Horiuchi:

REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT
KEAHOLE GENERATING STATION EXPANSION
NORTH KONA, HAWAII

Thank you for the opportunity to comment on the subject Revised Draft Environmental Impact Statement (DEIS) dated July 30, 1993. The Navy has no comments to offer at this time.

Sincerely,

/S/

STANFORD B. C. YUEN
Facilities Engineer
By direction of
the Commander

Copy to:
Mr. Clyde Nagata
Hawaii Electric Light Co., Inc.
P. O. Box 1027
Hilo, HI 96721

Mr. Al Lono Lyman
CH2MHill
1585 Kapiolani Blvd.
Suite 1420
Honolulu, HI 96814

Blind copy to:
PACNAVFACENGCOM (Code 23)

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Commander
c/o Stanford B.C. Yuen, Facilities Engineer
U.S. Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, HI 96860-5020

Dear Mr. Yuen:

Thank you for your October 19, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\004.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

(P)1659.3

SEP 1 3 1993

Department of Land and
Natural Resources
Office of Conservation and
Environmental Affairs
State of Hawaii
Honolulu, Hawaii

Attention: Mr. Don Horiuchi

Gentlemen:

Subject: Keahole Generating Station Expansion
North Kona, Hawaii
Revised Draft EIS

Thank you for the opportunity to review the subject document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ralph Yukumoto of the Planning Branch at 586-0488.

Very truly yours,

Gordon Matsuoka

GORDON MATSUOKA
State Public Works Engineer

RY:jy
cc: OEQC
HELCO, Inc.
CH2M Hill

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Gordon Matsuoka, State Public Works Engineer
Division of Public Works
Department of Accounting and General Services
P.O. Box 119
Honolulu, HI 96810

Dear Mr. Matsuoka:

Thank you for your September 13, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\011.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

JOHN WAIHEE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:

September 28, 1993 92-447/epo

To: Don Horiuchi
Department of Land and Natural Resources

From: John C. Lewin, M.D. for
Director of Health

Subject: Revised Draft Environmental Impact Statement
Keahole Generating Station Expansion
North Kona, Hawaii
TMK: 7-3-49: 36

Thank you for allowing us to review and comment on the subject revised document. We had commented earlier on the original draft environmental impact statement, but have no comments on this revised document.

c: Hawaii Electric Light Company Inc.
CH2M Hill

JOHN WAIHEE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:

October 29, 1993 92-447/epo

To: The Honorable Keith W. Ahue, Chairperson
Department of Land and Natural Resources

Attention: Mr. Don Horiuchi

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

Subject: Revised Draft Environmental Impact Statement (DEIS)
Keahole Generating Station Expansion
North Kona, Hawaii
TMK: 7-3-49: 36

Thank you for allowing us to review and comment on the subject document. We do not have any comments on this revised document.

c: HELCO, INC.
CH2M

Engineers
Planners
Economists
Scientists

December 7, 1993

John C. Lewin, M.D., Director of Health
State of Hawaii Department of Health
P.O. Box 3378
Honolulu, HI 96801

Dear Dr. Lewin:

Thank you for your September 28 and October 29, 1993, letters concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\013.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

JOHN WAIHEE
GOVERNOR

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

IN REPLY REFER TO:
93:PPE/4847

October 1, 1993

TO: Mr. Don Horiuchi
Department of Land and Natural Resources
Office of Conservation and Environmental Affairs

FROM: Joseph K. Conant
Executive Director

SUBJECT: Revised Draft Environmental Impact Statement (DEIS) for Keahole Generating Station Expansion

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

Thank you for the opportunity to participate in the review. Enclosed is the Revised DEIS document.

Enclosure

c: Mr. Clyde Nagata
Hawaii Electric Light Company, Inc.

Mr. Al Lono Lyman
CH2M Hill

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Joseph K. Conant, Executive Director
State Department of Budget and Finance
Housing Finance and Development Corporation
677 Queen St., Suite 300
Honolulu, HI 96813

Dear Mr. Conant:

Thank you for your October 1, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\014.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

JOHN WAIHEE
GOVERNOR

BRIAN J. J. CHOY
Director

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185

October 6, 1993

Mr. Don Horiuchi
Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Horiuchi:

Subject: Revised Draft Environmental Impact Statement for the Keahole Generating Station Expansion, North Kona, Hawaii

Thank you for the opportunity to review the subject revised draft environmental impact statement. We do not have any comments to offer.

Sincerely,

Brian J. J. Choy
Director

BC:jt

c: Hawaii Electric Light Company, Inc.
CH2M HILL

Engineers
Planners
Economists
Scientists

December 7, 1993

Brian J.J. Choy, Director
Office of Environmental Quality Control
220 South King Street
Central Pacific Plaza, Fourth Floor
Honolulu, HI 96813

Dear Mr. Choy:

Thank you for your October 6, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Although you had no comments, please feel free to contact us at any time regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\017.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
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JOHN WAIHEE
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

August 25, 1993

Mr. Don Horiuchi
Department of Land and
Natural Resources
Office of Conservation and
Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Horiuchi:

Subject: Revised Draft Environmental Impact Statement for the Keahole Generating Station Expansion

We have reviewed the subject Revised Draft Environmental Impact Statement ("Revised DEIS") and have the following comments to offer:

1) We confirm that the subject parcel, identified as TMK No. 7-3-49: 36, and consisting of approximately 14.998 acres, is within the State Land Use Conservation District.

2) On page 3-38, the seventh paragraph should clarify that the State lands bordering the generating station along the northern and eastern boundaries of the project site have been recommended for reclassification to the Urban District in the Five-Year Boundary Review prepared by the Office of State Planning.

3) Figure 3-8 on page 3-39 of the Revised DEIS should be amended to reflect that the area of the proposed development named "University Heights" by White Hat Development, Corp. is within the State Land Use Urban District. A location map for this project was supplied to you in previous comments dated December 21, 1992.

We have no further comments to offer at this time.

Thank you for the opportunity to provide comments on the Revised DEIS. If you have any questions in regards to this matter, please feel free to contact me or Leo Asuncion of my staff at 587-3822.

Sincerely,

for ESTHER UEDA
Executive Officer

EU:th

cc: OEQC
CH2M Hill
DBEDT
Hawaii Electric Light Co.

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Esther Ueda, Executive Officer
Department of Business, Economic
Development and Tourism
Land Use Commission
335 Merchant St., Rm. 104
Honolulu, HI 96813

Dear Ms. Ueda:

Thank you for your August 25, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Clarify on page 3-38 that State lands bordering the station along the northern and eastern boundaries have been recommended for reclassification to the Urban District in the 5-year boundary review prepared by the Office of State Planning.

This change has been made in the text of the Revised Final EIS.

Amend Figure 3-8 to reflect that University Heights is within the State Land Use Urban District.

This modification has been made to Figure 3-8 of the Revised Draft EIS and is included in the Revised Final EIS.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

Honolulu Office
HNL89a\010.51

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JOHN WAIHEE
GOVERNOR OF HAWAII

KEITH W. AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER, II
DONA L. HANAIKE

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

P. O. BOX 621
HONOLULU, HAWAII 96809

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

File No.: HA-487A

SEP 20 1993

Hawaii Electric Light Company, Inc.
54 Halekauwila Street
Hilo, Hawaii 96721-1027

Attn: Clyde Nagata

Dear Mr. Nagata,

Subject: Revised Draft Environmental Impact Statement for the Keahole Generating Station Expansion

Thank you for revising the Draft Environmental Impact Statement and addressing the concerns raised in our July 1, 1993 letter to you. Since full disclosure is required for the document, we would appreciate your addressing the following concerns in the final environmental impact statement.

The population growth estimates shown in section 3.3.3 is based on figures available during the late 1980's. This was a period of extraordinary economic growth in the State and not reflective of current conditions. The most conservative projections of table 3-11 may be considered optimistic under present circumstances. (We note that several resort projects in West Hawaii have delayed their development schedule.)

Assuming that the forecasted annual peak power demand shown in table 1-1 is based on population growth estimates of section 3.3.3, we would expect the projections to be lowered. The 9% projected increase in annual forecasted peak power demand between 1993 and 1995 appears to be very high given current economic realities. It may be useful to demonstrate in the appendix of the final EIS the methodology used to forecast peak power demand.

Also, the statement on page 3-44 that the proposed expansion is consistent with the State's land use classification is misleading. A generator station belongs in the urban district. The existence of the generator station in the Conservation District is a result of

unplanned historical circumstances. It would be appropriate to petition the Land Use Commission to remove the parcel from the Conservation District.

Please contact Don Horiuchi of the Office of Conservation and Environmental Affairs at 587-0381 if you have any questions.

Very truly yours,

John P. Keppeler II

for Keith W. Ahue
Chairperson

cc: CH2M Hill
OEQC

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Keith W. Ahue, Chairperson
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Ahue:

Thank you for your September 20, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

If demand projections (Table 1-1) were based on population estimates of Section 3.3.3, the demand should be lower. It may be useful to demonstrate in an appendix the methodology used to forecast peak power demand.

The forecasted annual peak power demand shown in Table 1-1 of the Revised Draft EIS was not based on the population growth estimates contained in Section 3.3.3. HELCO forecasts electrical demand by estimating future peak demand and kilowatt-hour sales from several different perspectives. Final forecasts are selected by the Forecast and Planning Committee (FPC) and can be corroborated by more than one analytical method. Although mathematical trending of historical kilowatt-hour sales data is one form of analysis used in the forecasting process, HELCO does not depend solely on mathematical trending to forecast the future. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place. Following is a description of the forecasting methodology.

Short-Term Peak Demand Forecasting

Generally, historical monthly morning and evening peak data are used in the short-term peak demand forecasts (e.g., for 1993-98). These forecasts are derived by multiplying the forecasted annual peaks by a morning monthly peak factor and an evening monthly peak factor. These factors are derived from actual monthly morning and evening peaks averaged over the most current 5 years. The system peak forecasts are then analyzed in relation to the energy sales forecasts and the projected load factor, which is the ratio of the average hours of operation to the total annual hours available.

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Another major portion of the short-term forecasted increase in demand can be directly attributed to large-scale construction projects currently under way. Such large-scale projects reflect the increasing competition among discount retailers for larger market shares and are not necessarily dependent on tourism or population increases. These projects, all scheduled to come on-line in 1993 and 1994, include:

Kealakehe Sewer Treatment Plant and Pump Station	2,000 kilovolt-amperes (kVA)
COSTCO Pacific Distribution Center	1,500 kVA
Keauhou Shopping Center Phase 2	2,000 kVA
Safeway/ACE/Ben Franklin	1,500 kVA
Lanihau Center Phase 2	4,000 kVA
K-Mart/Queen Liliuokalani Trust	3,000 kVA
Mauna Kea Prince Hotel	2,000 kVA
Royal Vista Golf Course Irrigation Pumps	3,000 kVA

Short-Term Sales Forecasting

Short-term energy sales forecasting at HELCO is performed through analyses of the marketplace: rate schedule analyses, system analyses, market analyses, economic analyses, and customer service analyses.

- Rate schedule analyses consider a spectrum of mathematical analyses of the patterns and trends in the number of customers and kilowatt-hour sales to the individual rate schedules using linear, Box-Jenkins and exponential models, econometric analysis, and other traditional curve-fitting methods.

- System analyses use a number of mathematical analyses and trending techniques of the patterns and trends in total system kilowatt-hours (kWh).

- Market analyses are based on survey analyses of the market conditions influencing the different rate schedules, with special emphasis on customer-by-customer accounting of loads in Large Power Rate Schedule P. Also considered are influences on Residential Schedule R, including new construction outlook, resort development, and government-supported or -sponsored housing.

- Economic analyses include judgmental analyses and considerations of the potential for future economic growth in the HELCO service area, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- Customer service analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month.

The inputs into these analyses are diverse and include such items as personal income, visitor count, population growth, national and state economic conditions, new construction, inflation factors, oil prices, conservation measures, and weather patterns.

Long-Term Sales Forecasting

The long-term sales forecasts for HELCO's electricity sales are the result of econometric equations, developed by HELCO, that relate historical patterns of energy usage to independent economic and weather variables. Care is taken to ensure that as many county-specific data as possible are used, rather than state-wide information. Sources for historical economic data include:

- Department of Business, Economic Development and Tourism's (DBEDT) State Data Book
- DBEDT's Quarterly Statistical and Economic Reports
- County of Hawaii's Department of Research and Development Data Book
- Bank of Hawaii's Annual Report
- Updated data from the Hawaii Visitors Bureau
- National Oceanic and Atmospheric Administration's (NOAA) weather data summaries from the State Department of Land and Natural Resources

The econometric models are validated using statistical tests for:

- Residual autocorrelation (Durbin-Watson Test)
- The goodness of fit (coefficient of determination or R-Squared Value)
- Statistical significance of the independent variables (t-Test)
- Heteroskedasticity of the residuals
- Multicollinearity of the independent variables

In addition, the reasonableness of the relationship between the independent and dependent variables for each model is evaluated.

The results of these models are reasonable predictors of long-term trends. The econometric models are not, however, responsive to rapid changes in the short-term conditions; for this reason, they are not used for the short-term forecasts.

On the other hand, the customer and market analyses described above examine the short term very carefully and are more likely to account for the near-term conditions that drive electricity sales. A combination of the short-term detailed analyses and the long-term econometric model has shown itself to be a reasonable method for projecting sales over a 20-year period. This is generally done by applying the rates of growth resulting from the econometric models to the short-term analyses forecasts.

Effects of Conservation

Potential effects of customer conservation and Demand-Side Management (DSM) activities are also factored into the forecasting process. The extent that customers have practiced load shifting and conservation in the past would be reflected in the historical database. For example, the FPC included 700 kW and 300 megawatt-hour (MWh) peak demand and energy forecast adjustments, respectively, beginning with the 1993 forecasts, for the impact of the Pilot Commercial Lighting Program. As other DSM programs move from the planning to implementation stage, the forecasts will be adjusted to account for the estimated demand and energy savings. However, the precise levels of future conservation and reduction in usage due to DSM programs are difficult to predict because a consumer's personal conservation rate is affected by a number of other factors that are difficult to reliably forecast. These factors include:

- The actions of the city, state, federal, and foreign governments
- Oil prices, which affect electricity prices
- Overall inflation
- Economic factors
- Weather variables
- Public acceptance of new energy-efficient appliances
- Public willingness to make lifestyle choices that encourage conservation

Economic and Population Inputs Used

Economic conditions and their possible influences on forecasted demand are regularly reviewed during deliberation on the forecasts for each rate schedule. The figures contained within Table 1-1 in the Revised Draft EIS were adopted by the HELCO Forecast and Planning Committee in March 1993 and reflect economic and population data up to that time. Concerns regarding the extent and duration of the state-wide economic slump, the drop in Big Island tourism, the eventual closing of Hamakua Sugar, the slowdown of Hilo Coast Processing Company, and the slowdown of new construction were all factored into the methodology. As a result of the state-wide recession and the downturn in new construction, HELCO's near-term kWh sales growth was projected at lower levels than the previous year's projections.

General population growth is but one element of the overall model, and the population figures used in the HELCO models are provided by HELCO. County population estimates

included in the 1989 General Plan and the State Department of Business, Economic Development and Tourism population projections Series M-K, developed in 1988, were not used to project the short-term peak demand for 1993 to 1998. For demand forecasts from 1998 to 2010, HELCO used the most recent population and tourism data available and the recommended modifications to the individually metered residential accounts developed by the Consumer Advocate's Office, which were incorporated into HELCO's Integrated Resource Planning proposal. The following table shows the population and visitor census projections used in developing the demand projections shown in Table 1-1 of the Revised Draft EIS.

Population and Visitor Census Projections		
	1992 Base and Projections	
Year	Population	Visitors
1992	129,610	14,718
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874
Source: HELCO Long Term Sales & Peak Forecast March 1993, page 3-65.		

The forecasting of system peak demand is more complex than the forecasting of kilowatt-hour sales. In general, peak loads are much more sensitive to changes in weather patterns than to changes in visitor arrivals or population changes. This was evidenced during the prolonged hot and humid weather on Oahu in September 1993. During this period, new high-peak demands were placed on Hawaiian Electric Company, Inc. (HECO) generating equipment, independent of any sudden increases in population or tourism. In addition, the peak demand is much more sensitive to the timing of a major project, such as a hotel, or large commercial use, than is the overall kWh sales forecast. For example, a 2-MW hotel that starts operating in December would contribute only one month of kWh sales, annualized over the entire year. However, the full 2 MW of electrical demand on the system peak would need to be met.

Accuracy of Forecasts

Historically, the FPC's recommendations have been reasonably close to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast. In 1989, the system peak of 130.4 MW was 1.6 MW below the forecast. In 1992, the recorded peak of 150.2 MW was 0.8 MW below the forecast.

The FPC's projection of future growth is frequently revised. In the 1987 forecast, an increase in system peak of 4 MW per year was projected on the basis of slightly pessimistic economic and visitor industry climates. In 1988, this forecast was revised to a 5-MW-per-year increase to reflect improved economic conditions. In 1989 and 1990, the strong influence of Japanese visitors and developers led to forecasts being revised upward to as much as a 9-MW-per-year increase. By 1991, the softened economy, lingering effects of the Persian Gulf War, and the beginning of a downturn in visitor arrivals led to a revision in the 5-year projected growth to only 5.8 MW. Current demand through November 1993 has been approximately 5 MW below the projected 157 MW.

Table 1-1 in the Revised Draft EIS reflects the following growth: 1993, 8 MW; 1994, 6 MW; 1995, 6 MW; 1996, 7 MW; 1997, and 1998, 7 MW. Possible reductions in demand, due to the adoption and implementation of the DSM programs contained in HELCO's proposed Integrated Resource Plan before the Public Utilities Commission (PUC), are incorporated in these forecasts. Some of the specific assumptions in the various HELCO schedules that compose these forecasts include:

- Persistence in the national economic recession
- Dropping of visitor arrivals in second half of 1993
- Further softening in resort condominium sales
- Decline in multi-family construction
- Sliding of 1994 proposed projects into 1995 and 1996
- Impact of Commercial Lighting Program
- Similar weather patterns

Alternative Scenarios

In addition to the demand forecasts presented in Table 1-1 of the Revised Draft EIS, HELCO has also examined alternative scenarios that explore the impact of other events on the peak demand. One such scenario is the possible impact of the Model Energy Code as reflected in the latest update of the Hawaii Building Energy Efficiency Standard developed in 1992 for the Energy Division of DBEDT.

The scope of the Energy Efficiency Standard encompasses the design of new residential and nonresidential construction as well as major renovations. DBEDT estimates the impact of the proposed building standards on electricity demand in the year 2010 for the State of Hawaii to be a cumulative savings of 114 MW and 404 gigawatt-hours (GWh). The breakdown of the savings is estimated to be 51 percent from nonresidential, 8 percent from the nonresidential renovations, and 41 percent from the residential sector. Based on the percentage of total state electricity consumption, the cumulative savings for the Island of Hawaii in the year 2010 are estimated at 10.3 MW and 36.6 GWh. This assumes that Hawaii County's electricity reductions are 7.2 percent of total state savings in nonresidential, 7.2 percent from nonresidential renovations, and 11.8 percent from the residential sector.

The adoption of the Energy Efficiency Standard for Hawaii County requires legislative action on the part of the Hawaii County Council. Currently, an advisory committee is reviewing the Model Energy Code for submittal to the Hawaii County Council. Adoption of the new standards is anticipated by 1995. Following adoption of the standards in their final form, HELCO will factor into its demand forecasts any estimated energy reductions that may result.

Summary

In summary, the peak demand forecasts contained in Table 1-1 reflect conservative, rather than optimistic, assumptions about the level of visitor arrivals and general economic growth for Hawaii County. Population projections are only one of the elements of the overall forecasting model; other elements include such items as weather patterns, conservation efforts, and projects under construction. These projections are frequently reevaluated to maintain accuracy and adequateness of HELCO's planning efforts. State Series M-K and County General Plan population projections are not used in the HELCO demand forecasts reflected in Table 1-1. Short-term projections are based mainly on the historical peak demand data and on the ongoing construction projects for those developments advanced enough in the planning process to be considered "certain." Long-term projections from 1998 to 2010 use population projections developed by the Consumer Advocate's Office for use in the Integrated Resource Planning process. Appropriate changes have been made to Section 3.3.3 of the Revised Final EIS. This discussion and a summary of the March 1993 Forecast and Planning Committee Meeting have been included in Section 9 of the Revised Final EIS.

It is misleading to state that the project is consistent with the State's land use classification (p. 3-44). Generators belong in the urban district. It would be appropriate to petition for removal of the parcel from the Conservation District.

The Revised Final EIS text has been changed to delete the referenced statement and reflect the fact that, because the site is in the State's Conservation District, an amendment will be required to the existing Conservation District Use Permit (CDUP) for the facility.

A copy of the letter from HELCO to DLNR, responding to the above comment, is attached to this letter and is incorporated by reference as part of this response letter.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89a\012.51

Hawaii Electric Light Company, Inc. • PO Box 1027 • Hilo, HI 96721-1027

Warren H. W. Lee, P.E.
President

December 8, 1993

The Honorable Keith W. Ahue
Chairman of the Board
Department of Land and
Natural Resources
State of Hawaii
130 Kalanimoku Building
Honolulu, HI 96813

Dear Mr. Ahue:

I am writing about your September 20, 1993, letter in which you comment on the Revised Draft Environmental Impact Statement for the Keahole Generating Station unit addition.

Hawaii Electric Light Company's consultant for the EIS, CH2M HILL, will be preparing a separate response to your comment letter. We believe our Revised Final EIS (EIS) and the responses to the comments on the Revised Draft will fully satisfy all legal requirements for your acceptance of our EIS.

Acceptance of our EIS is a very important initial step towards satisfying the Island of Hawaii's 1995 electrical needs. Your acceptance is urgently needed in order to prevent rolling blackouts on the Big Island resulting from delays in completing future generating units when they are required. Your acceptance of our EIS and the Land Board's approval of our CDUP amendment, are two of the very significant approvals needed before we can proceed with the expansion of our existing Keahole generation plant.

We need to have the next generating unit completed in mid-1995 when additional generation will be necessary. No other viable site has been proposed for new generating capacity in 1995, and the earliest date for which an independent power producer (IPP) has proposed new generating capacity is at the end of 1996 or later. We note that, very recently, an IPP proposing to build a 58 MW power plant on Department of Hawaiian Home Lands property near Kawaihae Harbor received a negative declaration for its EIS. Nevertheless, the IPP does not expect to have its generation unit completed until late 1996 or later.

Under these circumstances, we must not allow the residents of the Island of Hawaii to face the risks that would arise from waiting until late 1996 or beyond for power provided by an IPP. HELCO has learned, from the delays encountered by Puna Geothermal Venture, that the best-laid plans can go awry. So far, all of the IPPs with which HELCO has existing firm power purchase contracts have either encountered delays in developing their projects or have had unexpected periods in which they have ceased production.

Especially in light of this experience, HELCO believes that it is in the public's best interest, first, to build the 1995 generation unit at Keahole, and, second, to plan for the following generation unit through concurrent planning by HELCO for a utility-constructed addition along with discussions with IPPs proposing units in that time frame. In this way, the public will have better assurances that a reliable source of generation, providing power at a reasonable cost to the consumers, will be available when it is needed.

I would like to address the fourth paragraph of your comment letter, which states:

> *"... the statement on page 3-44 that the proposed expansion is consistent with the State's land use classification is misleading. A generator station belongs in the urban district. The existence of the generator station in the Conservation District is a result of unplanned historical circumstances. It would be appropriate to petition the Land Use Commission to remove the parcel from the 'Conservation District.'"*

HELCO believes that the proposed expansion of the Keahole Generating Station should be permitted in this instance. This conclusion is based, among other things, on the following:

1. HELCO constructed its generating station at Keahole in reliance upon a Conservation District Use Permit issued by the Board of Land and Natural Resources in December 1973. Subsequently, three CDUP amendments were issued by the Land Board in February 1984, February 1987, and September 1988. Since 1973, excluding operating costs, HELCO has invested more than $10 million in the Keahole Generating Station in reliance upon the CDUP approval and amendments granted by the Land Board over the last 20 years. We believe it would be unfair and unreasonable to now require HELCO to pursue the State Land Use and County rezoning approvals before undertaking the proposed expansion of the Keahole Generating Station. We also believe that this would be very detrimental to HELCO and would prejudice HELCO's

investment and its ability under law to continue to provide the Big Island's residents reliable power in a cost effective manner.

As we had indicated to both Mr. Paty and Mr. Masumoto in mid-1992, if HELCO were to pursue the State Land Use and County rezoning approvals before proceeding with the expansion of the Keahole Generating Station, this could delay the project beyond 1995 and even for up to three or more years. Such a delay would not be in the public's best interest.

2. HELCO's current application for an amendment to the CDUP was made following consultation with your predecessor, Bill Paty, in mid-1992, and in a separate meeting with Harold Masumoto, Director of the Office of State Planning, in mid-1992.

3. Since the CDUP amendment was accepted by DLNR in late 1992, HELCO has relied on DLNR's September 25, 1992 "Notice of Acceptance," which states in part that "The proposed use is a conditional use within the General Subzone of the Conservation District according to Administrative Rules, Title 13, Chapter 2, as amended . . . ." DLNR's staff report, dated January 21, 1993, to the Land Board for the initial hearing on the CDUP amendment restates the aforementioned finding.

DLNR's staff report, dated September 1988, and the acceptance of the CDUP amendment HA-6/27/88-487A, dated January 27, 1988, also makes an identical finding. In September 1988, the Land Board approved the 1988 CDUP amendment. HELCO has also relied on the direction provided in DLNR's finding and the Land Board approval of the 1988 CDUP amendment in pursuing the current amendment.

4. On the basis of the foregoing, the December 1992 Draft EIS, the June 1993 Final EIS, and the July 1993 Revised Draft EIS contained the statement that the expansion of the Keahole Generating Station "is consistent with . . . the State's land use classification. . . ."

The comments in the fourth paragraph of your September letter were not previously raised in DLNR's draft EIS comment letter, dated January 21, 1993, or in either of DLNR's two July 1993 letters concerning the Final EIS (published in June 1993).

DLNR staff also did not raise any of the comments stated in the fourth paragraph of your letter in any of their meetings with representatives of HELCO and/or CH2M HILL during 1992 and through September 1993.

5. Finally, we know of no reason to conclude that the present CDUP amendment for the proposed expansion of the power facility is not in conformance with all applicable statutes, rules, and standards relevant to the approval of the CDUP amendment.

Mr. Ahue, without your timely acceptance of our Revised EIS, the residents and economy of the Big Island may be again jeopardized by blackouts. We request your prompt action in accepting our EIS.

Very truly yours,

cc: The Honorable John D. Waihee,
Governor, State of Hawaii
Joshua C. Agsalud, Ph.D.,
Governor's Executive Administrator
Harold Masumoto,
Director, Office of State Planning
Roger C. Evans, Administrator,
Office of Conservation & Environmental Affairs, DLNR

JOHN WAIHEE
Governor
MUFI HANNEMANN
Director
JEANNE SCHULTZ
Deputy Director
RICK EGGED
Deputy Director
TAKESHI YOSHIHARA
Deputy Director

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

Central Pacific Plaza, 220 South King Street, 11th Floor, Honolulu, Hawaii
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804 Telephone: (808) 586-2406 Fax: (808) 586-2377

October 1, 1993

Mr. Don Horiuchi
Department of Land and
Natural Resources
Office of Conservation
and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Horiuchi:

The Department of Business, Economic Development & Tourism is pleased to submit the enclosed comments on the Revised Draft Environmental Impact Statement for The Proposed Keahole Generating Station Expansion.

The enclosed comments were provided by our Energy Division. Questions regarding these comments may be directed to Maurice H. Kaya, Energy Program Administrator, at 587-3812.

Thank you for the opportunity to provide these comments.

Sincerely,

Mufi Hannemann

Enclosures

cc: Office of Environmental Quality Control
Mr. Clyde Nagata, Hawaii Electric Light Company
Mr. Al Lono Lyman, CH2M Hill

JOHN WAIHEE
Governor
MUFI HANNEMANN
Director
JEANNE SCHULTZ
Deputy Director
RICK EGGED
Deputy Director
TAKESHI YOSHIHARA
Deputy Director

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

ENERGY DIVISION, 335 MERCHANT ST., RM. 110, HONOLULU, HAWAII 96813 PHONE: (808) 587-3800 FAX: (808) 587-3820

SUBJECT: Review of Revised Draft Environmental Impact Statement on Keahole Generating Station, July 30, 1993

Energy Division has reviewed the subject Draft Environmental Impact Statement (DEIS) and offers the following comments:

SECTION 1, Proposed Action:

1. We note that Hawaii Electric Light Company (HELCO) has added a 10 megawatt (MW) battery energy storage plant (BESP) to the proposed project (the BESP did not appear in HELCO's June 1993 Keahole Project EIS). Why was the BESP added to the revised DEIS? Further, what is the longest duration (in hours) of daily peak demand HELCO has experienced over the past two years? What is the annual average time duration of HELCO's daily peak demand? We believe that the answers to these questions will assist in the determination of need for the BESP, and we recommend that this information be provided in the final EIS.

2. On page 1-4, HELCO explains that it "must defer the scheduled retirement of some older units in order to maintain a reserve generating capacity." We understand that this deferral of retirements was from 1994 until 1995 to accommodate the delay caused by the initial rejection of HELCO's June 1993 Keahole EIS.

   If HELCO is able to defer retirements of East Hawaii generators from 1994 to 1995 because of permitting delays, can these retirements be delayed further? For example, even if only the three post-1960 units of those planned for retirement in 1995 were deferred, this would allow for about 14 MW of remaining capacity. Also, ramp-up of demand-side management (DSM) programs during the deferral years will add additional margin. We recommend that this alternative be assessed and described in the final EIS.

3. In Table 1-1, we note that Hilo Coast Processing Company (HCPC) is not accounted for as a future retirement. This leads us to query whether HCPC is assumed on line throughout the resource period, or has it been deleted entirely from HELCO's resource plan? This should be clarified in Table 1-1 and explained more fully in the final EIS section on Alternatives.

4. On page 1-9 HELCO states: "Because growth on the Island of Hawaii has occurred and is projected to continue in West Hawaii, the location of new generating capacity has been designated for West Hawaii." HELCO's 20-year forecasted peak demand, with and without DSM, is reported in Table 1-1. We understand from HELCO's draft Integrated Resource Planning (IRP) Integration Report that the main economic driver for this forecast

as annual average visitor census growth as reported in The Department of Business, Economic Development & Tourism's 1988 "M-K" series of economic projections. HELCO chose 5.2% average annual visitor census growth as its base case economic scenario. However, we understand that Hawaiian Electric Company (HECO) in its draft August 1993 forecast estimated visitor growth average at 2.8% over the period 1993 - 1997 (HELCO's earlier base case growth rate for this same period was 5.2%). Even though HECO's growth rates were developed for Oahu, since they are more reflective of current economic conditions; i.e., worldwide recession, general slowdown in tourism and construction, they may be more relevant to the Big Island, and HELCO's forecast appears overly optimistic.

Over the period 1993 - 1997, taking energy savings from DSM programs into account, HELCO has forecast an additional electricity peak demand of 21 MW. If HECO's more conservative visitor growth projection is adopted for HELCO's models, we have estimated HELCO's peak demand growth by 1997 to be an additional 12 MW. We suggest that the economic assumptions used by HELCO in its forecasting be updated to reflect current economic conditions. We recommend that this update be provided in the final EIS.

5. On page 1-6 and Table 1-2, HELCO describes its schedule of West Hawaii generating units. Our questions and comments above regarding retirements and the feasibility of retirement deferrals also applies here.

6. On page 1-9, HELCO states: "Locating the proposed 56-MW DTOC and a BESP at Keahole generating station will reduce the need for cross-Island transmission lines and will optimize the vacant HELCO-owned land and existing utility infrastructure." This statement implies that cross-island transmission lines are something to be avoided. However, we understand that improving HELCO's transmission and distribution (T&D) system will strengthen HELCO's reliability and flexibility in the transmission of power between East and West Hawaii. Accordingly, should additional generation capacity become available in East Hawaii, these T&D system improvements would facilitate its power delivery to West Hawaii. The EIS should address the cost and operational significance of cross-island T&D improvements fully.

   For example, Puna Geothermal Venture (PGV) has recently stated that it is currently fully capable of providing an additional of 5 MW of firm power to HELCO's system. Also, we understand that HCPC and HELCO are currently negotiating a new 20-year power contract, effective January 1, 1995, for 30 MW of firm power, which would be an additional 12 MW of additional capacity over HCPC's current contribution to HELCO. What are the tradeoffs associated with these resource options and any T&D investments in support of them? We recommend that these points be factored into HELCO's planning and reported on in the final EIS.

Section 2 - Alternatives:

1. On page 2-1, HELCO again discusses deferral of scheduled retirements of older generating equipment. Our questions and comments above apply here as well.

2. On page 2-4 HELCO states "The 15-acre site, known as the Puu Anahulu site, represents HELCO's long-term facility's planning for the development of a 200-MW facility (emphasis added)." HELCO's May 1993 DEIS on its proposed West Hawaii Power Facility is for a 168 MW facility. We suggest that this inconsistency be clarified in the Keahole final EIS.

3. Section 2.3.2 discusses geothermal energy in general. Also HELCO's draft IRP Integration Report states: "HELCO would seek to have future interconnects from the Puna geothermal fields run to West Hawaii (p. 11-15)." What would be the cost of such an interconnect from the Puna geothermal fields to West Hawaii? HELCO's Supply-side Resource Development Portfolio Final Report (pp. 6-11 and 6-12) indicates that a study, 138 kV Fifth Cross-Island Transmission Line Conductor and Structure Selection Study, was completed in 1990 to take into account the island's load growth in West Hawaii. The report states that "as a result of the planned addition of generation in the West Hawaii region, the installation of the fifth cross-island transmission line has been deferred beyond the year 2012." What are the relative economics between providing geothermal power (or other firm power from East Hawaii) to West Hawaii via a cross-island transmission line vice the planned addition of generation in West Hawaii, both the Keahole expansion and West Hawaii Power Facility? This analysis should be presented in the Alternatives section of the final Keahole EIS.

4. On page 2-7, Section 2.3.7, Coal, HELCO summaries the disadvantages of coal technologies as follows:

   - o More costly than oil;
   - o Require more land for fuel storage and ash disposal; and
   - o New fuel handling infrastructure would be required at the harbor facility.

   First, we are concerned that this technology may not have received an adequate evaluation. We base this assertion on the fact that in HELCO's Bibliography of Alternative Technology (December 1992 draft EIS, Volume 2, Appendix A), only four (4) references relating to coal are cited. We believe a more thorough assessment of these technologies is in order and should be conducted and reported on in the final EIS, particularly because of coal's potential advantages as a non-oil fuel.

   Next, large baseload technologies, like coal, are expected to require much higher capital investments up front with low production costs and supply/price security resulting in possible savings over the long term. In fact, in our comments to HELCO's IRP Integration Report as it relates to coal, we noted that the fuel prices in 2005 are estimated by HELCO to be $6.05/MBTU for No. 2 oil ($35.32/bbl) and $4.00/MBTU for coal ($96.00/ton). While HELCO's estimate for oil seems consistent with available estimates, coal is not expected to increase in price. Coal is currently available from Indonesia in Hawaii at $36.00 per short ton (1992 dollars), or $59.94 per short ton ($2.49/MBTU) in 2005-year dollars (at 4% per year). The most expensive coal available in the region is

Western U.S. coal due to transportation costs at $49.50 per short ton (1992 dollars), or $82.42 per short ton ($3.43) in 2005-year dollars. Coal prices are not expected to increase significantly. We presume that HELCO's coal price figures, which seem to overstate the future price of coal, were used in conducting a comparative analysis between coal and other resources. What is the impact on the economics of coal plants if lower fuel price estimates are used?

The AES Barbers Point 180-MW coal-fired plant has found ready markets for its ash and sorbent wastes, e.g., construction aggregate. Isn't it feasible that similar uses would be found for wastes from a Big Island coal-fired facility?

HELCO states that new harbor coal handling infrastructure would be needed to support a coal-fired facility. Again, what are the overall comparative economics between oil-fired and coal-fired facilities? Without this analysis, we cannot substantiate how a resource/technology decision was reached.

We request that the above questions and comments be addressed in the final Keahole EIS.

5. On page 2-8, HELCO states: "Availability of 25 MW from Puna Geothermal Venture, however, has not deferred the need for the first two phases of the proposed 56 MW unit addition to the Keahole generation station, because additional capacity is required to allow for the scheduled retirement of older generating equipment in West Hawaii." Our previous questions and comments regarding the potential deferral of scheduled retirements apply here.

   We note that HELCO reports its ongoing negotiations with PGV for additional purchased power, but that HELCO asserts that "increasing PGV's production of power will require the development of another reinjection well and a backup production well." PGV has stated that <u>with existing wells and equipment</u> it can begin producing an additional 5 MW of firm power immediately. PGV has also stated that it can produce 12 to 15 MW of "as available" power without the need for additional wells.

   It appears that retirement deferrals and expanded generation from PGV (and/or other IPP's such as HCPC) would allow for the deferral of HELCO's proposed Keahole expansion, or possibly even replace the project with alternative generation. Construction of HELCO's proposed BESP, along with appropriate T&D improvements would improve the flexibility and reliability of HELCO's overall system with respect to transmission of power between East and West Hawaii. We believe that these options should be more thoroughly analyzed and reported on in the final EIS. In short, the issue of utility ownership should not deter the full consideration of alternative resource options.

6. On page 2-8, HELCO states that "HCPC may decide not to convert to coal and to stop providing electricity when its sugarcane operations cease." Although we do not rule out this possibility, it appears improbable based on HCPC's letter to HELCO dated June 23, 1993, in which HCPC clearly states its intention to successfully negotiate a new 20-year power

contract for 30 MW of firm capacity with HELCO, to be effective January 1, 1995. It is difficult to accept that this situation is as uncertain as HELCO has portrayed it. Does HELCO have any documentation to corroborate the statement cited?

7. Section 2.5, Conservation and Energy Efficiency, generally describes HELCO's planned DSM programs, which will be proposed to the Public Utilities Commission for approval. HELCO is to be commended for its aggressive DSM programs, which by the year 2013 are projected to save approximately 44 MW of peak capacity. This amount represents approximately 12% of HELCO's peak demand. We believe, however, that in planning DSM programs, HELCO should also be factoring in the impacts on energy demand of the Model Energy Code, which can be adopted soon by all counties. We believe that this will be an important consideration in future DSM plans, particularly relative to new construction. Adoption of the model code will require that the new building owner rightfully bear the investment cost of efficiency improvements, not HELCO's customers.

8. In Section 2.6, HELCO states that the oil-fired combustion turbine (for Keahole) "is the least-cost alternative." Given our questions and comments above regarding comparative resource economics, conducting a more detailed analysis of available alternatives is necessary to support HELCO's conclusion. We recommend that the more rigorous comparative analysis that we have recommended be conducted and reported on in the final EIS.

   HELCO also states that "a unit addition at Keahole generation station can be accommodated in 1995." HELCO must already recognize that there is a high degree of uncertainty regarding this timetable. Rising community opposition to the proposed project and delays in the permitting process are largely beyond HELCO's control. How does HELCO intend to address these risks and uncertainties?

   Finally, HELCO states that the Keahole expansion project "will optimize the benefits of existing utility infrastructure." Without detailed answers to our questions regarding alternative generation options and T&D improvements, we do not believe HELCO has substantiated this statement.

SECTION 3, Environmental Setting, Impacts and Mitigation Measures

1. On page 3-20, HELCO discusses project impacts on the facility's water supply. We understand that the facility would obtain its water from the County Water Department and an on-site supply well. The facility would have a maximum draw of 500 gallons per minute or 12,000 gallons per day. Kawaihae Cogeneration Partners (KCP) is planning a virtually identical power generation facility to be built at Kawaihae, with the exception that KCP's unit is also planned to be a cogenerator for a desalination plant which will be designed to produce 2.6 million gallons of fresh water per day. The EIS should carefully review the merits of both proposals. For the Keahole site in particular, we understand that there are severe water shortages in the area.

2. In Section 3.3.3, page 3-45, HELCO cites population projections from the Hawaii County 1989 General Plan. It is doubtful that these projections accounted for the current economic climate and should, therefore, be viewed cautiously when applying them to utility resource planning.

3. In Section 3.3.4, Visual Resources, pp. 3-47 through 3-65, HELCO presents its analysis of the expansion project's visual impacts. HELCO admits that when exiting the airport from the airport access road, the existing stacks plus the proposed 104 foot exhaust stack associated with the Keahole expansion will be the dominant feature in the landscape. HELCO also acknowledges that "persons travelling the the Queen Kaahumanu Highway and the access to Keahole Airport represent the principal viewers of the proposed facility expansion (emphasis added, p. 3-48)." Yet, in its assessment of visual impacts, HELCO fails to acknowledge that significant visual impacts will occur and that "it is not uncommon to encounter industrial land uses adjacent to airports."

   We believe that the 104 foot exhaust stack associated with the proposed expansion would be a significant adverse visual impact. In fact, we understand that it is this adverse visual impact that forms the basis of much of the emerging community opposition to the Keahole expansion. We recommend that HELCO acknowledge the reality of the impact in the final EIS.

SECTION 4, Public Plans and Policies.

1. On page 4-3, with respect to the expansion project's support of the State's energy objectives and policies, HELCO states that the Keahole expansion "conforms with these objectives and policies." We disagree with this statement and recommend that HELCO explain how the addition of another 56 MW of oil-fired capacity will support and contribute to the State's energy objective of increased energy self-sufficiency. Alternatively, we recommend that HELCO acknowledge in the final EIS that the proposed project does not support this particular State energy objective, particularly with respect to the need to reduce the use of petroleum.

SECTION 5, Short- and Long-term Resource Commitments.

1. First, our earlier comments regarding the visual impact of the proposed exhaust stack apply here.

2. Next, as in our comments on the December 1992 draft EIS, we believe that approval and construction of the project will result in a irretrievable commitment for another 20-30 years of dependence on petroleum for the life of this plant. Although comments provided by CH2M Hill in response to this position were that "development of a 56 MW combustion turbine does represent continued reliance on fossil fuel for the short-term. It does not necessarily represent a long-term commitment to this technology . . . (CH2M Hill letter to DBEDT, June 21, 1993, Volume 2, Keahole DEIS)." Notwithstanding CH2M Hill's response, however, timeframes used for utility planning in Hawaii (i.e., the PUC's IRP Framework) which are based on the PUC's IRP framework are 5 years

representing a near-term planning window with 6 to 20 years representing a long-term planning period. What's HELCO's long-term commitment with respect to fuel choice issues?

Expansion of this oil-fired generation facility will, indeed, represent a long-term and irretrievable commitment to additional oil dependency for the capacity and life time of this facility. As in our previous comments, we recommend acknowledgement of this fact in the final EIS.

VOLUME 2, Section 9, Public Involvement Program

1. On page 5, CH2M Hill's June 21, 1993, letter to DBEDT in response to DBEDT's comments on the December 1992 Keahole DEIS, it is stated: "HELCO cannot immediately pass on the cost of fuel price increases to the customer. The decision to pass an increased fuel cost on to the customer is made by the PUC. If the PUC believes that the events changing the fuel price have been largely beyond HELCO's control, the PUC may be likely to authorize a cost pass-through."

   We acknowledge that CH2M Hill's assertion is technically correct. However, from a practical standpoint, oil is a commodity traded in a worldwide market. By the nature of this worldwide commodity market, it is inconceivable that HELCO has any control over fuel prices, except through the long-term fuel contracts that CH2M Hill also referred to. However, these contracting arrangements do not cover all of the fuel HELCO purchases. Moreover, past experience shows that these contracts did not serve as significantly effective mechanisms against the extremely volatile nature of oil prices and supply availability.

   For example within the 90 days following the August 1990 Iraqi invasion of Kuwait, state-wide energy utility sales prices increased on average 32% as a direct result of fuel oil price increases affecting the majority of power generation facilities in Hawaii. Further, many economists attribute the current recession, at least in part, on the Persian Gulf crisis and its accompanying petroleum price spikes.

   In short, while we acknowledge that HELCO may be attempting to do everything it can to control fuel prices, HELCO actually has little control over these prices and, therefore, it is the ratepayer who bears the risk associated with oil price and supply volatility. We recommend that this fact be acknowledged in the final DEIS.

Thank you for the opportunity to provide these comments.

MHK/JT:aw

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Mufi Hannemann, Director
Department of Business, Economic
Development and Tourism
220 S. King St., Suite 1100
Honolulu, HI 96813-4541

Dear Mr. Hannemann:

Thank you for your October 1, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Section 1 — Proposed Action

1-1. Why was the BESP added to the Revised DEIS? What is the longest duration (hours) of daily peak demand HELCO has experienced over the past 2 years? What is the annual average time duration of HELCO's daily peak demand? This information will assist in the determination of need for the BESP, and it should be provided in the FEIS.

The BESP was not "added" to the Revised Draft EIS. It was included in both the December 1992 Draft EIS and the June 1993 Final EIS. The Revised Draft EIS contains an expanded discussion of the BESP.

The HELCO system peak occurs approximately between 6 p.m. and 8 p.m. daily. This is referred to as the evening, or p.m., peak. A lower, although longer, day peak occurs approximately between 10 a.m. and 12 p.m. daily. There is no strict definition of the time the peak period begins and the time it ends based on the magnitude of the load. The HELCO tariff defines the priority peak period as the four continuous peak hours from 5 p.m. to 9 p.m. Monday through Friday. HELCO records the hourly peaks and produces hourly averages of the daily load profiles for each month. This information about hourly peaks, along with a discussion of the BESP's advantages, has been included in the Purpose and Need section of the Revised Final EIS.

Examination of the 1991 and 1992 average hourly profiles for each month (attached), using the corresponding day peak as a reference point, shows that the p.m. peak period lasts approximately 3 to 4 hours.

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1-2. If HELCO can defer retirements from 1994 to 1995 (p. 1-4), can these retirements be delayed further? For example, deferred retirement of the three post-1960 units will allow 14 MW of capacity, with ramp up of DSM programs adding additional margin. This alternative should be assessed and described in the FEIS.

A discussion on deferral of unit retirements has been added to the Revised Final EIS and is summarized in this response. HELCO could defer the retirement of its existing units until an independent power producer (IPP) comes on-line; however, HELCO has concluded that this is not a reasonable alternative. In addition, no IPP is anticipated to come on-line until late 1996 or 1997 at the earliest. With increased demand, deferral of retirements would greatly increase the risk of rolling blackouts in the event of unit breakdown. This is a risk HELCO cannot take. Diesel units, such as those at Waimea and Kanoelehua, must be retired because either they have become too costly to operate or they cannot be relied upon to provide emergency baseload generation. Reliance upon the deferred retirement of the three post-1960 units you mention would not add appreciably to the reserve margin in light of the projected planned growth and would place HELCO at too great a risk to be considered a reasonable alternative.

Should there be no other alternative, HELCO would have no choice other than to continue to defer retirement of its units. However, the continued postponement of retirement of generating units has already increased the maintenance costs and the likelihood of equipment failure. Additional postponement will further increase maintenance costs and the risk of equipment failure. This is not an action that HELCO can allow to occur in light of its responsibility to provide reliable service at the lowest practical cost to customers. In 1991 and 1992, without firm capacity from Puna Geothermal Venture (PGV), HELCO was forced to rely on these older units and had to curtail power to customers when some of these units failed. With the projected increase in demand, and even with the Integrated Resource Plan/Demand-Side Management (IRP/DSM) program proposed by HELCO, HELCO has concluded that the associated risk of deferred retirement in lieu of providing new generating capabilities is too great to be considered either a reasonable or a desirable alternative.

Many factors affect the decision to retire a generating unit. Violation of HELCO's generation planning criteria reserve margin is evaluated in determining whether or not a HELCO generating unit should be retired. In addition, any one or a combination of the following factors are evaluated:

- Parts availability
- Reliability
- Operations and maintenance expenses
- Environmental concerns

HELCO's generation planning criteria require HELCO to be able to meet the peak demand should the largest available unit fail while another unit is off-line for maintenance (PGV's 25 MW is now considered the largest unit on the system). Currently, HELCO can meet this requirement. As demand for electricity grows and the reserve margin diminishes, however, HELCO cannot rely on the use of these older units to provide emergency baseload generation over an extended period of time. This conclusion is true even with the most optimistic appraisal of what HELCO could theoretically achieve through its DSM programs.

The availability of major parts and components of the generating unit is critical in maintaining the generating unit for operations. Units are considered for retirement if parts are not readily available or will take an unreasonable amount to time to be special-ordered and delivered to HELCO. Currently, parts for several of the older diesel units cannot be purchased and must be specially made, which increases the down time of these units for maintenance and repair.

Reliability of the unit must also be taken into account. A generating unit that is constantly out of service reduces the generation reserve margin.

Maintenance expenses are another factor considered before a unit is retired. Operations and maintenance expenses include fuel efficiency and the cost to keep the unit "available" to meet the dispatcher's needs. Generally, the electro-motive diesels operated by HELCO are costly to maintain and operate, which results in a higher overall kilowatt cost. The Waimea units are more costly to operate than the other diesel units because they require manual operation.

Environmental concerns are the final factor considered. Several of the diesel units are considered noisy or may add to local air quality degradation. HELCO places a priority on replacing such generating units as soon as possible.

The manufacture year of the existing HELCO units and their planned retirements are shown in the following table.

Planned Retirements of Existing HELCO Units			
Unit	**Capability (MW)**	**Year Manufactured**	**Retirement Year**
Steam Units			
Shipman 1	3.4	1943	1995
Shipman 3	7.5	1955	2005
Shipman 4	7.7	1958	2008
Puna	15.5	1970	undetermined
Keaau CT-3	20.0	1992	undetermined
Hill 5	14.1	1965	undetermined
Hill 6	23.0	1974	undetermined
Diesel Units			
Kaneolehua 11	2.0	1962	1995
Kaneolehua 15	2.75	1972	1997
Kaneolehua 16	2.75	1972	1997
Kaneolehua 17	2.75	1973	1998
Kaneolehua CT-1	9.0	1962	1995
Waimea 8	0.8	1943*	1995
Waimea 9	0.9	1943*	1995
Waimea 10	1.0	1943*	1995
Waimea 12	2.75	1970	1995
Waimea 13	2.75	1972	1997
Waimea 14	2.75	1972	1997
Keahole 18	2.75	1974	1999
Keahole 19	2.75	1974	1999
Keahole 20	2.75	1966	2000
Keahole 21	2.75	1974	2000
Keahole 22	2.75	1966	2000
Keahole 23	2.75	1969	2000
Keahole CT-2	13.75	1989	undetermined
* Estimated year of manufacture. Units were built during World War II for use on landing ships (LSTs).			

Several of the units listed in the table to be retired in 1995 were actually scheduled for earlier retirement. However, PGV's inability to provide firm capacity until 1993 resulted in deferment of these planned retirements. In addition, rather than retiring units, HELCO operated them on a continuous basis to provide baseload generation.

With the addition of PGV's baseload power in mid-1993, HELCO has been able to bring several of these units down for overhaul and maintenance. However, during this maintenance it has become apparent that several units are no longer cost effective to maintain. In addition, the continuous use of some units has greatly increased the risk that these machines will malfunction in the future. For example, the three Waimea units (8, 9, and 10), manufactured during World War II, can no longer be operated at their full capacity because the additional stress could cause a breakdown. Given that parts for some of these units are no longer manufactured, the next loss of a unit may result in a lengthy repair period as replacement parts are specially ordered, manufactured, and delivered to HELCO. Lengthy repair periods would result in even greater stress on HELCO's generating system.

Thus, although HELCO could defer retirement of these generating units until mechanically they can no longer operate, without newer replacement generation in the short term, breakdowns in the older units become more likely, which could result in a repeat of the rolling blackouts experienced in 1991-92. Because it is HELCO's responsibility to provide reliable service to the public, it will not assume such a risk.

1-3. HCPC is not accounted for as a future retirement in Table 1-1. Is HCPC assumed on-line throughout, or has it been deleted from the resource plan? This should be clarified in Table 1-1 and explained more fully in the FEIS under Alternatives.

HCPC has indicated an interest in continuing its electrical production and is currently evaluating various alternatives. Therefore, HCPC is assumed on-line throughout Table 1-1. This has been clarified in the text of the Revised Final EIS. No changes to Table 1-1 are necessary.

1-4. Update the economic assumptions in forecasting to reflect current economic conditions. Provide the update in the FEIS (referral is made to use of 5.2 percent average growth as base case, while HECO used 2.8 percent for 1993-97, revised from 5.2 percent).

A comparison of Table 1-1 in the Draft EIS for the Keahole Generating Station Expansion (December 1992) and the Revised Draft EIS (July 30, 1993) indicates that the peak demand projections were revised before their inclusion in the Revised Draft EIS. These revisions reflect the updated economic information and assumptions used by HELCO's forecasting personnel. These more recent assumptions result in the lowering of the near-term peak demand figures. In addition, allowances were made in the later set of figures for energy conserved through the implementation of Demand-Side Management (DSM) measures currently awaiting approval by the Public Utilities Commission. HECO's demand forecasts

for Oahu are not appropriate for the Island of Hawaii. There is a larger population base on Oahu and a more mature tourism market. The forecasts for the Island of Hawaii reflect the unique population and tourism characteristics of the area.

HELCO forecasts electrical demand by estimating future peak demand and kilowatt hour sales from several different "viewpoints" or perspectives. Final forecasts are selected by the Forecast and Planning Committee (FPC) and can be corroborated by more than one analytical method. Although mathematical trending of historical kilowatt-hour sales data is one form of analysis used in the forecasting process, HELCO does not depend solely on it to forecast the future. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place.

Short-Term Peak Demand Forecasting

Generally, historical monthly morning and evening peak data are used in the short-term peak demand forecasts (e.g., for 1993-98). These forecasts are derived by multiplying the forecasted annual peaks by a morning monthly peak factor and an evening monthly peak factor. These factors are derived from actual monthly morning and evening peaks averaged over the most current 5 years. The system peak forecasts are then analyzed in relation to the energy sales forecasts and the projected load factor, which is the ratio of the average hours of operation to the total annual hours available.

Another major portion of the short-term forecasted increase in demand can be directly attributed to large-scale construction projects currently under way. Such large-scale projects reflect the increasing competition among discount retailers for larger market shares and are not necessarily dependent on tourism or population increases. These projects, all scheduled to come on-line in 1993 and 1994, include:

Kealakehe Sewer Treatment Plant and Pump Station	2,000 kilovolt-amperes (kVA)
COSTCO Pacific Distribution Center	1,500 kVA
Keauhou Shopping Center Phase 2	2,000 kVA
Safeway/ACE/Ben Franklin	1,500 kVA
Lanihau Center Phase 2	4,000 kVA
K-Mart/Queen Liliuokalani Trust	3,000 kVA
Mauna Kea Prince Hotel	2,000 kVA
Royal Vista Golf Course Irrigation Pumps	3,000 kVA

Short-Term Sales Forecasting

Short-term energy sales forecasting at HELCO is performed through analyses of the marketplace: rate schedule analyses, system analyses, market analyses, economic analyses, and customer service analyses.

- Rate schedule analyses consider a spectrum of mathematical analyses of the patterns and trends in the number of customers and kilowatt-hour sales to the individual rate schedules using linear, Box-Jenkins and exponential models, econometric analysis, and other traditional curve-fitting methods.

- System analyses use a number of mathematical analyses and trending techniques of the patterns and trends in total system kilowatt-hours (kWh).

- Market analyses are based on survey analyses of the market conditions influencing the different rate schedules, with special emphasis on customer-by-customer accounting of loads in Large Power Rate Schedule P. Also considered are influences on Residential Schedule R, including new construction outlook, resort development, and government-supported or -sponsored housing.

- Economic analyses include judgmental analyses and considerations of the potential for future economic growth in the HELCO service area, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- Customer service analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month.

The inputs into these analyses are diverse and include such items as personal income, visitor count, population growth, national and state economic conditions, new construction, inflation factors, oil prices, conservation measures, and weather patterns.

Long-Term Sales Forecasting

The long-term sales forecasts for HELCO's electricity sales are the result of econometric equations, developed by HELCO, that relate historical patterns of energy usage to independent economic and weather variables. Care is taken to ensure that as many county-specific data as possible are used, rather than state-wide information. Sources for historical economic data include:

- Department of Business, Economic Development and Tourism's (DBEDT) State Data Book
- DBEDT's Quarterly Statistical and Economic Reports
- County of Hawaii's Department of Research and Development Data Book
- Bank of Hawaii's Annual Report
- Updated data from the Hawaii Visitors Bureau
- National Oceanic and Atmospheric Administration's (NOAA) weather data summaries from the State Department of Land and Natural Resources

The econometric models are validated using statistical tests for:

- Residual autocorrelation (Durbin-Watson Test)
- The goodness of fit (coefficient of determination or R-Squared Value)
- Statistical significance of the independent variables (t-Test)
- Heteroskedasticity of the residuals
- Multicollinearity of the independent variables

In addition, the reasonableness of the relationship between the independent and dependent variables for each model is evaluated.

The results of these models are reasonable predictors of long-term trends. The econometric models are not, however, responsive to rapid changes in the short-term conditions; for this reason, they are not used for the short-term forecasts.

On the other hand, the customer and market analyses described above examine the short term very carefully and are more likely to account for the near-term conditions that drive electricity sales. A combination of the short-term detailed analyses and the long-term econometric model has shown itself to be a reasonable method for projecting sales over a 20-year period. This is generally done by applying the rates of growth resulting from the econometric models to the short-term analyses forecasts.

Effects of Conservation

Potential effects of customer conservation and Demand-Side Management (DSM) activities are also factored into the forecasting process. The extent that customers have practiced load shifting and conservation in the past would be reflected in the historical database. For example, the FPC included 700 kW and 300 megawatt-hour (MWh) peak demand and energy forecast adjustments, respectively, beginning with the 1993 forecasts, for the impact of the Pilot Commercial Lighting Program. As other DSM programs move from the planning to implementation stage, the forecasts will be adjusted to account for the estimated demand and energy savings. However, the precise levels of future conservation and reduction in usage due to DSM programs are difficult to predict because a consumer's personal conservation rate is affected by a number of other factors that are difficult to reliably forecast. These factors include:

- The actions of the city, state, federal, and foreign governments
- Oil prices, which affect electricity prices
- Overall inflation
- Economic factors
- Weather variables
- Public acceptance of new energy-efficient appliances
- Public willingness to make lifestyle choices that encourage conservation

Economic and Population Inputs Used

Economic conditions and their possible influences on forecasted demand are regularly reviewed during deliberation on the forecasts for each rate schedule. The figures contained within Table 1-1 in the Revised Draft EIS were adopted by the HELCO Forecast and Planning Committee in March 1993 and reflect economic and population data up to that time. Concerns regarding the extent and duration of the state-wide economic slump, the drop in Big Island tourism, the eventual closing of Hamakua Sugar, the slowdown of Hilo Coast Processing Company, and the slowdown of new construction were all factored into the methodology. As a result of the state-wide recession and the downturn in new construction, HELCO's near-term kWh sales growth was projected at lower levels than the previous year's projections.

General population growth is but one element of the overall model, and the population figures used in the HELCO models are provided by HELCO. County population estimates included in the 1989 General Plan and the State Department of Business, Economic Development and Tourism population projections Series M-K, developed in 1988, were not used to project the short-term peak demand for 1993 to 1998. For demand forecasts from 1998 to 2010, HELCO used the most recent population and tourism data available and the recommended modifications to the individually metered residential accounts developed by the Consumer Advocate's Office, which were incorporated into HELCO's Integrated

Resource Planning proposal. The following table shows the population and visitor census projections used in developing the demand projections shown in Table 1-1 of the Revised Draft EIS.

Population and Visitor Census Projections		
	1992 Base and Projections	
Year	Population	Visitors
1992	129,610	14,718
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874
Source: HELCO Long Term Sales & Peak Forecast March 1993, page 3-65.		

The forecasting of system peak demand is more complex than the forecasting of kilowatt-hour sales. In general, peak loads are much more sensitive to changes in weather patterns than to changes in visitor arrivals or population changes. This was evidenced during the prolonged hot and humid weather on Oahu in September 1993. During this period, new high-peak demands were placed on Hawaiian Electric Company, Inc. (HECO) generating equipment, independent of any sudden increases in population or tourism. In addition, the peak demand is much more sensitive to the timing of a major project, such as a hotel, or large commercial use, than is the overall kWh sales forecast. For example, a 2-MW hotel that starts operating in December would contribute only one month of kWh sales, annualized over the entire year. However, the full 2 MW of electrical demand on the system peak would need to be met.

Accuracy of Forecasts

Historically, the FPC's recommendations have been reasonably close to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast. In 1989, the system peak of 130.4 MW was 1.6 MW below the forecast. In 1992, the recorded peak of 150.2 MW was 0.8 MW below the forecast.

The FPC's projection of future growth is frequently revised. In the 1987 forecast, an increase in system peak of 4 MW per year was projected on the basis of slightly pessimistic economic and visitor industry climates. In 1988, this forecast was revised to a 5-MW-per-year increase to reflect improved economic conditions. In 1989 and 1990, the strong influence of Japanese visitors and developers led to forecasts being revised upward to as much as a 9-MW-per-year increase. By 1991, the softened economy, lingering effects of

the Persian Gulf War, and the beginning of a downturn in visitor arrivals led to a revision in the 5-year projected growth to only 5.8 MW. Current demand through November 1993 has been approximately 5 MW below the projected 157 MW.

Table 1-1 in the Revised Draft EIS reflects the following growth: 1993, 8 MW; 1994, 6 MW; 1995, 6 MW; 1996, 7 MW; 1997, and 1998, 7 MW. Possible reductions in demand, due to the adoption and implementation of the DSM programs contained in HELCO's proposed Integrated Resource Plan before the Public Utilities Commission (PUC), are incorporated in these forecasts. Some of the specific assumptions in the various HELCO schedules that compose these forecasts include:

- Persistence in the national economic recession
- Dropping of visitor arrivals in second half of 1993
- Further softening in resort condominium sales
- Decline in multi-family construction
- Sliding of 1994 proposed projects into 1995 and 1996
- Impact of Commercial Lighting Program
- Similar weather patterns

Alternative Scenarios

In addition to the demand forecasts presented in Table 1-1 of the Revised Draft EIS, HELCO has also examined alternative scenarios that explore the impact of other events on the peak demand. One such scenario is the possible impact of the Model Energy Code as reflected in the latest update of the Hawaii Building Energy Efficiency Standard developed in 1992 for the Energy Division of DBEDT.

The scope of the Energy Efficiency Standard encompasses the design of new residential and nonresidential construction as well as major renovations. DBEDT estimates the impact of the proposed building standards on electricity demand in the year 2010 for the State of Hawaii to be a cumulative savings of 114 MW and 404 gigawatt-hours (GWh). The breakdown of the savings is estimated to be 51 percent from nonresidential, 8 percent from the nonresidential renovations, and 41 percent from the residential sector. Based on the percentage of total state electricity consumption, the cumulative savings for the Island of Hawaii in the year 2010 are estimated at 10.3 MW and 36.6 GWh. This assumes that Hawaii County's electricity reductions are 7.2 percent of total state savings in nonresidential, 7.2 percent from nonresidential renovations, and 11.8 percent from the residential sector.

The adoption of the Energy Efficiency Standard for Hawaii County requires legislative action on the part of the Hawaii County Council. Currently, an advisory committee is reviewing the Model Energy Code for submittal to the Hawaii County Council. Adoption of the new standards is anticipated by 1995. Following adoption of the standards in their

final form, HELCO will factor into its demand forecasts any estimated energy reductions that may result.

Summary

In summary, the peak demand forecasts contained in Table 1-1 reflect conservative, rather than optimistic, assumptions about the level of visitor arrivals and general economic growth for Hawaii County. Population projections are only one of the elements of the overall forecasting model; other elements include such items as weather patterns, conservation efforts, and projects under construction. These projections are frequently reevaluated to maintain accuracy and adequateness of HELCO's planning efforts. State Series M-K and County General Plan population projections are not used in the HELCO demand forecasts reflected in Table 1-1. Short-term projections are based mainly on the historical peak demand data and on the ongoing construction projects for those developments advanced enough in the planning process to be considered "certain." Long-term projections from 1998 to 2010 use population projections developed by the Consumer Advocate's Office for use in the Integrated Resource Planning process. Appropriate changes have been made to Section 3.3.3 of the Revised Final EIS. This discussion and a summary of the March 1993 Forecast and Planning Committee Meeting have been included in Section 9 of the Revised Final EIS.

1-5 Previous responses concerning retirements apply here.

1-6. The EIS should address the cost and operational significance of cross-island transmission and distribution (T&D) improvements fully. With regard to PGV and HCPC expansions, what are the tradeoffs associated with these resource options and any T&D investments in support of them? These points should be factored into HELCO's planning and reported in the FEIS.

HELCO's policy is to include firm purchase power capacities in the resource plan. Such firm purchase power capacities are HCPC, Hamakua Sugar (until 1994), and PGV, with which HELCO has purchase power contracts for firm power approved by the PUC. PGV has proposed an increase to its current capacity contract above the present 25 MW, and HCPC has also indicated a desire to continue its electrical production to HELCO and possibly increase its capacity after ending its sugar processing operation in 1994. Discussions are continuing with PGV and HCPC, and HELCO cannot factor new capacities into the resource plan until a purchase power contract is signed by both parties and approved by the PUC. If any IPP contract is signed by HELCO, the firm power capacity must be of sufficient size and be available to meet the scheduled service date of new generation additions listed in the resource plan.

As far as T&D requirements are concerned, a load flow and stability analysis must be done to determine what transmission improvements will be required based on the amount of new generation capacity being proposed and where best to interconnect the resource into the

HELCO power grid. These studies are being performed at this time. Cost estimates for the T&D facilities can only be made after the interconnection requirements are determined through the studies.

It should be noted that comparative economics is only one of the selection criteria used during the evaluation to determine a preferred alternative, and it was not the overriding issue in the selection of the Keahole site for additional units. The need for a unit addition to the system in January 1995 was a key criterion. Regardless of how much the possible alternatives involving independent power producers or cross-island transmission lines cost, they do not meet the most critical selection criterion of providing the necessary power by January 1995, nor would they best meet the need for reliability and balancing the load between East and West Hawaii. Therefore, they were not considered reasonable alternatives for meeting project requirements and were not evaluated further.

Section 2 — Alternatives

2-1 Please see our previous responses concerning retirements.

2-2. Inconsistency between pg 2-4 (200 MW at Puu Anahulu) and WHPF DEIS (168 MW). This should be clarified in the FEIS.

HELCO plans to develop the Puu Anahulu site for 168 MW of generating capacity. The 200-MW reference on page 2-4 of the Revised Draft EIS refers to the design criteria used for the purpose of conducting the siting study. The statement on page 2-4 has been clarified in the Revised Final EIS to reflect HELCO's actual plans.

2-3. What would be the cost of an interconnect between PGV and West Hawaii? What are the relative economics between providing geothermal or other firm power to West Hawaii via a cross-island line vs. the planned addition of generation in West Hawaii (both at Keahole and Puu Anahulu)? This analysis should be presented in the Alternatives section of the FEIS.

The alternative of an interconnect between PGV and West Hawaii was evaluated and discussed in the Black & Veatch *Supply-Side Resource Option Portfolio Development Final Report*. Most of the development within the HELCO service area is occurring in West Hawaii in the Kona and North Kohala Districts. As stated in our response to your question 1-6, the resource from PGV must be timely to provide the capacity listed in HELCO's resource plan. Because of the time required to obtain appropriate permits and approvals, and where the IPPs are in that process, no IPP is anticipated to be able to provide power until late 1996 or 1997 at the earliest. Even though HELCO's schedule has slipped, it remains ahead of all IPP proposals in the process.

With regard to PGV's proposal to increase its present contract capacity, a system study is being done at this time. The study will identify what transmission improvements would be required to integrate the proposed capacity into the HELCO power grid. Cost estimates to compare PGV and West Hawaii can be made only after these interconnection studies are performed. Reference to this study has been included in the Revised Final EIS.

As mentioned before, economics is only one selection criterion used to identify alternatives for further evaluation. The fact that an interconnect between PGV and West Hawaii could not be developed in time to meet the need for power projected by 1995 led to this alternative's early rejection as undesirable, and it was not evaluated further.

2-4a. Concerned that coal technology did not receive an adequate evaluation because only four references related to coal are cited in Appendix A. A more thorough assessment should be conducted and reported in the FEIS.

Coal technology received extensive evaluation as an energy resource during HELCO's preparation of its IRP. In developing its IRP, HELCO was required to consider all supply-side and demand-side resource options, including coal technology, that are appropriate for Hawaii and are available in the planning horizon. HELCO identified and assessed supply-side resource options in the *Supply-Side Resource Option Portfolio Development Final Report*, prepared by Black & Veatch and issued in July 1993. This report is available from HELCO for review. Coal technology is one of the supply-side resource options evaluated in the report.

A wide range of commercial and developing resources appropriate for consideration as potential supply-side resource options were identified. These resources were then screened to eliminate resources not appropriate, or reasonably available, for Hawaii or the HELCO system. Screening of the options is allowed to eliminate those options that are clearly not feasible. In consultation with the IRP advisory group, HELCO is establishing the screening criteria. The resources were further screened to develop a listing of commercially available and developing resources that would be evaluated in detail during the assessment process.

The intent of the screening process was to place all resource options into three categories: commercial, developing, or other. Coal is categorized as a commercial resource option. Commercial resources are those considered to be available for utility application in the 1994 to 1999 time frame and that meet the following five criteria:

- Vendor availability
- Proven technology
- Utility scale
- Well-established capital and operating costs
- Resource availability

Attached to our response letter are Tables 1 through 4 from the Black & Veatch Final Report. These tables show summaries of information developed during the assessment of the commercial resources. Table 1 shows capacity and heat rate, annual generation based on the listed capacity factor, and availability information for the resource. Table 2 provides data primarily concerned with capital and operating costs. Table 3 shows estimated flue gas emissions and waste stream quantities for all of the commercial resources with the exception of wind energy conversion and small-scale photovoltaic systems, which are free of emissions and waste streams. The results of a qualitative characterization of the commercial resources are presented in Table 4. The qualitative characterization was required to assess certain issues and factors that are difficult to quantify. Two categories of issues were characterized: technical/engineering factors and environmental/social issues. The issues and factors were scored in the qualitative characterization process; the scoring range used was -2 to +2. The negative scores indicated a detrimental impact, the positive scores indicated a favorable impact, and the zero scores indicated little or no impact.

Detailed information about the results of the screening process for the coal resource option is provided in Chapter 4 (Commercial Resource Assessments) of the Black & Veatch Final Report. This information shows that HELCO performed as thorough an assessment for coal technology as it did for other commercial resource options. Comparative economics of the options are indicated in the summary tables and discussed in detail in the Black & Veatch Final Report. Some additional discussion has been added to the Revised Final EIS, and reference has been made to the Black & Veatch report.

2-4b. HELCO's coal price estimates may be high. What is the impact on the economics of coal plants if lower fuel price estimates are used?

HELCO has considered the price estimates for coal in its IRP. On the basis of information contained in the Black & Veatch Final Report, international coal markets are subject to significant changes over time as existing reserves are depleted, new reserves come on-line, and new ports and shipping logistics are developed. Coal is a commodity and, while not as volatile in supply/demand and price fluctuations as petroleum and natural gas, it is still subject to swings in trading patterns and pricing. Coal is open to political influences that affect its availability and pricing, especially in developing countries such as Indonesia, China, Columbia, Venezuela, and Russia. It is highly likely that any coal-fired project developed in Hawaii will use many different coals from a broad array of sources (many of which are not currently commercialized) over its 30- to 40-year plant life.

Past analysis of long-term coal prices shows that they do not have the volatility and extreme price fluctuations experienced by crude oil. However, significant short-term volatility is apparent in ocean shipping rates, which appear to have much shorter price cycles than those for coal and crude oil. Because of the low cost of ocean shipping (given adequate size ships and port capability), the fluctuations in shipping rates do not have a significant impact on the volatility of the delivered price.

The delivered cost of coal depends on its source, heating value, and ash and sulfur content. The current market is characterized by very depressed ocean shipping rates (less than half of normal rates) and depressed mine prices due to excess production capacity.

Because of their low free onboard vessel and trimmed (FOBT) price and very low sulfur and ash contents, many of the Indonesian coals are likely to supply markets in Europe. As a result of the high cost of European mining operations and the European Community's (EC's) commitment to remove subsidies of these operations, the coal mining industries of Europe (Germany and the United Kingdom in particular) are forecast to undergo severe cutbacks by the year 2000. These cutbacks are also being promoted by the EC's equivalent of the U.S. Clean Air Act, which requires lower sulfur dioxide emissions from power plants. While some electric utilities in Europe are electing to install flue desulfurization systems, the majority will probably switch to imported low-sulfur coal. European power plants will be the primary market for low-sulfur coal producers in Columbia, Venezuela, Indonesia and, to a lesser extent (because of its higher mining prices), Australia, and will establish (on a net-back value basis against other fuels) the pricing structures for world coal trading.

Black & Veatch spent considerable effort evaluating the long-term price behavior of crude oil and coal. The Black & Veatch investigations included an analysis of FOB mine coal prices and FOB wellhead crude oil prices going back to 1859. The findings of these investigations show that both fuels exhibit cyclical price behavior with long-term cycles of about 20 years. The usual scenario is that, after a long-term low in fuel prices has been reached, oil prices begin a rapid rise, which is soon followed by a rise in coal prices. The typical low price in the cycle for crude oil and coal was found to vary little in the 100-plus-year period of analysis. The analysis shows that the long-term trends of gradually rising prices (2 to 5 percent per year in constant dollar terms) that are now being projected are the exception, particularly for crude oil. The primary long-term trend was the 20-plus-year decline in oil and coal prices that commenced in about 1950 and ended around 1970.

While current oil prices are relatively high on a historical basis, coal prices and domestic natural gas prices have been nearing their historical low levels. It is anticipated that the next cyclical low in coal and oil prices will occur in the mid- 1990s. When planning an overall fuels procurement strategy, it is important to bear in mind the price levels from which prices normally begin their major uptrends and downtrends. At the next peak in the fuel price cycle, which should occur in the early 2000s, current FOB mine coal prices could nearly double in constant dollar terms. Therefore, while coal prices may be at historical lows during the short-term horizon, HELCO anticipates they would be higher than present values in the long term.

2-4c. Isn't it feasible that uses could be found for wastes from a Big Island coal-fired facility?

The Barbers Point coal-fired plant located on Oahu has found a market for its wastes, and it is possible that markets could be found for the wastes from a coal-fired plant on the Island of Hawaii. Although reuse is possible, it was not a significant element in HELCO's decision making.

2-4d. HELCO states that new coal handling infrastructure would be needed for a coal-fired facility. Again, what are the overall comparative economics between oil-fired and coal-fired facilities? Without this analysis, we cannot substantiate how a resource/technology decision was reached. The above questions and comments [related to coal] should be addressed in the FEIS.

Again, there are many factors other than comparative economics that make coal an unreasonable alternative for providing the power needed by 1995. The ability to provide additional power in a timely way was a critical factor in the decision not to further consider coal. The issue is actually one of timing rather than of comparative economics. The selection of a coal-based technology would require the addition of coal handling facilities to either Kawaihae or Hilo Harbor, as well as coal storage areas near the harbor and at an end destination. Improvements or modifications to either of these two State-operated facilities would require compliance with the provisions of Chapter 343, Hawaii Revised Statutes. In addition, no funds are currently budgeted for such improvements, which would require legislative appropriations. Even if private funds were used for the harbor improvements, the EIS process would still need to be followed. This process could not be completed in time to order the generating equipment, have it manufactured and shipped, and complete the necessary construction of the harbor to meet the near-term need for electricity. Oil facilities currently in place at Hilo can be used; no expansion to these facilities would be necessary. Also, sufficient lands for a storage area do not exist at Keahole. Therefore, additional purchase of lands from the State would be required if coal were to be considered.

Because a coal-based technology could not meet the criterion of providing the necessary power in the required time frame, it was eliminated as a reasonable alternative and not evaluated further.

2-5. Retirement deferrals and expanded generation from existing IPPs would allow for the deferral of the project, or may even replace the project. Construction of the BESP along with T&D improvements would improve the flexibility and reliability of the overall system. These options should be more thoroughly analyzed and reported on in the FEIS. The issue of utility ownership should not deter full consideration of alternative resource options.

Deferring unit retirements is not desirable if new capacity cannot be placed on-line to allow the retirement to occur. A discussion regarding unit retirements has been included in the Alternatives section of the Revised Final EIS. Expansion of existing IPPs is only in the discussion stages. In fact, the Hamakua 10-MW contract will expire in 1994, after

Hamakua Sugar Company harvests its last field. HCPC's 18 MW is also questionable, as HCPC has indicated that it will end its sugar operations in 1994 but continue its electrical production to HELCO. HCPC is evaluating alternatives for fuel because bagasse would no longer be available after sugar operations are stopped. HCPC has indicated the possibility of increasing its output over 18 MW. PGV has also requested to provide HELCO with 15 MW of additional capacity.

Discussions are continuing with all existing IPPs, but it is not known whether any of the proposed increases can be achieved in time to replace HELCO's planned addition at Keahole in 1995. Studies are under way to determine what the interconnection requirements will be for each of the proposals. At this time, these discussions are not considered options to replace HELCO's 1995 unit addition. The status of each IPP is discussed in the Alternatives section of the Revised Draft EIS.

The BESP has been fully analyzed and was part of the IRP filing. The BESP will help to improve the power quality and reliability of the overall system, but it is not equivalent to a generation unit addition; this is because after the BESP is discharged, it will require a charging cycle, which requires power from existing generation sources.

Our response to the consideration of expanding transmission capacity between East and West Hawaii can be found in 1-6.

2-6. Does HELCO have any documentation to corroborate its statement regarding the uncertainty of HCPC's situation?

HCPC issued a press release in 1992 concerning its intent to cease sugar operations in late 1994, and to explore power production using alternative fuels. Since that time, HCPC has approached HELCO about amending its existing contract and/or entering into a new power purchase contract to cover post-sugar operations. However, as in any negotiation process, there is always a question as to whether HELCO and HCPC will be able to agree on terms and conditions acceptable to the PUC, which would allow HCPC to continue power production after 1994.

2-7. In planning DSM programs and projecting demand, HELCO should be factoring in the impacts of the Model Energy Code.

HELCO's consideration of the Model Energy Code was included in the response to your question 1-4.

2-8a. A more detailed analysis of available alternatives is necessary to support HELCO's conclusion that the oil-fired CT is the least-cost alternative.

As stated on page 4 of the CT-5 and ST-7 application filed February 26, 1993, in Docket 7623, the May 1991 Unit Type and Size Study addressed the selection of a combined-cycle unit to meet the long-term need for capacity. This study was attached as Exhibit III to HELCO's application filed July 29, 1991, in Docket No. 7048. The HELCO Integrated Resource Plan, filed October 15, 1993, further supports the installation of phased combined-cycle units as the most feasible method of meeting the Island of Hawaii's future needs.

2-8b. How does HELCO intend to address the risks and uncertainties in its timetable (in-service date of 1995)?

HELCO continues to pursue expeditious resolution of all issues, risks, and uncertainties that could affect the projected timetable. In addition, HELCO is pursuing an aggressive DSM program to lessen demand, continues to hold discussions with independent power producers, and continues to pursue the West Hawaii power facility at Puu Anahulu. If no other new generating sources become available as planned, HELCO will be forced to defer retirement of units to meet demand.

2-8c. Need to substantiate the statement that the project optimizes the benefits of existing utility infrastructure (Section 2.6).

The Keahole project optimizes existing utility infrastructure in several ways. The benefits of a West Hawaii site to improve system reliability and efficiency are explained in the May 1991 Unit Type and Size Study (under site selection), as well as in the August 1988 *West Hawaii Site Study* by CH2M HILL. Locating the project close to the load means less transmission line construction, lower transmission losses, improved voltage, and greater system reliability, as well as greater reliability for West Hawaii. Keahole has existing transmission facilities that allow additional generation to be connected to the system. Kawaihae, on the other hand, would require additional transmission lines that are not currently incorporated in HELCO's planning. Because the distances from Kawaihae to the population centers of Kailua-Kona are greater than from Keahole, transmission lines would experience a greater line loss from Kawaihae than from Keahole.

Installation of the combined-cycle unit at the existing Keahole facility also allows HELCO to optimize the use of existing plant infrastructure. For example, rather than building an entire new switchyard, only a switchyard extension is required. Access roads are already in place, and many of the existing and proposed plant systems will be interconnected to allow increased reliability and operating flexibility.

Section 3 — Environmental Setting, Impacts and Mitigation Measures

3-1. The EIS should review the merits of the Keahole and Waimana proposals with respect to water use.

The proposed Keahole expansion has not been designed to compete with the Waimana proposal, but rather to address an immediate generation need. The Waimana proposal is not developed in sufficient detail to permit a comparative evaluation. In addition, the Waimana proposal may change over time as it progresses through the permitting process.

3-2. Section 3.3.3 population projections should be viewed cautiously when applied to resource planning.

HELCO did not use the population projections of the Hawaii County General Plan contained in Section 3.3.3 in forecasting its electrical demand. A discussion of HELCO's forecasting methodology was developed to answer your question 1-4.

3-3. The stack will be a significant adverse visual impact. HELCO should acknowledge the reality of the impact in the final EIS.

The perceived inconsistencies in statements about the nature of visual resource impacts in the Revised Draft EIS have been corrected in the Revised Final EIS. Visual impacts are expected to be adverse, but not significant. This is because the unit addition would not alter the dominance of the Keahole facility within the viewsheds analyzed. As discussed in Section 3.3.4 in the Revised Draft EIS, the existing facility is characterized as being codominant from two viewpoints, subordinate from one viewpoint, and dominant from two viewpoints. Dominant, codominant, and subordinate are defined as follows:

- Dominant — The viewer's attention will be focused on the facility.
- Codominant — The viewer's attention will be divided among other features in the landscape of equal interest to the viewer.
- Subordinate — The facility will constitute a minor component of the landscape. The viewer will not be aware of the presence of the facility unless specifically looking for the facility.

The analysis of visual impacts concluded that the dominance of the facility with the proposed unit addition would not change significantly over existing conditions. If the proposed facility's dominance were expected to increase from subordinate to codominant or dominant, or from codominant to dominant, a determination that the impact would be significant would have been made.

Section 4 — Public Plans and Policies

4-1. Disagree with statement on p. 4-3 that the project conforms with State's energy objectives and policies. HELCO should explain how the project supports the objective of energy self-sufficiency or, alternatively, acknowledge that this is not the case.

The Hawaii State Plan's purpose is to serve as a guide for the future long-range development of the State. It identifies overall goals and objectives to help establish priorities and allocate resources. Because the document deals broadly with topics, it contains objectives and policies that can be both complementary and/or contradictory. The objectives of the State Energy Functional Plan tend to be complementary for renewable resources and, to a lesser extent, coal and inherently contradictory for oil-based technologies.

In the case of the latter, one such contradiction can be seen in Section 226-18 on Objectives and Policies for facility systems—energy/telecommunications. While objective (2) states that planning shall be directed toward "increased energy self-sufficiency," policy (c)(2) states that it shall be the policy of the State to "ensure a sufficient supply of energy to enable power systems to support the demands of growth."

HELCO has identified an energy deficiency that will occur within the near term and is moving to meet the policy statement under 226-18(c)(2). After examining alternatives (including coal, non-firm renewable energy sources such as wind or hydro power, and increased DSM programs), HELCO determined that the expansion of the present Keahole Generating Station was the only reasonable alternative to meet its PUC obligations of providing high-quality, reliable service at the least cost to the customer within the necessary time frame.

HELCO acknowledges that, in making this decision to expand with an additional oil-fired unit, it is contradicting the objective of energy self-sufficiency. However, as the project comes on-line it will be possible to retire less fuel efficient units, and the overall ratio of fuel consumption to megawatts produced should improve. In addition, HELCO continues to pursue long-term conservation measures and alternative fuel sources that will lessen the dependency on imported fossil fuels.

Section 5 — Short- and Long-Term Resource Commitments

5-1. Stack will have an adverse visual impact.

As stated in the answer to your question 3-3, HELCO does not believe that the proposed stack will have a significant adverse visual impact.

5-2. Despite earlier response, still think the project will result in an irreversible and irretrievable dependence on petroleum. This should be acknowledged in the FEIS. What is HELCO's long-term commitment with respect to fuel choice issues?

HELCO acknowledges that, in making this decision to expand with an additional oil-fired unit, it is continuing a dependence on petroleum. The decision to continue the use of fuel oil, rather than other fuel sources, was based on the economics of providing the required power in the necessary time frame. However, the addition of the unit, which will allow the retirement of older, less fuel efficient units, will lower HELCO's use of fuel oil for power generation on a per-megawatt basis.

HELCO also remains committed to the development of feasible, cost-effective alternative fuels and power sources and increased conservation measures to lessen the dependency on imported fossil fuels. This discussion has been added to Section 5 of the Revised Final EIS.

Finally, we would note that the basis for your reference to "long-term" is PUC's IRP framework. While this is an appropriate basis for the IRP framework, it is not the basis used to define "irreversible and irretrievable" for the purpose of an EIS. In short, the IRP process and the EIS process use different definitions of the time frames that apply in this instance.

Volume 2, Section 9, Public Involvement Programs

Despite earlier response, still think that the ratepayer bears the risk associated with oil price and supply volatility. This should be acknowledged in the FEIS.

Ultimately, the ratepayer bears the costs and risks associated with the purchase and supply of any energy resource, be it oil, coal, bagasse, etc. However, rate increases must be approved by the PUC, and this is generally a lengthy process that does not allow for instant adjustments due to increases or decreases in the spot-oil market. This has been acknowledged in Section 1 of the Revised Final EIS.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

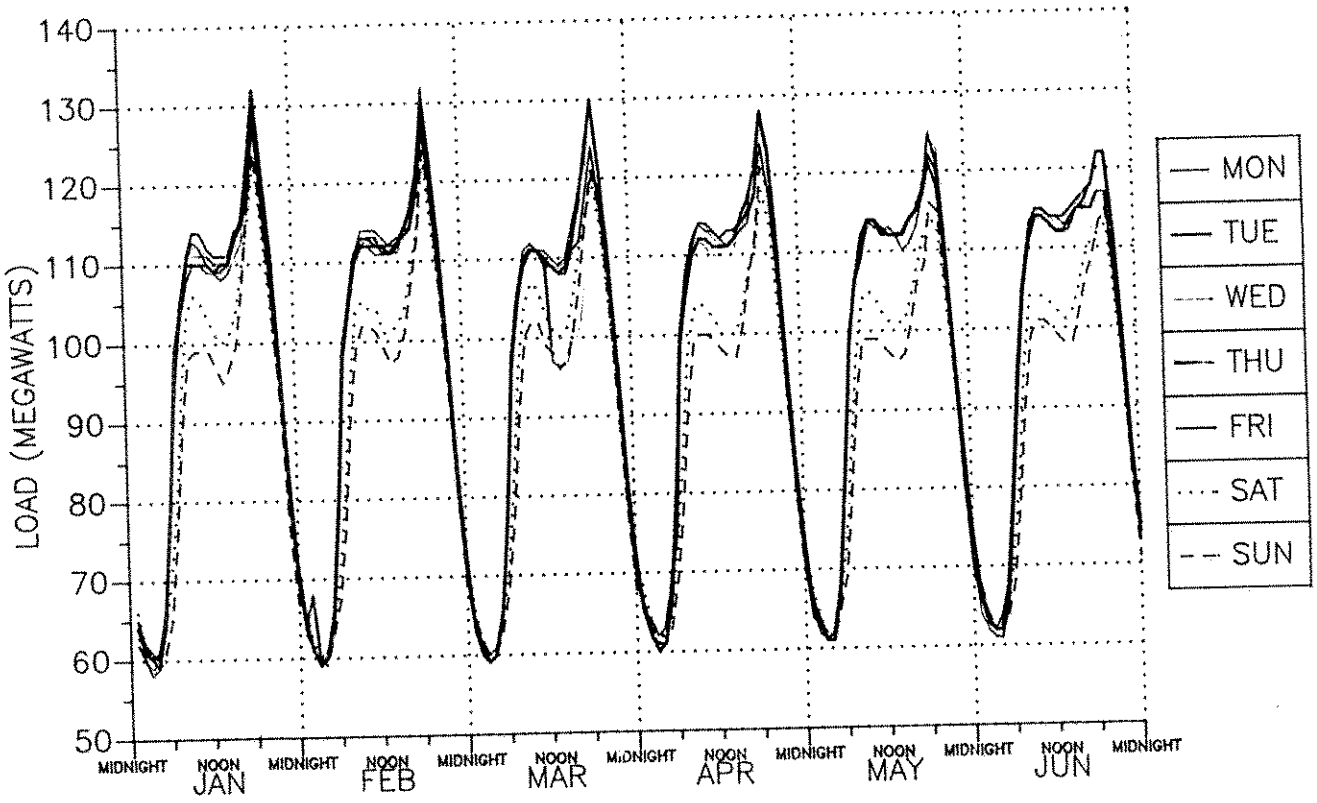
Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89a\015.51

HELCO 1991 RECORDED AVERAGE HOURLY PROFILE
(JAN–JUN)



November 27, 1992

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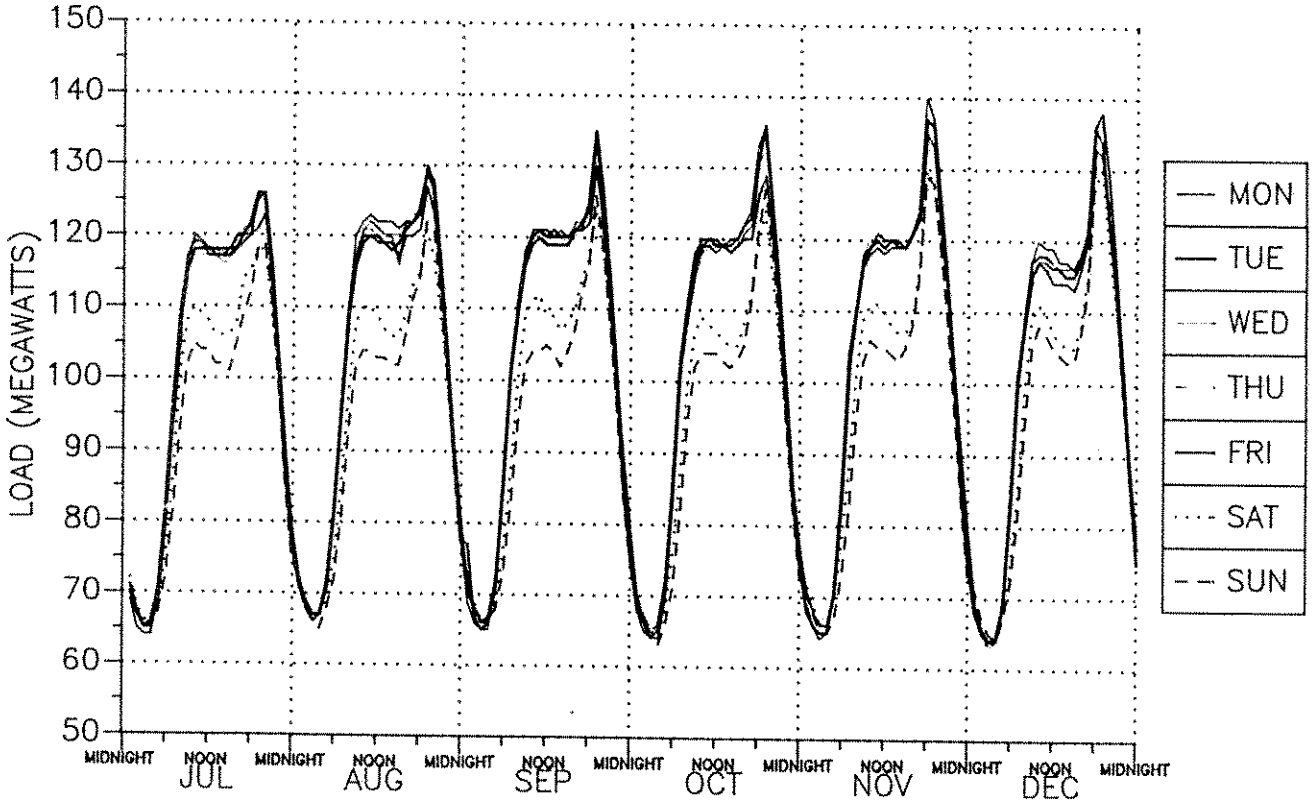
HELCO 1991 RECORDED AVERAGE HOURLY PROFILE
(JUL–DEC)



November 27, 1992

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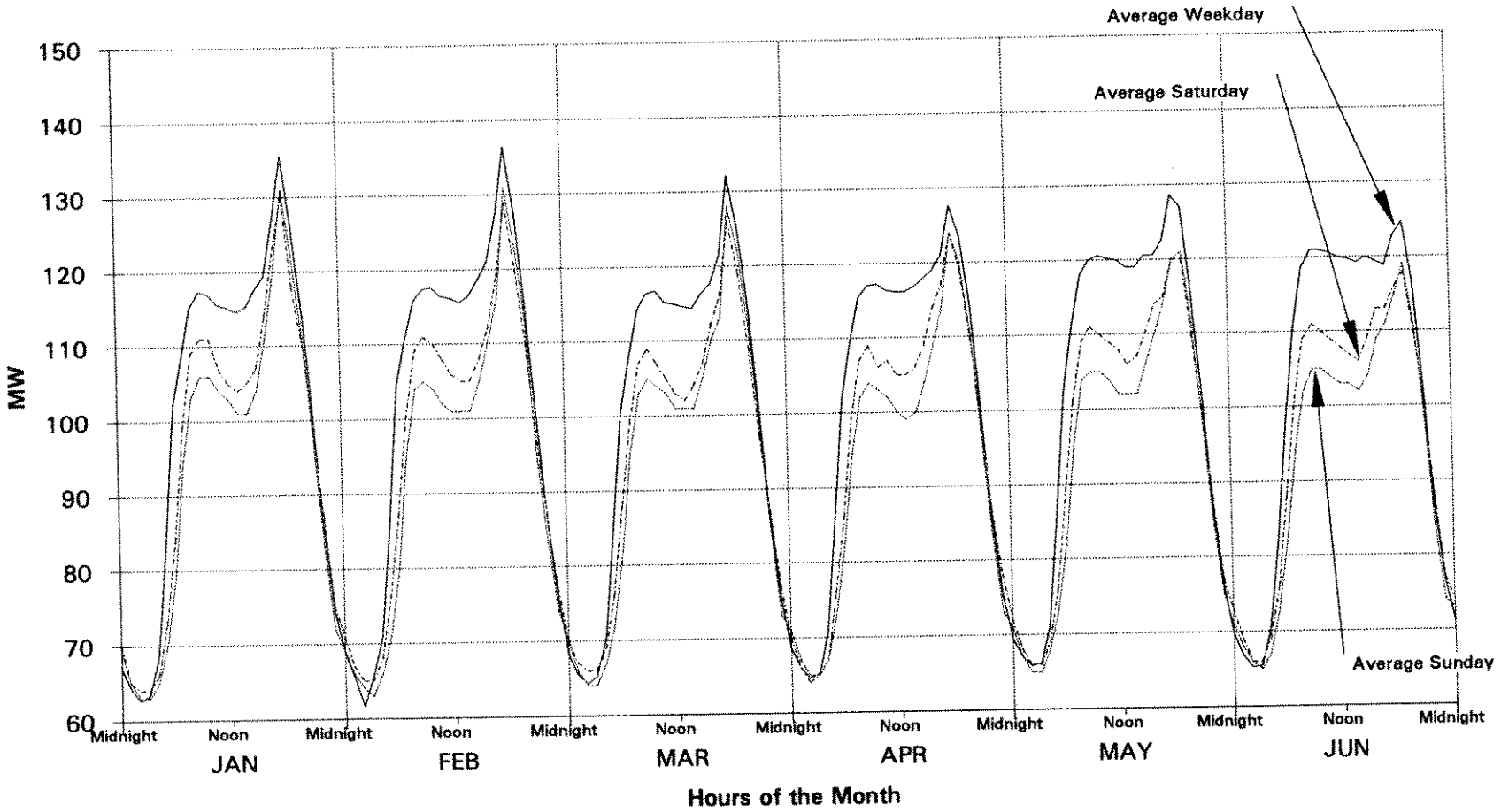
PRODUCED BY GDDM-CSPF

1992 HELCO Hourly Average of the Daily Load Profile
(Jan to Jun)



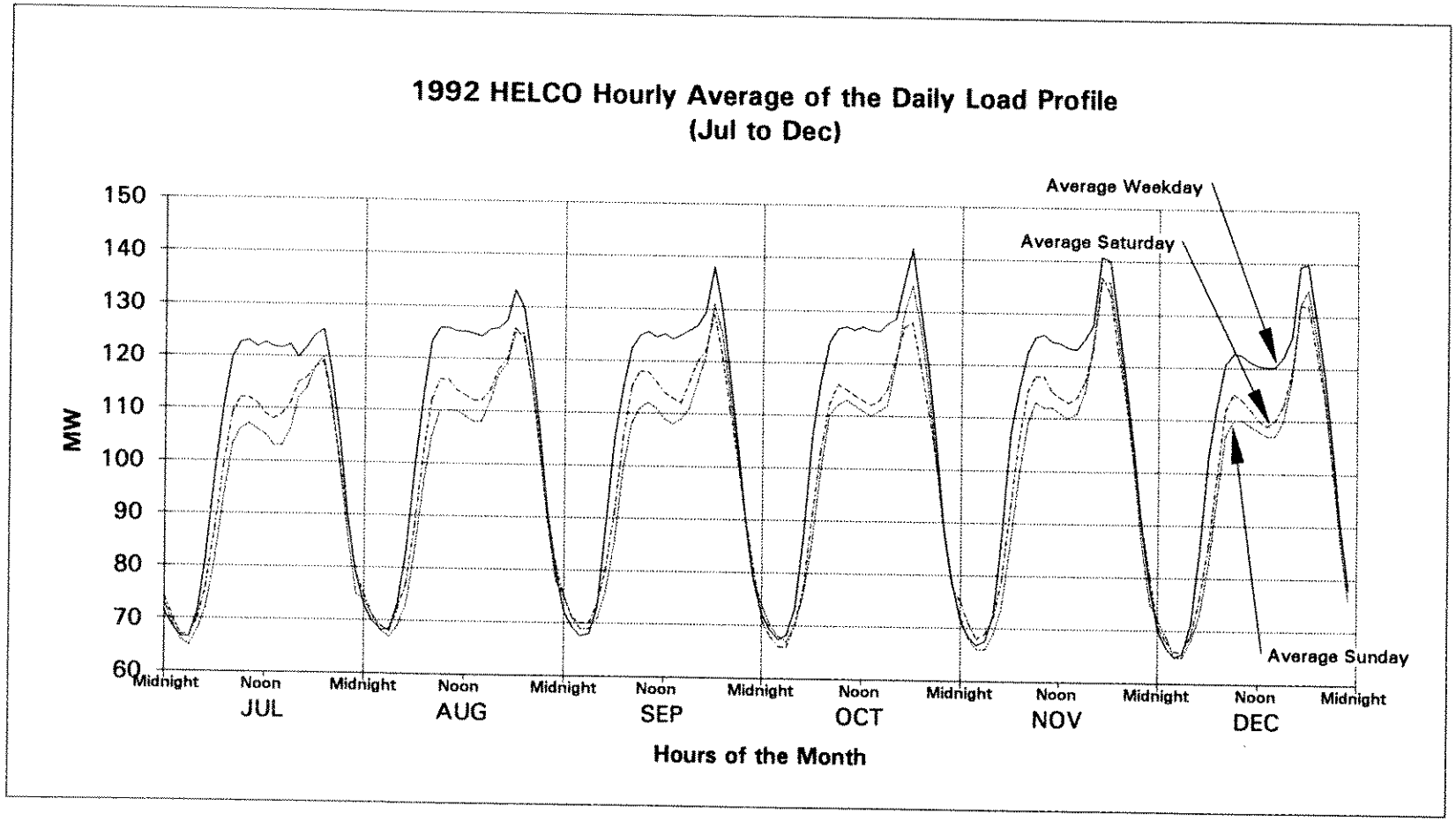

1992 HELCO Hourly Average of the Daily Load Profile
(Jul to Dec)
MW
150
140
130
120
110
100
90
80
70
60
Average Weekday
Average Saturday
Average Sunday
Midnight
Noon
JUL
AUG
SEP
OCT
NOV
DEC
Hours of the Month

Table 1
Commercial Resource Technical Performance and Availability Comparison Summary

Commercial Resource Options	Capacity and Heat Rate[a]				Operating Data			Availability	
	Gross Capacity MW	Auxiliary Power MW	Net Capacity MW	Net Heat Rate Btu/kWh	Annual Production GWh	Duty Cycle	Capacity Factor percent	Outage Rate[b] percent	Equivalent Availability percent
Pulverized Coal[c]									
1 x 30 MW	34.2	4.2	30.0	12,360	171	Baseload	65	6	84
Atmospheric Fluidized Bed Combustion[e]									
2 x 15 MW	35.0	5.0	30.0	13,100	171	Baseload	65	6	84
1 x 30 MW	35.0	5.0	30.0	12,780	171	Baseload	65	6	84
Oil-fired Combustion Turbine[d,e]									
Phase I 1 x 22.0 MW	22.2	0.2	22.0	11,690	102	Intermediate	53	6	85
Phase II 2 x 22.0 MW	44.4	0.4	44.0	11,690	204	Intermediate	53	6	85
Phase III 64.2 MW	65.8	1.6	64.2	8,020	366	Baseload	65	7	84
Oil-fired Combustion Turbine[d,f]									
Phase I 1 x 22.4 MW	22.7	0.2	22.5	10,690	104	Intermediate	53	5	86
Phase II 2 x 22.4 MW	45.4	0.5	44.9	10,690	208	Intermediate	53	5	86
Phase III 62.7 MW	64.3	1.6	62.7	7,660	357	Baseload	65	6	85
Oil-fired Steam[d]									
2 x 15 MW	33.4	3.4	30.0	12,650	171	Baseload[h]	65	6	86
1 x 30 MW	33.4	3.4	30.0	12,350	171	Baseload[h]	65	6	86
Diesel Engine Generator[d]									
1 x 15.2 MW	15.4	0.2	15.2	8,520	86.5	Baseload[h]	65	3	88
1 x 26.6 MW	26.9	0.3	26.6	8,520	152	Baseload[h]	65	3	88
Biomass Combustion[g]									
1 x 30 MW	33.0	3.0	30.0	17,630	171	Baseload	65	9	80
Geothermal Power									
1 x 25 MW	28.5	3.5	25.0	24,000	142	Baseload	65	N/A[i]	92
Oil-fired Simple Cycle[d]									
1 x 22.0 MW Industrial Frame	22.2	0.2	22.0	11,690	9.6	Peaking	5	6	85
1 x 22.4 MW Aero-derivative	22.7	0.2	22.5	10,690	9.9	Peaking	5	5	86
Wind Energy Conversion									
20 x 500 kW	10.2	0.2	10	--	21.9	Supplemental	25	5	95
Small Scale Photovoltaic									
0.5 kW (with 700 Ah battery)	0.0006	0.0001	0.0005	--	0.001	Distributed	25	N/A	N/A
Battery Energy Storage									
10 MW: 15 MWh	N/A	N/A	10	--	5.3[j]	Storage	[j]	N/A	95

Notes:
- [a] Based on reserve rating. For steam units, reserve rating is at valves wide open and 5 percent overpressure.
- [b] Mature forced outage rate.
- [c] Fuel is bituminous coal.
- [d] Fuel is No. 2 diesel fuel oil.
- [e] Industrial frame combustion turbine.
- [f] Aero-derivative combustion turbine.
- [g] Fuel is banagrass.
- [h] These resource options are also suitable for an intermediate/cycling operation mode.
- [i] N/A = Not available.
- [j] Based on providing 15 MWh daily to the system at 10 MW capacity.

Table 2
Commercial Resource Cost, Schedule and Resource Requirement Comparison Summary

Commercial Resource Options	Date of Available Service[a]	Service Life years	Cost, 1/93$						Resource Requirement[b]				
			Total Capital		Fixed O&M		Variable O&M		Land Requt. acres	Fuel tpd/ bpd	SO_2 Control Additive[c] tpd	Plant Water mgd	CT Makeup Water[d] mgd
			$ million	$/kW	$/week	$/kW-y	$/h-run	$/MWh					
Pulverized Coal[e]													
1 x 30 MW	1997	30	119.1	3,970	127,500	221	81.0	2.70	6.0	348	9.6	0.2	2.4
Atmospheric Fluidized Bed Combustion[e]													
2 x 15 MW	1997	30	143.4	4,781	189,800	329	139	4.64	6.5	368	35.8	0.2	2.4
1 x 30 MW	1997	30	125.9	4,197	116,500	202	136	4.54	6.0	359	34.4	0.2	2.4
Oil-fired Combustion Turbine[f,g]													
Phase I 1 x 22.0 MW	1996	30	37.7	1,714	48,300	114	29.3	1.33	2.5	1,054	--	0.18	--
Phase II 2 x 22.0 MW	1997	30	58.0	1,318	81,100	95.9	58.6	1.33	3.5	2,105	--	0.36	--
Phase III 64.2 MW	1997	30	86.4	1,346	103,200	83.6	59.7	0.93	5.0	2,109	--	0.40	4.1
Oil-fired Combustion Turbine[f,h]													
Phase I 1 x 22.4 MW	1996	30	40.1	1,788	52,300	121	29.3	1.31	2.5	979	--	0.18	--
Phase II 2 x 22.4 MW	1997	30	62.3	1,390	89,100	103	58.6	1.31	3.5	1,966	--	0.36	--
Phase III 62.7 MW	1997	30	89.1	1,421	111,000	92.1	59.7	0.95	5.0	1,966	--	0.40	3.9
Oil-fired Steam[f]													
2 x 15 MW	1996	35	78.9	2,631	104,300	181	24.8	0.83	4.0	1,556	--	0.16	2.4
1 x 30 MW	1997	35	67.6	2,255	61,300	106	23.6	0.79	3.5	1,519	--	0.16	2.4
Diesel Engine Generator[f]													
1 x 15.2 MW	1997	30	30.1	1,981	32,500	111	39.5	2.60	1.5	532	--	.004	--
1 x 26.6 MW	1997	30	43.7	1,643	36,900	72:2	69.2	2.60	2.0	930	--	.004	--
Biomass Combustion[i]													
1 x 30 MW	1998	30	70.1 to 102.3	2,335 to 3,410	27,100 to 58,200	47 101	93 to 201	3.1 6.7	10	774	--	0.2	2.4
Geothermal Power													
1 x 25 MW	1997	30	80.0 to 123.0	3,200 to 4,920	41,800	87	175	7.0	20	--	N/A[j]	N/A	N/A
Oil-fired Simple Cycle[f]													
1 x 22.0 MW Industrial Frame	1996	30	30.5	1,388	48,200	114	29.3	1.33	2.0	1,054	--	0.18	--
1 x 22.4 MW Aero-derivative	1996	30	32.6	1,457	52,200	121	29.3	1.31	2.0	979	--	0.18	--
Wind Energy Conversion													
20 x 500 kW	1995	30	13.9	1,390	2,000	10.4	91	9.1	60	--	--	--	--
Small Scale Photovoltaic													
0.5 kW (with 700 Ah battery)	1994	20	0.0087 to 0.0125	17,400 to 25,000	10	1,040	0	0	0.01	--	--	--	--
Battery Energy Storage													
10 MW: 15 MWh	1994	20	11.8	1,179	1,711	8.9	0	0	0.7	--	--	--	--

Notes:

[a] Date that technology would be available for operation if licensing started in 1993.
[b] Based on 24 hour operation at reserve rating.
[c] Additive for control of sulfur dioxide emissions. Additive is lime for PC units and limestone for AFBC units.
[d] Saltwater cooling tower (CT) makeup water.
[e] Fuel is bituminous coal.
[f] Fuel is No. 2 diesel fuel oil.
[g] Industrial frame combustion turbine.
[h] Aero-derivative combustion turbine.
[i] Fuel is banagrass.
N/A = Not available.

Table 3
Commercial Resource Environmental Comparison Summary

Commercial Resource Options	Flue Gas Emissions[a], lb/MWh						Waste Streams[b]		
	NO_x	SO_x	CO_2	CO	VOC	PM	Solid tpd	Water mgd	Thermal MBtu/d
Pulverized Coal[c]									
1 x 30 MW	3.7	2.0	2,300	1.9	0.25	0.19	61.5	2.0	216
Atmospheric Fluidized Bed Combustion[c]									
2 x 15 MW	1.4	2.1	2,440	2.6	0.26	0.20	77.4	2.0	216
1 x 30 MW	1.4	2.0	2,380	2.6	0.26	0.19	74.6	2.0	216
Oil-fired Combustion Turbine[d,e]									
Phase I 1 x 22.0 MW	1.9	4.8	1,870	1.9	0.11	0.082	--	0.14	13
Phase II 2 x 22.0 MW	1.9	4.8	1,870	1.9	0.12	0.082	--	0.28	26
Phase III 64.2 MW	1.3	3.3	1,280	1.3	0.07	0.056	--	3.7	400
Oil-fired Combustion Turbine[d,f]									
Phase I 1 x 22.4 MW	1.7	4.4	1,710	0.64	0.11	0.075	--	0.14	13
Phase II 2 x 22.4 MW	1.7	4.4	1,710	0.64	0.11	0.075	--	0.28	26
Phase III 62.7 MW	1.2	3.1	1,230	0.46	0.08	0.054	--	3.5	378
Oil-fired Steam[d]									
2 x 15 MW	2.5	5.2	2,020	2.4	0.51	0.089	--	2.0	216
1 x 30 MW	2.5	5.1	1,980	2.3	0.49	0.086	--	2.0	216
Diesel Engine Generator[d]									
1 x 15.2 MW	21.6	3.6	1,410	1.6	0.75	0.062	--	0.004	3
1 x 26.6 MW	21.6	3.6	1,410	1.6	0.75	0.062	--	0.004	3
Biomass Combustion[g]									
1 x 30 MW	1.4	1.8	3,900	1.2	1.8	0.26	25.8	2.0	216
Geothermal Power[h]									
1 x 25 MW	--	--	--	--	--	--	--	N/A[i]	N/A
Oil-fired Simple Cycle[d]									
1 x 22.0 MW Industrial Frame	1.9	4.8	1,870	1.9	0.11	0.082	--	0.14	13
1 x 22.4 MW Aero-derivative	1.7	4.4	1,710	0.64	0.11	0.075	--	0.14	13
Wind Energy Conversion									
20 x 500 kW	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Small Scale Photovoltaic									
0.5 kW (with 700 Ah battery)	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--
Battery Energy Storage[j]									
10 MW: 15 MWh	1.6	4.0	1,570	0.59	0.10	0.069	--	--	--

Notes:

a. NO_x = oxides of nitrogen, SO_x = oxides of sulfur, CO_2 = carbon dioxide, CO = carbon monoxide, VOC = volatile organic compounds, and PM = particulate matter.
b. Based on 24 hour operation at reserve rating.
c. Fuel is bituminous coal.
d. Fuel is No. 2 diesel fuel oil.
e. Industrial frame combustion turbine.
f. Aero-derivative combustion turbine.
g. Fuel is banagrass.
h. The following emissions in tons per year are based on composite Puna geothermal reservoir fluid samples: 0.33 tpy NO_x, 0.03 tpy H_2S, 0.63 tpy CO_2, 0.08 tpy CO, 4.25 tpy C_3H_{12}, and 0.20 tpy TSP.
i. N/A = Not Available.
j. Emissions are based on those of No. 2 diesel fuel oil fired combined cycle unit, but assuming a 78 percent cycle efficiency for BESS operation.

Table 4
Commercial Resource Qualitative Evaluation Comparison Summary[a,b]

Commercial Resource Options	PC	AFBC	CC	Oil-Steam	DEG	GEO	SC	WEC	PV	BESS
Technical Flexibility	+1	+1	+2	0	+2	0	+2	-1	+1	+1
Fuel Diversity	+1	+1	-2	-2	-2	+1	-2	+2	+2	+1
System Compatibility	+1	+1	+2	+1	+2	+1	+2	0	+2	+2
Public Safety	0	0	-1	-1	-1	-1	-1	0	0	0
Noise Impact	0	0	0	0	0	0	0	0	0	0
Traffic Impact	-1	-1	-1	-1	-1	0	-1	0	0	0
Cultural/Archaeological	-1	-1	-1	-1	-1	-2	-1	-1	-1	0
Land Use Compatibility	-1	-1	-1	-1	-1	-1	-1	0	-1	0
Socioeconomic Impacts	0	0	0	0	0	0	0	+1	+1	0
Secondary Economic Benefits	+2	+2	+2	+2	+2	+2	+1	+1	+1	0
Botanical/Terrestrial	-1	-1	-1	-1	-1	-1	-1	0	0	0
Aquatic	0	0	-1	-1	-1	0	-1	0	0	0
Aesthetics	-2	-2	-2	-2	-1	0	-1	-2	-1	0
Natural Disaster	-1	-1	-1	-1	-1	-2	-1	-1	-1	-1

Notes:

[a] Negative scores indicate detrimental impacts, positive scores indicate favorable impacts, zero scores indicate little or no impact.

[b] PC = pulverized coal, AFBC = atmospheric fluidized bed combustion, CC = No. 2 diesel fuel oil-fired combined cycle, Oil-Steam = No. 2 diesel fuel oil-fired steam, DEG = diesel engine generator, GEO = geothermal power, SC = No. 2 diesel oil-fired simple cycle, WEC = wind energy conversion, PV = small scale photovoltaics, BESS = battery energy storage system.

JOHN WAIHEE
Governor

YUKIO KITAGAWA
Chairperson, Board of Agriculture

LIMA A. PIIANAIA
Deputy to the Chairperson

FAX: (808) 973-9613

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

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96823-2159

October 7, 1993

TO: Keith Ahue, Chairperson
Board of Land and Natural Resources

ATTN: Don Horiuchi

FROM: Yukio Kitagawa, Chairperson
Board of Agriculture

SUBJECT: Revised Draft Environmental Impact Statement (DEIS) for Keahole Generating Station Expansion
TMK: 7-3-49:36 Keahole, Hawaii
Area: 14.998 Acres

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

The revised DEIS has adequately addressed our concerns regarding the impacts of stack emissions and noise. However, we are aware of the many unresolved concerns expressed by our Keahole agricultural park lessees (letter of July 16. 1993). We would like to see these concerns satisfactory addressed in the Final EIS.

Thank you for the opportunity to comment.

c: Office of Environmental Quality Control
Hawaii Electric Light Company, Inc.
Attn: Clyde Nagata
CH2M Hill
Attn: Al Lono Lyman
Peggy Ratliff

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Yukio Kitagawa, Chairperson,
Board of Agriculture
Department of Agriculture
1428 S. King Street
Honolulu, HI 96814

Dear Mr. Kitagawa:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our response to your comment follows.

We would like to see the many unresolved concerns of Agricultural Park lessees addressed in the Final EIS.

HELCO has continued to meet with Agricultural Park lessees throughout the EIS process to identify concerns and to respond to these concerns in a meaningful way. All of the issues raised by lessees have been addressed directly in written correspondence, which is included in the Revised Final EIS. Several of the concerns raised by lessees have resulted in additional studies to gather the information required to resolve the concerns in a technically responsible way. Studies of noise impacts, property value impacts, and traffic safety were among those conducted. In all cases, either the study showed that no impact is expected or the project was redesigned to mitigate an identified impact. These studies were included in the Revised Draft EIS.

Air quality has been a continued concern for some Agricultural Park lessees. In several meetings with residents, HELCO was able to clarify this general concern into specific questions related to sulfur dioxide, nitrogen oxides, ethylene emissions, and acid aerosols. In response to this concern, specific studies on each of these topics were commissioned, some involving onsite monitoring. HELCO will continue to hold discussions with you and residents of the Agricultural Park as necessary to clarify the results of these studies. The results of these studies are provided in Section 9 of the Revised Final EIS.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

Honolulu Office
HNL89a\018.51

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University of Hawaii at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawaii 96822
Telephone: (808) 956-7361

October 7, 1993
RE:0635

Mr. Don Horiuchi
Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Dear Mr. Horiuchi:

Revised Draft Environmental Impact Statement (EIS)
Keahole Generating Station Expansion
North Kona, Hawaii

The Hawaii Electric Light Company, Inc. (HELCO) proposes a unit addition at the Keahole Generating Station in North Kona on the Island of Hawaii. The generating station is located approximately one mile mauka of Keahole Airport and 750 feet mauka of the Queen Kaahumanu Highway. The purpose of the proposed project is to provide additional power generation capacity on the west side of Hawaii to allow for the scheduled retirement of older generating units. The proposed generating plant area has a control house, two switchgears, six 2.75 megawatts (MW) diesel engine generators, one 13.75 MW combustion turbine generator and two fuel oil storage tanks. The switching station area has a switchyard, three transformers, and a cesspool. Up to 56 MW of power generating capacity would be added to the Keahole Generating Station and would be brought on line in three phases.

The original DEIS for the Keahole Expansion Project was submitted in December 1992, while the FEIS was submitted for review in June 1993. The FEIS for the proposed project was rejected due to recent proposals to build other power facilities in West Hawaii that were not considered in the original Keahole Expansion Project documents. Consequently, the Revised DEIS includes a discussion of the proposed expansion at Keahole and its relationship to the other proposed power projects at Kawaihae and Puu Anahulu, North Kona, Hawaii.

An Equal Opportunity/Affirmative Action Institution

The Environmental Center has reviewed the Revised DEIS with the assistance of Paul Ekern (Emeritus), Agronomy and Soil Science; Yu-Si Fok and Henry Gee, Water Resources Research Center; and Andrew Tomlinson of the Environmental Center.

General Comments

In general, the Revised DEIS for the proposed expansion of the Keahole Generating Station does not meet the content requirements of a draft EIS as prescribed in Title 11-200-17, Department of Health Administrative Rules (HAR). Firstly, while the original draft EIS included numerous appendices and studies concerning the existing environmental conditions and the potential environmental impacts of the proposed project, the Revised DEIS omits many important sections including studies on soils, hydrology, and archaeology, etc. Despite their omission the revised document relies heavily on the content of these appendices to render its conclusions in the revised draft. The Revised FEIS should include all the related studies and appendices on which the document relies to support its conclusions as prescribed by Chapter 343, Hawaii Revised Statutes (HRS), and Title 11-200-18, HAR. Secondly, the document does not adequately describe the existing environmental conditions of the area and the potential significant environmental impacts of the proposed project on water resources and air quality.

Water Resources

The discussion of the existing environmental conditions and the potential impacts to water resources from the proposed project are incomplete and need to be expanded. The document mentions that water will be obtained from the county system as well as from a brackish well due to the inability of the county to provide for all the proposed expansion's water requirements. However, the document fails to outline the County of Hawaii's water budget and how the proposed expansion will affect its balance. What is the County of Hawaii's water budget and how will the proposed expansion affect it in the future?

The document also does not pinpoint the locations of the brackish well and the injection well or mention the sustainable yield of the Keauhou aquifer. What is the aquifer's sustainable yield and how will the proposed project affect it? Where will the wells be located? Moreover, the water quality of the wells at the depths to be utilized is unknown according to the Revised DEIS, but is assumed to be saline. While this appears to be a logical conclusion, it is important that baseline data be established prior to operation of the expansion project so that the affects of the project can be determined in future monitoring programs. Furthermore, the Natural Energy Laboratories of Hawaii (NELH) and the existing Keahole Generating Station could have altered the characteristics of the water resources in the area during their years of operation. The Revised FEIS should include all the information related to existing water resources of the area.

Furthermore, how will the injection of wastewater containing nonspecific quantities of oil, acids, phosphates, ammonia, and other various caustics affect coastal water quality? The document states that wastewater will be dispersed and have no significant impact on the groundwater quality and marine environment, but fails to describe the conditions existing in the area. What are the characteristics of the existing marine environment surrounding the proposed project area including oceanographic conditions, biological resources, etc., and how will these be effected by the proposed wastewater injection?

Septic System, Domestic Wastewater Treatment

The document also states that a septic system and domestic wastewater treatment facility would be established, yet very little information is provided as to the location, size, and type of facilities to be established and the soil conditions at the site. The document merely states that information concerning the facilities and soil and site conditions will be evaluated (p. 3-22). The document does not include the percolation tests planned as part of the geotechnical investigation and it is thus difficult to assess the potential environmental impacts of the proposed systems and determine any necessary mitigative measures. This information should be included in the Final EIS as prescribed by Title 11-200-17, HAR.

Moreover, the document states that the domestic treatment facility will conform to Department of Health rules. However, the intent of Chapter 343, Hawaii Revised Statutes(HRS), and Title 11-200, HAR is to provide for disclosure of information for public review. Clearly, the reliance on future permitting processes does not lend to the public review of this phase of the proposed project. The Revised FEIS should include a description of the treatment facility including its capacity and its potential specific as well as cumulative impacts to the environment.

Air Quality

While the document models the dispersion of stack emissions from the proposed 104 foot stack, it does not identify the possible impact of the prevailing sea-breeze at the project site. This sea-breeze could potentially hinder the dispersal of the plume and retain it over the local area. What are the possible impacts of the diurnal sea-breeze on the dispersal of the plume, and how could the maintenance of the plume over the area affect local air quality conditions? In addition, what are the post-construction monitoring procedures for the proposed project?

Conclusion

As a result of the incomplete nature of the Revised DEIS it is difficult to make a determination of the potential environmental impacts and any necessary mitigating measures. The Revised FEIS should include an expanded discussion of the existing

environmental conditions as well as the specific information related to wastewater treatment and injection. Furthermore, all the pertinent information and appendices from the original Draft and Final EIS should be included as part of the Revised FEIS.

Thank you for the opportunity to review the document. We hope our comment will be helpful in the writing of the final document.

Sincerely,

Jacquelin N. Miller

Jacquelin N. Miller
Associate Environmental Coordinator

cc: OEQC
Hawaii Electric Light Co., Inc.
CH2m Hill ✓
Roger Fujioka
Yu-Si Fok
Henry Gee
Paul Ekern
Andrew Tomlinson

Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Jacquelin N. Miller, Associate Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
Crawford 317, 2550 Campus Road
Honolulu, HI 96822

Dear Ms. Miller:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

EIS does not meet the content requirements of Title 11-200-17 because technical appendices were omitted.

The Office of Environmental Quality Control (OEQC) indicates that the procedures followed by CH2M HILL in distribution of the Revised Draft EIS were in accordance with the public access requirements for an EIS. Attached is a copy of the letter from OEQC on this issue.

What is the County's water budget and how will the project affect it in the future?

HELCO is not qualified to address how its project affects the County's water budget. The County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and has indicated that it will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

The Revised Draft EIS and Appendices C and D of the Draft EIS Volume II (December 1992) include a discussion of the underlying groundwater and aquifer and the impacts that the project may have.

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Where will the brackish and injection wells be located?

The locations of the supply and injection wells are indicated in the Revised Final EIS, Volume I, Section 1.5: Figures 1-5, 1-6, and 1-7. A copy of these figures is attached.

What is the sustainable yield of the Keauhou aquifer and how will the project affect it?

The estimated sustainable yield of the Keauhou aquifer is 38 million gallons per day, as stated on page 3-17 of the Revised Draft EIS, Volume I. The potential impacts to groundwater levels are expected to be minimal within 600 feet of the supply well, and unmeasurable beyond 600 feet of the pumping well. Impacts on groundwater resources are more thoroughly described on pages 3-23 to 3-27 of the Revised Draft EIS.

Baseline water quality data for aquifer at depths to be utilized should be established prior to operation so that effects of the project can be determined in future monitoring programs.

Baseline water quality data will be established as the wells are developed. This is consistent with Department of Health (DOH) permitting procedures.

NELH and existing generating station could have altered the characteristics of the water resources quality during their years of operation. The Final EIS should include all information related to existing water resources of the area.

Extensive studies based on existing data were evaluated and are detailed in Appendices C and D of the Draft EIS, Volume II (December 1992) and summarized in the Revised Draft EIS, Volume I, Section 3.1.4. There is no evidence to support your statement that NELH and the existing power plant have altered groundwater quality through their operations. No additional modifications to the EIS are required.

How will wastewater injection affect coastal water quality? The DEIS says "no impact" but fails to describe the conditions existing in the area. What are the characteristics of the existing marine environment (oceanographic conditions, biological resources, etc.) and how will these be affected by the proposed injection?

The potential impacts to coastal hydrology and the marine environment have been described in Appendices C and D of the Draft EIS, Volume II, and summarized in the Revised Draft EIS, Volume I, Section 3.1.4. In addition, four EISs completed for the Natural Energy Laboratory Authority of Hawaii (NELHA) at Keahole Point were reviewed for information about the existing marine environment and oceanographic conditions in the vicinity of Keahole Point. These documents report that the marine environment off Keahole Point is exceptionally diverse. The surface waters also support a low crop of phytoplankton. A cluster of seven small anchialine ponds lies adjacent to the NELHA access road. These ponds are reported to have opae'ula (*Halocaridina rubra*) and small, unidentified red amphipods. One of the ponds also has opae'o'haa (*Macrobrachium grandimanus*). This species is the most abundant of the seven types of shrimp found in Hawaiian anchialine ponds, and they are extremely hardy animals. In terms of rare, threatened, endangered,

and protected species, the endangered humpback whale (*Megaptera novaengliae*) is seasonally present in the area, and a number of dolphin species are common. In addition, the threatened green sea turtle (*Chelonia mydas*) is occasionally observed in the area. However, the nearest important resident area of green turtles to the Keahole region is at the northwestern tip of Hawaii.

Coastal waters near Keahole are classified AA by the DOH (Chapter 54, Water Quality Standards). Offshore waters, beyond 100-fathom depths, are classified as "oceanic," all Class A. Several studies have reported that DOH coastal water quality standards are exceeded near the shore. This is not considered unusual because nutrient concentrations are generally elevated as a consequence of a high proportion of groundwater in very nearshore surface samples. The principal sources of the nutrients in the groundwater are, however, believed natural rather than man-made. (Please refer to the March 1987 Final Supplemental EIS prepared by the Natural Energy Laboratory of Hawaii, available from OEQC.)

Under the worst-case scenario, if all the injected wastewater were to reach the ocean as a single point discharge, the plume would become completely dispersed within 30 feet of the point of discharge. In actuality, the discharge will most likely occur as a series of minute point discharges equal to the injection rate of 89 gallons per minute. This would occur over a wide area extending from the shoreline down to a depth of 500 feet. No significant impact to the marine environment is anticipated as a result of this plume dispersion. This response to your letter is included in the Revised Final EIS.

Information on the location, size, and type of septic and domestic wastewater treatment facility; soil conditions; and percolation tests at the site should be provided. Without them it is not possible to assess impacts and determine necessary mitigative measures. Potential specific and cumulative impacts should be included in the Final EIS.

A discussion of septic wastewater was presented in the Revised Draft EIS, Volume I, Section 3.1.4, page 3-21 and in the Draft EIS, Volume II, Appendix D. Additional discussion is presented in the January 22, 1993, comment letter from DOH, and in the June 21, 1993, response letter prepared by CH2M HILL (Revised Draft EIS, Volume II, Section 9). DOH subsequently had no further comments regarding this issue. These discussions address the issues raised in your comments.

The evaluation of permit approval for a domestic wastewater facility will be conducted by DOH under a separate permit approval process. The percolation tests and geotechnical evaluation will be performed in accordance with that permit process. The tests are not typically performed at this point in the process.

DEIS does not identify the possible impact of the prevailing sea breeze at the site, which could hinder dispersal of the plume. What are the impacts of the diurnal sea breeze on dispersion; how would maintenance of the plume over the area affect local air quality?

The prevailing daytime sea breeze would not hinder dispersal but would disperse the plume inland. At night, when the winds shift to offshore, those remaining plume constituents that had not already undergone some type of chemical conversion or normal removal mechanism would move in the offshore direction. Sulfur dioxide (SO_2) concentrations, for example, would decline as the gas was oxidized to sulfates or removed by other mechanisms. The recent short-term study at Keahole, for example, found daytime SO_2 levels to be almost three times greater than nighttime levels. The plume would not be maintained intact over the area. It would be moving, dispersing, chemically reacting, and generally be in a dynamic state, changing both physically and chemically.

What are the post-construction monitoring procedures for the project?

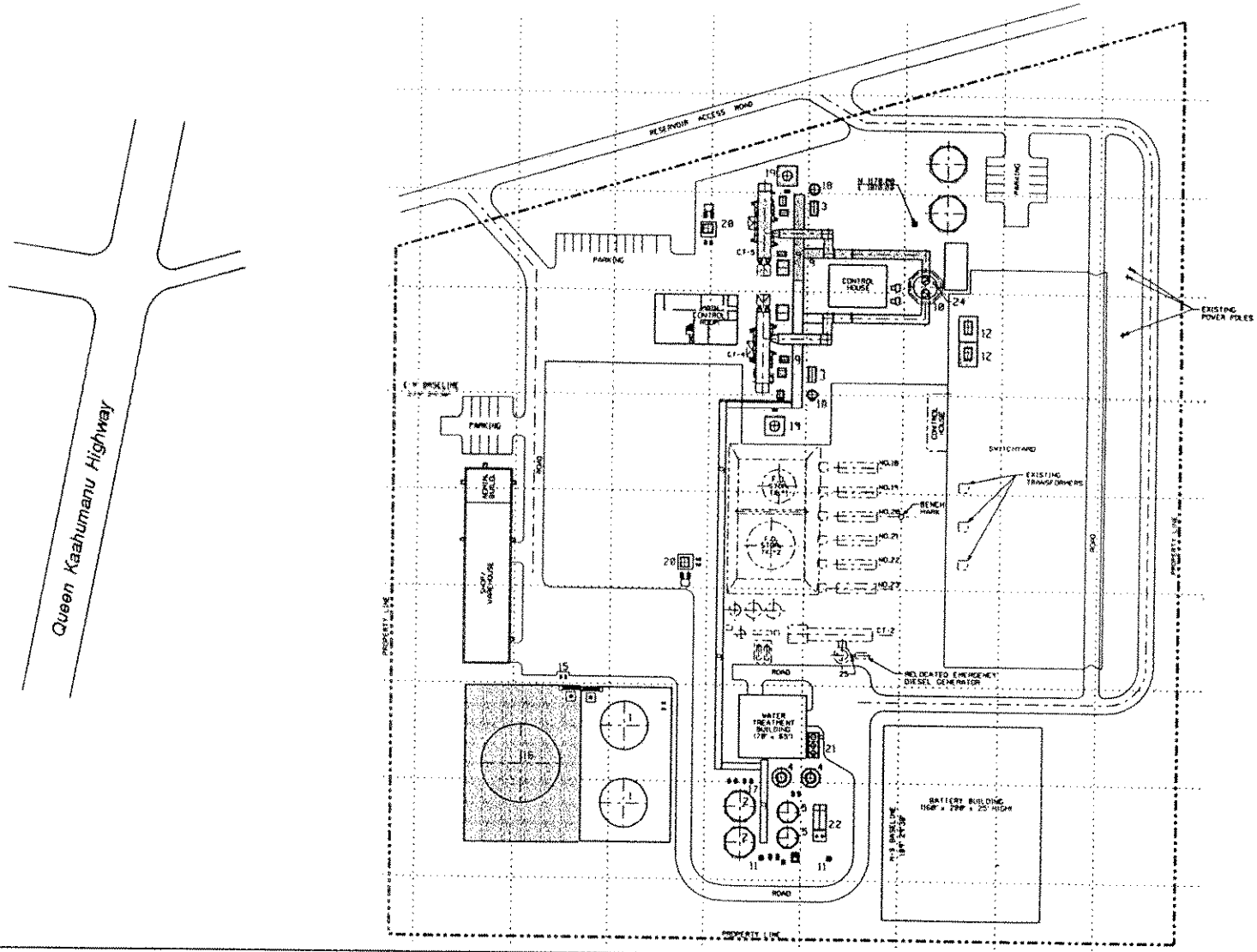
DOH will decide the post-construction monitoring requirements. Typically, post-construction monitoring requirements are delineated in the Authority to Construct (ATC) permit issued by DOH's Clean Air Branch. HELCO expects that one year of ambient monitoring for the pollutants nitrogen oxides, SO_2, and particulate matter will be a special condition of the ATC. At that time, HELCO will prepare an ambient monitoring plan according to the EPA ambient monitoring guidelines and submit it to DOH for approval.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager



LEGEND

New Facilities

Number	Description
1	Fuel Oil Storage Tank
2	Demineralized Water Storage Tank
3	Water Injection Pumps for Combustion Turbine
4	Neutralization Tank with Containment Wall
5	Waste Water Tank
7	Fire/Service Water Tank
8	Fire Pump House
9	Pipe Rack
10	Dual Flue Stack
11	Injection Well
12	Transformer
15	Fuel Oil Unloading Facilities
16	Fuel Oil Storage Tank
17	Demineralized Water Transfer Pumps
18	Demineralized Water Day Tank
19	Fuel Oil Day Tank
20	Oil/Water Separator
21	Sulfuric Acid and Caustic Soda Storage
22	Solid Settling Basin
24	Diesel Flue Exhaust
25	Relocated Backstart Diesel
26	Brackish Water Supply Well

Source: HELCO, 1993

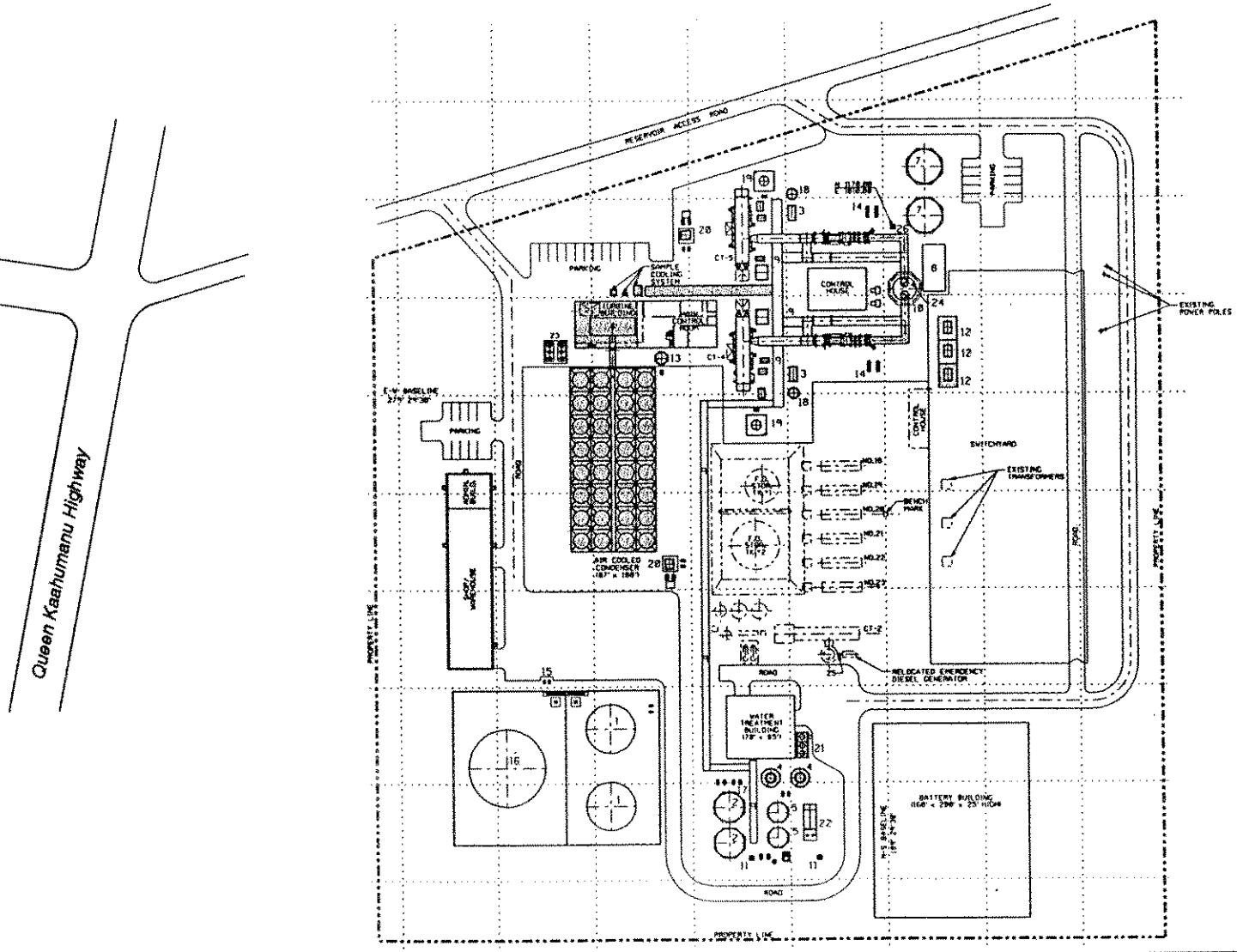
FIGURE 1-6

PHASE 2 ADDITIONAL 20-MW EXPANSION SITE PLAN

NORTH

0 100 200 FEET

CH2M HILL



LEGEND

New Facilities

Number	Description
1	Fuel Oil Storage Tank
2	Demineralized Water Storage Tank
3	Water Injection Pumps for Combustion Turbine
4	Neutralization Tank with Containment Wall
5	Waste Water Tank
6	Steam Turbine
7	Fire/Service Water Tank
8	Fire Pump House
9	Pipe Rack
10	Dual Flue Stack
11	Injection Well
12	Transformer
13	Condensate Storage Tank
14	HRSG Feed Pumps
15	Fuel Oil Unloading Facilities
16	Fuel Oil Storage Tank
17	Demineralized Water Transfer Pumps
18	Demineralized Water Day Tank
19	Fuel Oil Day Tank
20	Oil/Water Separator
21	Sulfuric Acid and Caustic Soda Storage
22	Solid Settling Basin
23	Turbine Lube Oil Radiator
24	Diesel Flue Exhaust
25	Relocated Backstart Diesel
26	Brackish Water Supply Well

FIGURE 1-7

PHASE 3 56-MW EXPANSION SITE PLAN

NORTH 0 100 200 FEET

CH2M HILL

JOHN WAIHEE
GOVERNOR

MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE

ROY C. PRICE, SR.
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 734-2161

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

October 26, 1993

TO: Mr. Don Horiuchi
Office of Conservation and Environmental Affairs
Department of Land and Natural Resources

FROM: Roy C. Price, Sr.
Vice Director of Civil Defense

SUBJECT: KEAHOLE GENERATING STATION EXPANSION; REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT (RDEIS)

We appreciate this opportunity to comment on the RDEIS by the Hawaii Electric Light Company, Inc., for the Keahole Generating Station Expansion, island of Hawaii, North Kona District, County of Hawaii, TMK: 07-03-49:36.

State Civil Defense (SCD) does not have negative comments specifically directed at this RDEIS. However, we do have a proposal that entails the purchase and installation of a siren simulator device and siren simulator support infrastructure by the developer. This simulator will help alert station personnel of an impending or actual event that threatens the area. The location for such a simulator is normally in any 24-hour manned office. However, if none is available, any manned office during normal working hours can be used.

A siren simulator is a large, suitcase size, portable siren, complete with built-in battery backup power. This device is triggered by the same radio signal that triggers the outdoor sirens. The installation of the proposed device consists of a siren simulator, an antenna, an antenna cable duct, 120 volt AC electrical power and a backup source for AC electrical power, if one is available. The design for the antenna cable would typically provide ducting from the ground floor level to the rooftop/antenna site.

Volume I, Section 3, page 3-1, "Environmental Setting, Impacts, and Mitigation Measures," paragraph 3.1, "Physical Resources," subparagraph 3.1.1, "Climate and Air Quality," "Existing Conditions," and "Topography," addresses slope and elevation. The impact of these terrain features on tropical cyclone/hurricane force winds and the resulting amplification of such winds should be addressed. The results of the above investigation could dictate the type of facility structures necessary to withstand the winds that could result from orographic amplification.

Our SCD planners and technicians are available to discuss this further if there is a requirement. Please have your staff call Mr. Mel Nishihara of my staff at 734-2161.

c: Mr. Clyde Nagata
Hawaii Electric Light Co., Inc.

Mr. Al Lyman
CH2M HILL

Office of Environmental Quality Control

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Roy C. Price, Sr.
Vice Director of Civil Defense
State of Hawaii Department of Defense
3949 Diamond Head Road
Honolulu, HI 96816-4495

Dear Mr. Price:

Thank you for your October 26, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

A siren simulator device and siren simulator support infrastructure by the developer are recommended for purchase and installation.

HELCO is looking into your proposal and hopes to be able to incorporate the siren simulator device into the project design.

The impact of these terrain features on tropical cyclone/hurricane force winds and the resulting amplification of such winds should be addressed.

The plant will be designed in accordance with the Uniform Building Code (UBC) and the County of Hawaii Building Code. The UBC and American National Standards Institute (ANSI) A58.1 provide for different effects due to the geography in the area, and all pertinent geographic features are examined for unusual wind conditions. The authority having jurisdiction can, if necessary, adjust the design values to meet any special conditions. The normal design approach used for wind loading on structures is from the UBC and ANSI A58.1. Typically, the wind design velocity for Hawaii is 80 mph in accordance with the UBC and ANSI A58.1. The design velocity is based on a 2 percent annual probability of the velocity being exceeded. HELCO typically requires all structures at its plants to be designed for 100 mph wind velocity; this will result in the structures being designed for a wind load pressure of approximately 60 percent higher than that required by the UBC and ANSI A58.1.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

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Fax No. 808 941-8225

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WAIMANA ENTERPRISES, INC.

October 7, 1993

Mr. Don Horiuchi
Department of Land and Natural Resources
Office of Conservation and Environmental
Affairs
1151 Punchbowl Street, Rm. 131
Honolulu, HI 96813

Re: Revised Draft Environmental Impact Statement for Keahole Generating Station Expansion

Dear Mr. Horiuchi:

Waimana Enterprises, Inc. ("WEI") has reviewed HELCO's Revised Draft Environmental Impact Statement ("RDEIS") and has the following comments:

1. The RDEIS repeatedly states that there is an identified need for additional generation in **January** 1995. (p. 2-1) Therefore, the RDEIS states:

> The successful development of a facility in Kawaihae in 1996, however, will not offset the need for a unit addition to the Keahole Generating Station. Fifty percent of the generating capacity at HELCO's Waimea facility in West Hawaii is scheduled to be retired **by 1995.** The proposed unit addition to the Keahole Generating Station is essential, both to provide and maintain reliable power on the Island of Hawaii, and to balance the distribution of generating capacity between East and West Hawaii.

(p. 2-9)(emphasis added).

However, the RDEIS, itself, states that the first phrase (one 20-MW, simple-cycle combustion turbine) of HELCO's proposal will not be on-line until **mid**-1995. Clearly, then, HELCO's proposal will not meet the need for additional power in **January** 1995.

How does HELCO plan to meet its generation needs between January 1995 and mid-1995?

Whatever HELCO's plan, if any, to meet its generation needs between January 1995 and mid-1995, why can't this plan be extended to 1996?

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Meeting the mid-1995 installation date is highly dependant on all permits and construction being achieved in a timely manner. Given HELCO's past experience of not being able to meet scheduled deadlines, what is HELCO's contingency plan for delay?

HELCO in its application to the PUC requesting approval for CT-4 stated that they needed the additional generation by April 1994 and estimated that it would cost $33,643,300. Later, in its Amended Application to the PUC requesting approval for CT-4, HELCO stated that its in-service date would be November 1994 and that it would cost approximately $38,221,600. Now, in its RDEIS, HELCO is stating that CT-4 will not be in-service until mid-1995.

What is the current estimated cost for CT-4?

2. The RDEIS contains a section which discusses Parallel Path Planning. The RDEIS states, "As a contingency against IPP project delays, HELCO pursues parallel path planning for the installation of its own capacity." (p. 1-8).

What is HELCO's contingency against its own project delays?

Why doesn't HELCO utilize NUGs as its parallel path planning by assisting, rather then obstructing NUG projects?

3. The RDEIS states that no contractual agreement has been reached with WEI? (p.1-8)

Why has no contractual agreement been reached between HELCO and WEI? Has HELCO been aggressively pursuing reaching an agreement?

Since no agreement has been reached with WEI, why hasn't HELCO filed a petition with the PUC pursuant to Hawaii Administrative Rules (H.A.R.) 6-74-15(c)?

H.A.R. 6-74-15(c) states:

> In the event the electric utility and qualifying facility has failed to reach an agreement on the rate or terms of purchase within seventy-five days after the qualifying facility first offers to sell energy or capacity to the electric utility, the electric utility **shall** submit a petition to the PUC requesting a hearing on the matter.

(emphasis added). WEI is a certified qualifying facility and first offered to sell HELCO energy and capacity in July, 1991.

4. During the CT-4 hearing before the PUC, WEI restated its offer to sublease property in Kawaihae to HELCO. Since HELCO's own study (made in consultation with the community) identified Kawaihae as the most desirable site for new generation, why hasn't HELCO pursued obtaining a sublease from WEI?

5. Although, the RDEIS contains an Alternative Power Producers section, the section is incomplete. The section does not fully disclose to the public the effects to the ratepayer if HELCO were to purchase power from an alternative power producer, versus building its proposed plant at Keahole.

Does PURPA or Hawaii law allow the ratepayer to pay more for purchased power than it would if HELCO built its own power plant?

What would be the effects to the ratepayers monthly bill if HELCO were to purchase power from a Non-utility generator, versus building its proposed project at Keahole?

Does HELCO/HECO make a return on its investment if it builds its own power plant?

What would be the impact to HELCO/HECO stockholders if HELCO purchased power instead of building its own power plant?

6. The RDEIS mentions that HELCO is also proposing to add a battery energy storage plant. However, the RDEIS only gives a cursory description of the system. More specifics need to be provided. For example:

How many batteries will be used in HELCO's proposed battery energy storage plant?

What is the expected life of the batteries to be used in HELCO's proposed battery energy storage plant?

How does HELCO plan to dispose of the used batteries?

Additionally, the RDEIS states the allege advantages of battery energy storage systems. However, the RDEIS does not examine the disadvantages of a battery energy storage system - i.e. the emission of toxins, the dangers of the hazardous wastes associated with such technology, and the explosions and fires that other battery storage systems have experienced on the Continental United States.

How many battery storage systems are being utilized by U.S. utilities today?

What has been the experience of those utilities with the battery storage systems?

Has other utilities experienced fires and/or explosions as a result of battery storage systems?

What is HELCO's contingency plan for fires and/or explosions as a result of the battery storage system?

Are other utilities building more battery storage systems?

How is HELCO planning to prevent toxic acids from leaking into the ground from broken batteries, overheated batteries and/or water sprayed on the batteries in the case of fire?

How would the acid/lead solution from the batteries affect the groundwater?

Also, the RDEIS states that HELCO has yet to file its application for its proposed battery energy storage plant with the Public Utilities Commission.

Why has HELCO delayed in filing its application for the proposed battery energy storage plant with the PUC?

Why didn't HELCO include the battery energy storage plant in its application for CT-4 or CT-5 and ST-7 that it filed with the PUC?

7. HELCO is now proposing to build CT-5 at the same time CT-4 is built for a total of 40 mw.'s

Is there a need for CT-5's additional capacity? If so, why?

Is there a cost savings by building CT-5 at the same time? If yes, why? If yes, how much is that cost savings?

Has HELCO already ordered CT-4? If yes, when?

Is CT-4 currently in production?

How much has HELCO paid to date for CT-4?

What is HELCO's schedule for the remainder of the payments for CT-4?

Has HELCO already ordered CT-5? If yes, when?

Is CT-5 currently in production? If no, how is HELCO going to

realize any cost savings?

How much has HELCO paid to date for CT-5?

What is HELCO's schedule for the remainder of the payments?

If HELCO has already ordered and paid for CT-4 and CT-5 before receiving any approvals, permits, and/or authorization, what would happen if HELCO did not receive the approval to build at Keahole? Can HELCO return the turbines? Would there be a penalty for returning the turbines? Would HELCO use the turbines at another site? Would HELCO try to sell the turbines? What would be the effect to the ratepayers of each of these actions?

Would HELCO petition the PUC to recover its investment if HELCO could not build at Keahole?

If HELCO could not recover its investment in CT-4 and/or CT-5, what would happen to the ratepayers' monthly bill? What would happen to HELCO? Should the ratepayers reimburse HELCO for its poor decision?

8. What is HELCO's latest peak forecast for the years' 1994 - 1996?

The October 5, 1993, 8k, filing with the SEC states:

> . . .HECO and its subsidiaries currently estimate that KWH sales average annual growth rate for the five-year period 1993-1997 could decline to approximately 1.5%. **Peak** demand estimates in this period should also decline from **previous** estimates.

(emphasis added).

In conclusion, the RDEIS fails to examine all the alternatives to its proposed projects. Moreover, a more complete discussion of HELCO's proposed battery energy storage system needs to be provided.

Thank you for the opportunity to submit comments.

Sincerely,

Sandie

Sandra-Ann Y.H. Wong

cc:Clyde Nagata
HELCO
Al Lono Lyman
CH2M Hill

Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Sandra-Ann Y. H. Wong
Waimana Enterprises, Inc.
1001 Bishop Street, Suite 1520
Honolulu, HI 96813

Dear Ms. Wong:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

How does HELCO plan to meet its generation needs between January 1995 and mid-1995? Why can't this plan be extended to 1996?

HELCO is forced to defer retirement of units as necessary to meet demand when no new generating sources are available. In addition, HELCO is pursuing a Demand-Side Management (DSM) program in order to lessen demand, will continue to hold discussions with independent power producers (IPPs), and will continue to pursue the West Hawaii power facility at Puu Anahulu. Although HELCO could continue to defer retirement of older units until they physically can no longer be operated, this would lead to breakdowns in these older units, which could then result in a repeat of the rolling blackouts experienced in 1991-92. Given HELCO's responsibility to provide reliable service to the public, it has concluded that it cannot assume such a risk. Thus, the deferred retirement of the older generating units cannot be viewed as a reasonable or desirable alternative.

What is HELCO's contingency plan for delay in its schedule?

As stated in the response to your first question, HELCO is forced to defer retirement of units as necessary to meet demand when no other new generating sources are available. In addition, HELCO is pursuing DSM programs to lessen demand, continues to hold discussions with independent power producers, and continues to pursue the West Hawaii power facility at Puu Anahulu.

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What is the current estimated cost for CT-4?

As of October 5, 1993, the total cost to construct and place CT-4 in service was estimated to be $36,965,700 based on a July 1, 1995, commercial operation date. This is an estimate that is periodically revised as further information becomes available.

Why doesn't HELCO use NUGs as its parallel path planning by assisting, rather than obstructing NUG projects?

HELCO does not obstruct non-utility generator (NUG) projects, as evidenced by the amount of capacity and energy they supply to HELCO. HELCO has encountered considerable uncertainties with NUG projects, which have had profound impacts on HELCO's generation planning and operations. In the past, delays in NUG projects (e.g., delay in Puna Geothermal Venture coming on-line) have caused HELCO to have reduced reserve margins. HELCO has also had to be extremely flexible in developing and modifying its capacity addition plans because of the uncertainty of the status of the firm-power producers with which it currently has firm power contracts. These problems have caused HELCO to delay retirements of inefficient, less reliable units; operate peaking units for prolonged periods (thereby increasing maintenance requirements); and accelerate new unit additions at added cost.

Purchase power negotiations and contract approvals add an additional element of uncertainty to NUG projects, and firm power contracts tend to reduce HELCO's flexibility. Past experience has shown the need for parallel path planning for NUG projects. The degree of parallel path planning depends on the nature of the NUG resource and how well it meets agreed-upon milestone dates.

HELCO also does parallel path planning for its own projects. The battery energy storage plant (BESP) is considered a contingency for Keahole's CT-4. Similarly, HELCO continues to pursue a long-term generation site at Puu Anahulu, while proceeding with the Keahole project.

It is not appropriate for HELCO to use NUGs as parallel path planning for HELCO's own units (as opposed to using HELCO units as parallel path planning to proposed NUGs, which is done). This is because the NUG, unlike HELCO, does not have a legal obligation to serve the public and, therefore, could back out of its commitments. A back-up plan would not be economically feasible for a NUG, because NUGs usually need to have signed, firm contracts with the utility in place in order to receive financing for a project.

Why hasn't a contractual agreement been reached with WEI? Has HELCO been aggressively pursuing agreement?

Waimana first approached HELCO with the concept of building a power plant in July 1991 (at that time, a coal-fired plant); negotiations relating to a potentially viable project (the combined-cycle plant still under consideration) began in August 1992. Both HELCO and Waimana have expended considerable time, effort, and resources in the negotiations. A number of significant issues remain unresolved, including the cost to be charged by Waimana and borne by ratepayers. These issues have prevented a contractual agreement from being reached. HELCO has been participating diligently in negotiations with Waimana.

Why hasn't HELCO filed a petition with the PUC pursuant to HAR 7-74-15(c)?

HELCO had planned to file a petition with the Public Utilities Commission (PUC) in response to a request from Waimana. However, Waimana filed a complaint with the PUC, and HELCO subsequently suspended further action pending direction from the PUC. The PUC has since dismissed the complaint and opened a separate docket for the purpose of reviewing Kawaihae Cogeneration Partners' offer to sell energy and capacity to HELCO.

Why hasn't HELCO pursued obtaining a sublease at Kawaihae as WEI offered?

To date, while Waimana has reached an agreement on key lease terms with the Department of Hawaiian Home Lands (DHHL), Waimana is still waiting for the lease document to be finalized and executed. Although much has been mentioned in meetings and in the press about a possible subleasing arrangement with HELCO by Waimana, Waimana did not formally approach HELCO to discuss the matter until late October 1993. At this time, discussions on possible subleasing arrangements between HELCO and Waimana are ongoing. Therefore, the feasibility of a sublease is unknown at this time.

This section does not disclose the ratepayer effects of IPP purchase vs. HELCO building its proposed plant at Keahole.

Until an agreement with an IPP is reached, ratepayer effects cannot be determined. Each IPP's proposal differs to some extent. If avoided costs are paid, there should be no significant difference in costs borne by ratepayers.

Does PURPA or Hawaii law allow the ratepayer to pay more for purchased power than it would if HELCO built its own power plant?

The Public Utilities Regulatory Policy Act (PURPA) and Hawaii law require that HELCO pay 100 percent of its avoided cost to a qualifying facility, as defined in the laws. Generally, Hawaii law prevents HELCO from paying more than avoided cost for purchased power. However, several IPPs insist on being paid an amount that is in excess of avoided

cost as part of their proposed contracts, and this has been a factor in delaying or preventing contracts from being executed.

What would be the effects to the ratepayer's monthly bill if HELCO purchased power from a NUG vs. building at Keahole?

Generally, there should be no difference to the ratepayer's monthly bill if the NUG were a qualifying facility, since HELCO would be required to pay 100 percent of its avoided cost. If the NUG were not a qualifying facility, HELCO would not be obligated to pay 100 percent of its avoided cost and could, presumably, pay less. If such a lesser amount could be negotiated, it would result in lower monthly bills for ratepayers.

Does HELCO/HECO make a return on its investment if it builds its own power plant? What would be the impact to HELCO/HECO stockholders if HELCO purchased power instead of building its own plant?

It would be speculative to estimate what the impact on HELCO's profits would be if it purchased power from an IPP.

If HELCO were to build a plant at Keahole, additional stockholder investment would be required to pay for the plant. This additional investment would require additional return on the investment; however, the rate of return on the investment would not change. Currently, HELCO does not earn anything on power purchased from IPPs such as Waimana. HELCO passes the purchased power cost through to ratepayers without a markup. However, if an IPP were to be paid HELCO's avoided cost, then ratepayers would pay the same amount they would have if HELCO had built the plant itself. The ratepayers would be paying the IPP stockholders instead of HELCO's stockholders.

How many batteries will be used in HELCO's proposed battery energy storage plant (BESP)?

The entire system is considered one battery that consists of the following components:

- 3 cells per module
- 936 modules per string
- 3 parallel strings
- A total of 2,808 modules with 8,424 cells

What is the expected life of the batteries?

The expected life of a module is 1,250 cycles, or 10 years.

How does HELCO plan to dispose of used batteries?

The modules are recyclable and will be returned to the manufacturer at the end of their useful life.

How many battery storage systems are being used by U.S. utilities today? What has been their experience? Fires and/or explosions? Are they building more?

Almost all utilities use battery storage systems as part of an uninterruptible power supply (UPS) for their vital equipment. The following U.S. utilities use battery energy storage systems for such purposes:

- Johnson Controls, Inc., Humbolt Foundry; Milwaukee, Wisconsin
- Delco Remy, Division of General Motors; Muncie, Indiana
- Public Service Electric & Gas; Hillsborough, New Jersey
- Crescent Electric Membership Corp.; Statesville, North Carolina
- San Diego Gas & Electric; San Diego, California

Battery energy storage is also used for power production at:

- Puerto Rico Electric Power Authority; Sabana Llana Substation, Puerto Rico
- Southern California Edison Company; Chino, California

The Southern California Edison Chino facility experienced a fire in its DC switchgear, which is part of its battery system. The fire was caused by rain that leaked into the switchgear enclosure, and the system's failure to detect the resultant short circuit. Modifications to the switchgear, along with ground fault protective circuits, have eliminated this problem. To date, there have been no fires or explosions attributed to the battery modules.

Puerto Rico is constructing the first of five 20-MW battery systems, and it is scheduled to be operational in the latter part of 1993.

What is HELCO's contingency plan for fires/explosions as a result of the BESP system?

The following safety measures are designed into the battery storage building and system. Because of the safety measures identified, the BESP is not considered to be dangerous.

- The valve regulated lead acid (VRLA) batteries do not emit significant levels of hydrogen gas under normal operating conditions, and the hydrogen levels in the battery room will not exceed one-tenth of 1 percent by volume. Hydrogen is flammable at 4 percent by volume and explosive at 18 percent by volume. The charge voltage and cell temperatures will be carefully monitored to ensure that the BESP adheres to normal operating conditions.

- The VRLA batteries are enclosed in an explosion-resistant casing and use an absorbed electrolyte material that make them virtually spill-proof and leak-proof.

- The battery storage building includes a hydrogen detection system consisting of six hydrogen monitors set to alarm at 1 percent by volume. If any monitor should alarm or fail, all charging will stop.

- The battery storage building will include a fire protection system and adhere to all National Fire Protection Association (NFPA) codes.

- The battery system will include ground fault protection to prevent incidental short-circuitry from contact with grounded items.

- The battery storage will include a heating, ventilating, and air conditioning (HVAC) system for ventilation and cooling.

Along with the designed safety precautions listed above, a fire suppressant system, fire extinguishers, and portable eye wash stations will be provided.

How is HELCO planning to prevent toxic acids from leaking into the ground from broken batteries, overheated batteries, and water sprayed on batteries in case of fire? How would the acid/lead solution from the batteries affect groundwater?

The VRLA batteries are enclosed in an explosion-resistant casing and use an absorbed electrolyte gel material. The composition of this material makes the cells virtually spill-proof and leakproof.

Batteries will be placed on a hard, impermeable surface designed to prevent water runoff. In the unlikely event that some of the gel should leak, the design of the battery storage building and alarm/monitoring systems will prevent it from coming into contact with groundwater.

Why has HELCO delayed in filing its application for the BESP with the PUC? Why didn't HELCO include the BESP in its application for CT-4, CT-5, or ST-7?

HELCO is currently working on its application to the PUC for the BESP. Because of the changes in the Integrated Resource Plan (caused by the PGV delay, the projected loss of Hamakua, DSM measures, and the general economic downturn, among other reasons), HELCO is currently reevaluating the BESP. HELCO is also investigating various sources of funds to support the cost of the BESP project.

Is there a need for CT-5's additional capacity? If so, why?

Yes. As shown in Table 1-1 of the Revised Draft EIS, HELCO requires additional capacity in 1996 and 1997 to meet continued load growth and a decreasing reserve margin, and to allow for the retirement of older generating units. A request to install CT-5 in 1995 has been made because of the cost savings that would be realized.

Is there a cost savings by building CT-5 at the same time? If yes, why and how much?

Yes. As stated in PUC Docket 7623, HELCO determined that the savings in revenue requirements for early installation amounted to $428,000, excluding fuel and operations and maintenance costs in years that both plans are the same. This is because of the increased capital costs that would be incurred by the one-year delay.

Has HELCO ordered CT-4? If so, when?

HELCO placed an order for CT-4 on November 1, 1991, as stated in HELCO's November 20, 1991, letter to the PUC.

Is CT-4 in production? How much has HELCO paid to date for CT-4? What is HELCO's schedule for the remainder of payments on CT-4?

Yes, the CT-4 unit is currently in production. As of October 18, 1993, HELCO has paid a total of $4,552,460.50 on the CT-4 contract. The schedule for the remaining payments for the unit is as follows:

December 8, 1993	$2,734,557.00
February 1, 1994	$1,828,172.50

Has HELCO ordered CT-5? If so, when?

Yes. HELCO has ordered CT-5, as indicated in HELCO's February 12, 1993, letter to the PUC. The order for CT-5 was placed on February 1, 1993.

Is CT-5 in production? If not, how will HELCO realize cost savings?

Yes, the CT-5 unit is currently in production.

How much has HELCO paid to date for CT-5? What is HELCO's schedule for the remainder of payments on CT-5?

As of October 18, 1993, HELCO has paid a total of $7,150,044.75 for CT-5. The remaining payment of $1,779,645.25 is due on February 1, 1994.

If HELCO has already ordered and paid for CT-4 and CT-5, what would happen if HELCO did not receive approval to build at Keahole? Would HELCO return the turbines? Use at another site? Sell them? What would be the effect to the ratepayers of each of these actions?

In the event that HELCO does not receive approval to build at Keahole, HELCO would evaluate the alternatives available, such as installing the turbines at another site, transferring the turbines to the Maui Electric Company (MECO), or locating a purchaser for the turbines. The effect on HELCO's customers would depend on the alternative selected. If CT-4 and CT-5 were located at another site, the relative effect would depend on the cost of locating CT-4 and CT-5 at that site relative to the existing Keahole Generating Station. If the units were sold to another purchaser, there would be minimal, if any, impact on HELCO's customers.

Would HELCO petition the PUC to recover its investment if HELCO could not build at Keahole?

HELCO would seek cost recovery for reasonable expenses prudently incurred on its CT-4 and CT-5 projects.

If HELCO could not recover its investment in CT-4 and/or CT-5, what would happen to the ratepayers' monthly bills? What would happen to HELCO? Should the ratepayers reimburse HELCO for its poor decision?

We do not agree with your characterization of HELCO's decision. HELCO's investment in CT-4 and/or CT-5 would not be recoverable only if the PUC ruled that the investments had not been prudent and disallowed inclusion of the investments in rate base. The current process is designed to ensure that this does not happen. Before significant expenditures are made on projects expected to exceed $500,000, HELCO files an application with the PUC. This application gives the PUC the opportunity to rule that a proposed project is considered imprudent.

Dockets for consideration of CT-4 and CT-5 have been filed with the PUC. If the PUC rules that these investments are not prudent, HELCO will not make the investment. The amounts invested before the ruling would not be significant.

Even if the above procedures were not in place or were not being followed, there would be no effect on the ratepayers. If HELCO's investment in CT-4 and/or CT-5 could not be recovered in rates, then rates would not be affected; therefore, the ratepayers' monthly bills would not be affected. If the investment could not be recovered, the ratepayer would not have to "reimburse" HELCO.

What is HELCO's latest peak forecast for 1994-96?

The latest peak forecasts for 1994 to 1996 are reflected in Table 1-1 of the Revised Final EIS. The demand is estimated to be 165 MW for 1994, 171 MW for 1995, and 177 MW for 1996. The demand with DSM is estimated to be 164.4 MW, 170 MW, and 174 MW, respectively, from the years 1994 through 1996. For its March 1993 meeting, the HELCO Forecast and Planning Committee reviewed current data and trends and determined that the kWh sales average annual growth rate for HELCO, independent of other Hawaiian Electric Industries subsidiaries, would be approximately 3.8 percent.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

ENSERCH DEVELOPMENT CORPORATION

3000 West MacArthur Boulevard
Santa Ana, California 92704-6993
Tel: 714-662-4091
Fax: 714-662-4107

Jody Allione
Project Development Manager

October 7, 1993

VIA FACSIMILE AND U.S. MAIL

Mr. Don Horiuchi
Department of Land and Natural Resources
Post Office Box 621
Kalanimoku Building
1151 Punchbowl Street
Honolulu, Hawaii 96809

Re: Keahole Generating Station Expansion Revised Draft Environmental Impact Statement (EIS)

Dear Mr. Horiuchi:

Enserch Development Corporation ("EDC") is a leading developer of independent power projects (IPPs), including qualifying facilities (QFs) in the United States and throughout the world. EDC has proposed development of a 58 MW IPP at a site in Hamakua, which EDC believes is a less costly and a more environmentally benign alternative to HELCO's proposed generation expansion of the Keahole site.

In this regard, EDC has reviewed HELCO's revised draft Environmental Impact Statement ("EIS") and wishes to submit the following comments. In general, while HELCO has amended its discussion in certain sections of the revised draft EIS with respect to other alternatives to its proposed generation additions, EDC believes that these sections continue to contain misstatements and omissions that require correction and completion in order to meet statutory disclosure requirements. EDC's specific comments on the revised draft EIS are as follows:

1. In Section 1.3, entitled "Purposes and Need", HELCO notes that IPP projects have been proposed by several parties, including Enserch (EDC) but dismisses them with the blanket statement that "none of these facilities are planned for

completion within a time frame that will meet the need for more electricity by 1995." (EIS, at 1-8). EDC has several concerns with this statement. First, EDC believes that HELCO's own proposal can not meet such a schedule. The revised draft EIS indicate (EIS at iii, iv) that HELCO's estimated start-up date has already slipped from 1994 to mid-to-late 1995. There is no assurance that it will not slip again. The real issue, which the revised draft EIS does not address, is whether there are other, better generation alternatives that can meet HELCO's projected needs in the same time frame as the generation additions proposed by HELCO in the revised draft EIS.

EDC believes that, with HELCO's cooperation, its proposed project would supply HELCO's needs for capacity more quickly than any other option, including HELCO's proposed expansion at the Keahole site. Both HELCO's proposal, which would be located near a population center and the airport and Waimana's proposed project, which would be located on a site where there is a native Hawaiian cemetery and significant archaeological finds, pose serious environmental concerns. EDC's proposed project, by contrast, would be located on an existing industrial site in an area of the Island that is remote yet easily interconnected with HELCO's system. Moreover, throughout its negotiations with HELCO during the past nearly two years, EDC repeatedly has expressed its willingness to undertake certain steps and assume certain obligations which would enable it to develop its project in the same time frame, if not sooner, than HELCO itself.

2. EDC also objects to HELCO's statement on page 1-8, that it can not fully evaluate EDC's proposal until it has acquired a project location. EDC has, in fact, identified a suitable site for development of the project. EDC is prepared to close on its purchase of the site once it is assured that HELCO will execute a power contract. The fact that it has not done so at this time bears in no way either or HELCO's ability to evaluate EDC's proposal or on EDC's ability to provide power in the required time frame. Permitting activities are not dependent on closing the purchase of the site, and it is normal to acquire the site for independent power projects after entering into the power contract, not before. In fact, under the terms of the power contract between HELCO and EDC as proposed by HELCO site acquisition is listed as a contract milestone, to be accomplished after contracting but prior to the commencement of construction of the facility.

3. HELCO's specific discussion of the alternate power producers in Section 2.4 is also incomplete. Section 2.4.4 currently contains a discussion only of proposals to develop a cogeneration plant at Kawaihae (EIS at 2.8). However EDC's proposal to develop its project at the Hamakua site as an IPP or a qualifying Cogeneration facility, (depending on HELCO's preference) has been on the negotiating table since late 1992. In fact, HELCO and EDC negotiated

substantially all of the terms and conditions of a power contract for EDC's Hamakua project during January and February, 1993. EDC has been waiting since March 2, 1993, when it submitted a final draft power contract, for HELCO to take action with respect to the proposed Hamakua project.

Nevertheless, Section 2.4 contains no discussion of EDC's Hamakua Project. Given these circumstances, EDC believes that HELCO's revised draft EIS must be amended by adding a new section 2.4.5 which describes the current status of HELCO's negotiations with EDC regarding the Hamakua project. Absent such disclosure, HELCO's revised draft EIS is still deficient with respect to discussion of other alternatives and should be rejected.

We appreciate the opportunity to submit these comments.

Sincerely,

Jody Allione

Jody Allione

cc: Mr. Clyde Nagata (HELCO)
Mr. Al Lono Lyman (CH2M Hill)
Jerry Sumida, Esq. (Carlsmith, Ball)
Carl Steen, Esq. (Wright & Talisman)

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Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Jody Allione, Project Development Manager
Enserch Development Corporation
3000 West MacArthur Blvd.
Santa Ana, CA 92704-6993

Dear Ms. Allione:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

1. HELCO believes its schedule is realistic, most economical to the ratepayer, and necessary to meet customer needs in the required time frame. Enserch Development Corporation's (EDC) claim that HELCO cannot meet the schedule is pure speculation, as is its claim that its own project could be completed more quickly. There are no "assurances" for any party proposing to develop a project. A comparison of the two projects shows the following significant differences:

   a. HELCO already owns its proposed site; to our knowledge, EDC does not. Moreover, although EDC has verbally represented that it has the bankruptcy trustee's approval to a sale of the land, EDC's timely ability to purchase the Hamakua Sugar Company site may be complicated by Hamakua's bankruptcy proceeding. From HELCO's tangential involvement in that proceeding, it is clear that any actions affecting assets or activities of the bankruptcy estate often require much time, coordination, and resolution of legal issues.

   b. HELCO has already filed its Revised Final EIS, while EDC has not started to prepare one.

   c. HELCO has already collected data and filed applications for State and federal air pollution permits. To our knowledge, EDC has not begun this process, which takes considerable time.

   d. HELCO has already filed applications for PUC approval of capital expenditures. EDC does not have a contract with HELCO. Once EDC and HELCO conclude a contract, it would be subject to PUC approval. (EDC has represented, however, that it is willing to proceed with certain aspects of the development without waiting for PUC approval.)

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e. The Hamakua site involves a number of existing environmental concerns that would need remediation, as well as transmission issues that require additional time and money to resolve.

Given the foregoing, it is reasonable to conclude that EDC's project must be considered to be behind HELCO's schedule.

2. HELCO believes that, in the context of meeting its system capacity requirements, any proposer that offers to sell power to HELCO must demonstrate control, if not ownership, over a site. Control can be demonstrated by a letter, option agreement, or similar document showing that the owner fully intends to sell or lease the land exclusively to the proposer (even if that sale or lease is contingent on the proposer obtaining a contract with HELCO). Although EDC has verbally stated that the bankruptcy trustee has approved the sale of Hamakua land and that the offer will be submitted to the Bankruptcy Court for approval, EDC has not presented such a document to HELCO. In fact, before EDC's October 7 comment letter, EDC had not indicated that even a contingent purchase was imminent or assured. This factor becomes increasingly important as alternative projects are evaluated, some of which have stronger assurances now as to site control. HELCO has recently received copies of filings in the bankruptcy court relating to this matter.

3. Exclusion of EDC's proposal was an oversight; a discussion of the status of negotiations with EDC's Hamakua proposal has been included in the Revised Final EIS.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

Forests

The West Hawaii Sierra Club

Seas

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DLNR OCEA

October 6, 1993

Department of Land and Natural Resources
1161 Punchbowl Street
Honolulu, HI 96813

Attn.: Don Horiuchi

SUBJECT: New Draft EIS for Keahole Generating Station Expansion

Dear Mr. Horiuchi,

After reviewing the New Draft EIS, the West Hawaii Sierra Club wishes to reiterate the issues we raised in our letters of September 22, 1992, January 20, 1993 and July 13, 1993. We specifically asked that the following issues be addressed in HELCO's EIS:

We asked HELCO to address ENERGY CONSERVATION.

HELCO's response is that we must wait for the Integrated Resource Plan (IRP). *There is no need to wait for the IRP.* In fact, HELCO could have implemented energy conservation 20 years ago! HELCO claims on page 2-9 that "The actual timing of peak savings is dependent on two variables: PUC approval of individual DSM programs, and customer acceptance of individual programs." What about the fact that HELCO's management is 20 years behind mainland utilities in DSM? Why must we continue to suffer from bad utility management? Might the solution be to subcontract the management of HELCO's DSM program out to a mainland utility with proven track recorde in DSM? *Where is their study?*

We asked HELCO to address HEAT RECOVERY.

HELCO asserts that this is not a viable option. If our experts are wrong, HELCO could at least have the decency to show us where we have failed. *Where is their study?*

We asked HELCO to address DISTRIBUTION SYSTEM RENOVATION.

Once again, HELCO asserts that this is not a viable option. Once again, *where is their study?*

We have some specific comments and questions/corrections concerning the EIS:

1. (Page 1-4) "During resource planning, the following issues are evaluated"

Q Souldn't "How to maximize profit to the shareholders at the least possible risk" be among the criteria?

2. (Page 1-4) "Because of permitting delays, however, HELCO must defer scheduled retirement of some older units in order to maintain a reserve generating capacity."

Q What is the impact of these delays on HELCO's profit?

Hawaii's Sierra Club - now over 4,000 strong!

3. (Page 1-5 – table 1-1) Please note that this "HELCO Resource Plan" represents arbitrary decisions on the part of HELCO's management and is not part of any colaborative process with the public.

Please explicitly state the assumptions upon which HELCO's DSM plan is founded.

4. (Page 1-9)

Q How long has WEI been negotiating with HELCO for a power contract?

Q How much would HELCO's profit decline if it bought 25 MW of power from an IPP instead of building its own power plant?

5. We feel that the unique Kona diurnal air quality conditions have not been addressed. HELCO has only considered impacts to air quality in the vicinity of the power plant. Where will the effluents go? What are the cumulative, potential impacts to Kailua village? We feel that HELCO should conduct a tracer gas study to find out!

6. If this power plant is not allowed to go forward, what will the impact on the IRP process be?

Aloha,

Jay Hanson, Program Chair,
West Hawaii Sierra Club,
78-6622 Alii Drive,
Kailua-Kona, HI 96740

Phone 808-329-6645 Fax 808-329-6523

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December 7, 1993

Mr. Jay Hanson, Program Chair
West Hawaii Sierra Club
78-6622 Alii Drive
Kailua-Kona, HI 96740

Dear Mr. Hanson:

Thank you for your October 6, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

HELCO did not address energy conservation as we asked previously. There is no need to wait for the IRP. Where is their study?

HELCO has addressed energy conservation, both in our original response letter of November 17, 1992, to you and in revisions to Section 2.5 of the Revised Draft EIS. These responses explained that, although the Integrated Resource Plan (IRP) was not yet approved, HELCO had already begun to implement conservation and energy efficiency programs. Specific savings for ongoing programs were listed in Table 2-2 of the Revised Draft EIS. Therefore, your comment is incorrect in stating that HELCO's response to energy conservation is to "wait for the IRP."

As part of the IRP process, HELCO developed energy demand forecasts, a portfolio of supply-side resources, and Demand-Side Management (DSM) programs. These forecasts, resources and program elements were then integrated with the aid of a computer program to determine the optimal mix of resources and DSM programs. The integration process was supported by scenario and sensitivity analyses, which examined optimistic and depressed economic scenarios and IRP sensitivity to a variety of items, including the loss of 25 MW from Puna Geothermal Venture, implementation of an energy tax, different levels of DSM projects, DSM transmission and distribution credits, and externality costs. In all cases, the analyses indicated that HELCO should proceed with CT-4, CT-5, and the conversion to a dual-train combined cycle (DTCC) at Keahole. The timing of CT-5 and the DTCC varied slightly depending on the scenario examined. HELCO's IRP, entitled *HELCO Resource Integration Plan: 1994-2013*, describes the results of this planning process in detail.

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As a member of the IRP advisory group, you received a copy of HELCO's study and have had an opportunity to provide input to it and the supporting studies that were prepared and reviewed throughout the IRP process.

It should be noted that HELCO's DSM program is one of the most aggressive and dynamic in the United States. Most of the more aggressive U.S. programs save approximately 7 to 10 percent of peak, compared with HELCO's projected 12 percent savings in its 20-year plan. Anticipated DSM savings have already been incorporated into the forecasted peak demands shown in HELCO's resource plan (Table 1-1 of the Revised Draft EIS).

HELCO did not address heat recovery as we asked previously. If our experts are wrong, HELCO could at least have the decency to show us where we have failed. Where is their study?

As described in our November 17, 1992, letter to you, heat recovery is an integral part of the proposed phased expansion of Keahole Generating Station. Two heat recovery steam generators and a steam turbine-generator are proposed for Phase 3, which involves the conversion of the two simple-cycle combustion turbines to a combined-cycle unit. HELCO did not state that your experts on heat recovery were "wrong." In fact, HELCO believes that your conclusions are technically correct, but believes that your suggestion to use existing exhaust stacks for heat recovery is not a viable option given the condition of HELCO's existing generating plants. HELCO believes heat recovery is not a viable option for the following reasons.

In general, power plants equipped with waste heat recovery units have taller exhaust stacks to facilitate dispersion of air emissions. In addition, as the temperature of the exhaust gas is reduced, which is what occurs in a heat recovery system, the volume of the gas is reduced. Unless the diameter of the exhaust stack is proportionally reduced, the exit velocity and buoyancy of the exhaust gas will drop when heat recovery is added. When heat recovery is considered for a generating facility, special exhaust stacks are required to mitigate the loss of thermal buoyancy and the lower exit velocity. The 56-MW unit's proposed heat recovery exhaust system has been designed to accommodate the lower temperature and exit velocities anticipated with the proposed unit addition. The design of the existing stack may result in excessive air quality impacts if it were to support conversion to a combined-cycle unit, and would likely trigger the need for an air permit modification. If the exhaust stack were modified to compensate for the loss of thermal buoyancy, it is likely that HELCO would be required to demonstrate that the new stack would not result in an exceedance of the air quality permit. Such a demonstration would likely require an amount of time comparable to that required for permitting alone.

Most of HELCO's generating plants that could add heat recovery are quite old and scheduled for retirement. While heat recovery can be added to diesel generators, it would be quite expensive, would require new (and higher) exhaust stacks because of the lower exhaust temperatures, and HELCO would need to make a commitment to replace the older

diesels. Diesel generators have about a 10-year life under baseload operations. Although the existing combustion turbine at Keahole Generating Station could be modified to accept waste heat recovery, the cost of retrofitting and the need for a higher exhaust stack associated with that alternative have been two of the considerations in HELCO's decision to propose the new 56-MW unit.

HELCO asserts that distribution system renovation is not a viable option. Where is their study?

As discussed in our November 17, 1992, response letter to you, as well as in the Purpose and Need section of the Revised Draft EIS (Section 1.3), locating future power generation on the west side of Hawaii, which is the area of greatest demand, will reduce the line losses that currently occur through long-distance transmission. Therefore, line losses will be reduced as a result of the proposed expansion of Keahole Generating Station through the reduction in long-distance transmission.

Total transmission and distribution losses of 8 to 10 percent are common in the utility industry; most line losses are a result of normal resistive losses, even with properly operating equipment. HELCO has reduced its system losses from 1987 to 1993, as shown by the following recorded data:

Year	Loss
1987	9.6%
1988	9.5%
1989	9.4%
1990	8.1%
1991	7.5%
1992	7.7%
1993	7.7% (as of August 1993)

Transmission line improvements, such as increasing voltage to higher levels or increasing the conductor size, can also reduce line losses. However, these types of improvements would require extensive modifications to existing transmission lines, would not be economical, and would not provide the first 20 MW of power needed by 1995. Major transmission line reconductoring or voltage upgrades may also require additional permitting, engineering, and right-of-way acquisition, and would likely require several years to implement. A major part of upgrading the transmission system involves the scheduling of lines to be taken out of service. With the current loads very near the amount of generation available, this alternative may not be feasible at this time.

Shouldn't "How to maximize profit to the shareholders at the least possible risk" be among the criteria evaluated during resource planning (ref. p. 1-4 of DEIS)?

The referenced page, 1-4 of the Revised Draft EIS, discusses issues that were evaluated in resource planning relating to HELCO's system needs. The information is given in support of the purpose and need for the Keahole Generating Station expansion, and it does not address issues of corporate profitability. HELCO's Integrated Resource Plan, in addition to the system issues that were evaluated, addresses profitability indirectly as an objective. The Corporate Competitiveness/Financial Integrity set of objectives of the HELCO IRP supports corporate profitability by minimizing capital requirements, maintaining low reasonable revenue requirements, maintaining low technology and financial risk exposures, and limiting exposure to future energy taxes. Remaining profitable is important, because it enables the utility to maintain low electricity prices and thus to attract and retain investors. However, it is not the only objective. In addition to the Corporate Competitiveness/Financial Integrity objectives, other objectives in the HELCO IRP fall into the following four categories:

- Low Customer Cost/Economic Flexibility
- Energy Efficiency/Self-Sufficiency
- Environmental, Societal, and Cultural Values
- Utility System Reliability

What is the impact of the permitting delays (ref. p. 1-4 of DEIS) on HELCO's profit?

Delays in permitting and construction generally increase project costs, but they do not necessarily affect HELCO's profits. HELCO's profits are determined primarily by the return on equity allowed in a rate case. Return on equity is allowed only when the plant is used or useful for utility purposes.

The delay would also affect fuel, operating, and maintenance expenses; however, the impact to these cannot be calculated at this time.

HELCO's resource plan represents arbitrary decisions on the part of HELCO's management and is not part of any collaborative process with the public. Please explicitly state the assumptions upon which HELCO's DSM plan (ref. Table 1-1) is founded.

Your statement that the IRP was developed without public participation is incorrect. Three IRP advisory groups consisting of 28 people were formed. These groups actively participated in the development of the IRP.

The assumptions for the DSM programs listed in Table 1-1 are summarized in Section 2.5, Conservation and Energy Efficiency, which begins on page 2-9 of the Revised Draft EIS. The DSM programs in Table 1-1 include the standby and interruptible rate program, commercial high-voltage air conditioner program, commercial lighting program,

commercial refrigeration program, commercial water heating program, industrial motors program, custom rebate program, and residential water heating program. Descriptions of these various programs are included in Table 2-1 on page 2-10 of the Revised Draft EIS. The major assumptions behind the anticipated reduction in energy use from these programs are based on past performance of other utility programs and general public acceptance and participation. At this time, the Pilot Commercial Lighting Program and the Pilot Residential Lighting Program are the only programs that have been approved by the PUC for implementation. An Interim Commercial Lighting Program, filed in December 1992, and a Residential Retrofit Program, filed in April 1993, have not been approved by the PUC.

How long has WEI (Waimana) been negotiating with HELCO for a power contract?

Waimana first approached HELCO in July 1991 with the concept of building a power plant (at that time, a coal-fired plant); negotiations relating to a potentially viable project (the combined-cycle plant still under consideration) began in August 1992. Both HELCO and Waimana have expended a considerable amount of time, effort, and resources in diligently pursuing negotiation of a contract since a potentially viable project was proposed in August 1992. From that time to the present, the two parties have had many differences on key contract terms, including (but not limited to) the price to be charged HELCO and borne by ratepayers. Negotiations with Waimana are ongoing.

How much would HELCO's profit decline if it bought 25 MW of power from an IPP instead of building its own power plant?

It would be speculative to estimate what the impact on HELCO's profits would be if it purchased power from an IPP. If HELCO were to build a plant at Keahole, additional stockholder investment would be required to pay for a portion of the plant. This additional investment would require additional return on the investment; however, the rate of return on the investment would not change. Currently, HELCO does not earn anything on power purchased from IPPs such as Waimana. HELCO passes the purchased power cost through to ratepayers without a markup. However, if an IPP were to be paid HELCO's avoided cost, then ratepayers would pay the same amount they would have if HELCO had built the plant itself. The ratepayers would be paying the IPP's stockholders instead of HELCO's stockholders.

The unique Kona diurnal air quality conditions have not been addressed. Where will the effluents go? What are the cumulative, potential impacts to Kailua village? HELCO should conduct a tracer gas study to find out.

The prevailing daytime sea breeze would not hinder dispersal but would disperse the plume inland. At night, when the winds shift to offshore, those remaining plume constituents that had not already undergone some type of chemical conversion or normal removal mechanism

would move in the offshore direction. Sulfur dioxide (SO_2) concentrations, for example, would decline as the gas was oxidized to sulfates or removed by other mechanisms. A recent study prepared for the project, for example, found daytime SO_2 levels to be almost three times greater than nighttime levels. The results of this study are summarized in the Revised Final EIS. The plume would not be maintained intact over the area. It would be moving, dispersing, chemically reacting, and generally be in a dynamic state, changing both physically and chemically.

As demonstrated in the Prevention of Significant Deterioration (PSD) application, the project will not cause or contribute to a violation of any federal or State ambient air quality standard (NAAQS and SAAQS). The NAAQS define the air quality levels that the U.S. Environmental Protection Agency (EPA) judges are necessary to protect the public health and welfare from any known or anticipated adverse effects. The maximum concentrations, which are less than 65 percent of any NAAQS or SAAQS, occur on or near the Keahole property. The diurnal air quality conditions may result in slightly higher concentrations for areas at some distance from the plant. However, the level of concentrations in these areas will be less than the maximum concentrations predicted by the model in the vicinity of the plant. The identification of the maximum impact from the plant does not require a tracer gas study.

If this power plant is not allowed to go forward, what will be the impact on the IRP process?

If the Keahole project does not go forward, resource alternatives described in the IRP will be reevaluated to determine an appropriate course of action. The IRP was filed with the Public Utilities Commission on October 15, 1993. In accordance with PUC directives, the IRP process will continue to be an important component of HELCO's operations. As an interim course of action, if the Keahole expansion does not go forward, retirements of older generating units will again be postponed, leading to an increased risk of failure of these units. HELCO remains committed to implementing the optimal amount of cost-effective DSM programs allowed by the PUC.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89b\033.51

FILE:KOC-1073.DOC

KONA OUTDOOR CIRCLE

76-6280 Kuakini Highway
Kailua-Kona, Hawaii 96740

RECEIVED
'93 OCT 12 PM 12:17

7 October 1993

Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813

DLNR
OCEA

Attn: Mr. Don Horiuchi

Dear Sir:

Subject: Keahole Generating Station Expansion, revised draft, EIS, July 30, 1993.

Please consider the Kona Outdoor Circle (KOC) letter to you dated 12 July 1993 (File:KOC-7123.DOC) as our response to the subject EIS. The revised draft did not address our comments and concerns.

Furthermore, in answer to the KOC letter of 19 January 1993 the CH2M Hill response of June 21, 1993, is not up to date, makes unsubstantiated assertions, and misrepresentations. Without detailing all of the flaws in the CH2M Hill letter I do think two comments must be made.

Page 5 "The proposed expansion is the only alternative that can be completed to meet the 1994 service date."
Earlier the KOC questioned whether or not HELCO could indeed meet that date which they have now slipped to 1995. As HELCO has certified PGV Ormat as a 25 megawatt firm capacity power producer the need for CT-4 at Keahole in 1995 is questionable. Given a choice between 25 MW of firm power from PGV or 20.8 MW of inefficient "peaking" from CT-4 the former is much preferred. However, there are many old, over aged, inefficient generating units in the HELCO system, e.g. CT-1, that should be retired as soon as possible. In order to proceed with the desired retirements, CT-4 should be installed next to CT-3 in Keaau and built out to a dual train combined cycle system. However, the fastest possible addition of new, efficient power generation of all the options discussed would be to add a waste heat steam recovery unit to CT-3; this addition of 8 MW consumes no fuel and would not require an air emissions permit.

Page 6 "The American Lung Association ... no adverse health effects attributable to vog have been identified."
Because there has not been a definitive study on the effects of VOG on humans correlated to air quality, an additional statement should be made to the effect "Nor is there information suggesting that VOG does not have adverse health effects on humans". Many Kona doctors will attest to treating patients whose respiratory problems and allergies are exacerbated by the VOG. Furthermore, we know personally persons who have had to leave Kona because of ill effects from the VOG.

Your consideration of these comments and our position is appreciated.

Sincerely,

Barbara J. Shim-Kossow, President
Kona Outdoor Circle

PRINTED ON RECYCLED PAPER

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Barbara J. Shim-Kossow, President
Kona Outdoor Circle
76-6280 Kuakini Highway
Kailua-Kona, HI 96740

Dear Ms. Shim-Kossow:

Thank you for your January 19 and October 7, 1993, letters concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

CT-4 should be installed next to CT-3 in Keaau and built out to a DTCC.

Installation of CT-4 next to CT-3 at Keaau would not be an expedient course of action because of the time required for permitting and the uncertainty of permitting success. Air quality modeling studies in support of the CT-3 application for Keaau indicate that the area affected by CT-3 may also be affected by existing sources in Hilo. It could take up to 18 months to prepare an air permit application for Keaau, and it is not certain that modeling would show acceptable air quality limits with another 20-MW CT. It would take another 18 months for the Department of Health (DOH) to process an air permit.

Installation of CT-4 in East Hawaii would also require a new cross-Island transmission line to deliver the electricity to West Hawaii, resulting in additional environmental analysis, permit processing time, and costs, as well as potential line losses. In addition, with the facility sited above the underground injection control (UIC) line, it is likely that additional wastewater would have to be disposed of offsite.

The fastest option would be to add a waste heat steam recovery unit to CT-3. This addition of 8 MW consumes no fuel and would not require an air emissions permit.

Your suggestion to add a waste heat recovery unit to CT-3 is not a viable alternative for several reasons. A waste heat unit would provide only 8 MW, which is not enough to allow for the retirement of older generating units and to meet the generating capacity needed in early 1995. Also, the design of the existing stack may result in excessive air quality impacts if it were to support conversion to a combined-cycle unit. Moreover, it could not be implemented quickly, as you suggest, because of permitting requirements.

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While it is technically correct that heat recovery will not require more fuel, the conversion would require an air emissions permit. Power plants equipped with waste heat recovery units require taller exhaust stacks to facilitate dispersion of air emissions. In addition, as the temperature of the exhaust gas is reduced (which is what occurs in a heat recovery system), the volume of the gas is reduced. Unless the diameter of the exhaust stack is proportionally reduced, the exit velocity and buoyancy of the exhaust gas will drop when heat recovery is added. When heat recovery is considered for a generating facility, special exhaust stacks are required to mitigate the loss of thermal buoyancy and the lower exit velocity.

Because the thermal buoyancy of the exhaust gas would drop, there is a high probability that the existing air quality permit limits would be violated if a heat recovery unit were added. Therefore, adding heat recovery would trigger the need for an air permit modification. If the exhaust stack were modified to compensate for the loss of thermal buoyancy, it is likely that HELCO would be required to demonstrate that the new stack would not result in an exceedance of the air quality permit. Such a demonstration would require 36 months, which is the amount of time required to collect and analyze air data and process the required permits.

Regarding the Lung Association—should add statement to the effect "nor is there information suggesting that vog does not have adverse health effects on humans."

We agree with your statement.

In 1988, DLNR told HELCO that no further additions would be allowed at Keahole. HELCO acknowledged this in PUC testimony. A major factor was to prevent noise and emissions to surrounding community.

In its 1988 Conservation District Use Application, HELCO stated that the 13.75-MW CT would be the last new unit to be installed at Keahole. The statement was made based on the assumption that HELCO would develop a new generating site at Kawaihae or at Puu Anahulu, and that power would be available from Puna Geothermal Venture (PGV) the following year. PGV's contract was to provide power to HELCO by 1990. HELCO did not anticipate the delays encountered in acquiring a site at either Kawaihae or Puu Anahulu, and the delays, from 1990 through mid-1993, in geothermal development by PGV.

Need for project questioned in light of Hamakua continuing, PGV coming on-line.

HELCO has included the production of 25 MW of power from PGV in its resource planning. Hamakua has indicated that it will cease all operations following the 1994 harvest. The power generated at the Hamakua Mill will also cease.

Visual and emission impacts to future development (the largest planned development) on the Big Island have not been adequately addressed.

Section 3.3.2 of the Revised Draft EIS addresses both existing and future planned land uses in the vicinity of the proposed project. These planned land uses are discussed both in the section on existing conditions, and under project impacts. Because there are no specific plans for the State-owned land surrounding the project, there are no conflicts identified. HELCO provided input to the State's EIS for the proposed boundary amendment for the 2,640 acres of State-owned land surrounding Keahole Generating Station and Keahole Agricultural Park. If the proposed Keahole expansion goes forward, any subdividing and/or site planning of surrounding lands would consider the presence of the generating station.

Disagree with ranking in Summary of Impacts. Visual Resources should have been ranked "Adverse Impact (may be significant)"; air and groundwater cannot be considered to have "no Adverse Impact" if pollutants are released.

Visual impacts were judged to be "adverse (may not be significant)" because the proposed unit addition would not alter the dominance of the Keahole facility within the viewsheds analyzed. Although the impacts of the project may not be significant, HELCO will install landscaping to screen the project from viewers.

The determination of significance for air quality impacts was based on federal and State standards. These standards are established at levels determined by the regulating authority to be adequate to prevent adverse impacts.

The determination of significance for groundwater quality impacts is based on analysis of groundwater and discharge water quality. Underground injection of certain wastewater streams is allowed in the State of Hawaii makai of the UIC line. An application to construct and operate an underground injection well was approved by the Department of Health on April 6, 1993. HELCO's injection of wastewater will be consistent with all applicable State requirements to ensure that adverse impacts do not occur.

The Hawaii State Plan and the County's General Plan regarding visual resources would be compromised.

We do not agree that there would be any compromise to the State's and County's plans related to visual resources. A review of the Hawaii County General Plan indicates that mauka views along that portion of Keahole are not considered significant. A review of the County's Kailua to Kona Plan does indicate that the mauka view from the airport is a "view from a point of interest." The plan is a guide to land use actions, not a regulatory measure, and it does not pose additional developmental controls. Finally, the County General Plan has designated almost the entire area mauka of the airport for urban

expansion. The State plans to develop 2,640 acres within this area. The addition of units at Keahole will be only a small part of the State and County's planned changes to the area.

The Hawaii State Plan is not definitive on the issue of views and states only that the policy is to "promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscape, and other natural features." This must be weighed against other objectives and policies within the State Plan that call for the necessary energy to support the continued growth and economic development of the area. Through the request for reclassification, the State has indicated a preference in this instance for growth.

We take exception to the concept that new emission sources can be constructed anywhere as long as calculated emissions do not exceed limits of various government regulations and laws.

HELCO acknowledges your disagreement with the concept of allowing new facilities to emit pollutants "anywhere" provided those emissions are in compliance with laws and regulations. However, the laws and regulations pertaining to new emission sources are designed to protect human health and the environment. The regulatory process is designed to weigh the impacts at a single location against the impacts at alternative locations, so that a common good can be achieved. HELCO will comply with all applicable laws and regulations to ensure that adverse impacts do not occur.

Emission analysis focuses on the near field; no mention is made of the wind-blown plume. Should conduct tests to determine pollutant concentrations that will be drawn into Kona by afternoon offshore breezes.

Air quality modeling to determine impacts from the proposed project was conducted for the Prevention of Significant Deterioration (PSD) application. This modeling used one year of meteorological data gathered approximately 0.8 mile from the Keahole site. Within that one year of data were wind conditions from several directions, including "off-shore" sea breezes. Currently, an onsite meteorological station is gathering further information to verify the previously gathered data. Following the proposed expansion, post-construction monitoring of air quality will be conducted to verify the results of the model.

Treatment of alternative and renewable generation technologies was not fair. Assuming nonviable if not continuous ignores value for avoidance of fossil fuel combustion. Reason there are not more renewable energy supplies is that Hawaii does not require incorporation of externality costs. If this were done, these clean resources would be the "least cost" option.

HELCO has extensively evaluated numerous supply-side resource alternatives in developing its Integrated Resource Plan (IRP). The *Supply-Side Resource Option Portfolio Development Final Report* (Black & Veatch, July 1993) documents this alternative resource assessment. The selection of resource options for HELCO's IRP is based on a screening

process, where a large number of potential supply-side options are considered and then screened to eliminate resources that are clearly infeasible and not appropriate for the Island of Hawaii or the HELCO system. The screening process is a detailed process with significant input from an advisory group, which was convened to ensure maximum participation from the public sector in the overall IRP process.

HELCO does not assume that intermittent energy sources are not viable. However, HELCO is required by law to use its best efforts to provide electricity when and where it is needed. For planning purposes, electric utilities cannot include intermittent or nondispatchable sources of energy production as assured system generating capacity. HELCO does use electricity from hydroelectric power and wind energy when it is available. To the extent that electricity is available for these sources, it allows HELCO to avoid burning fossil fuels.

Before HELCO undertook its Integrated Resource Planning, the Public Utilities Commission (PUC) issued a framework for the planning process. One of the governing principles stated in the framework is the consideration of a plan's impact on the utility consumer, environment, culture, community lifestyles, State's economy, and society. The framework stated that, to the extent possible and feasible, the external costs and benefits should be quantified and expressed in dollar terms. When it is neither possible nor feasible to quantify any cost or benefit, such cost or benefit should be qualitatively measured.

HELCO followed the PUC framework in preparing its IRP and considered externality costs as part of resource evaluation. Monetized externalities were used to assess air emission impacts, and other externalities were assessed qualitatively. Even considering externality costs, the combustion turbine technology was the most cost-effective resource that could provide the needed amount of generation capacity within the required time frame.

In its first cycle of Integrated Resource Planning, HELCO selected a resource plan within the context of short- and long-term resource strategies. For the short term, HELCO selected conventional oil-based technologies because of the costs and uncertainties associated with renewable energy sources. The short-term role for renewable/alternative energy resources, therefore, will continue to be in power purchased from independent power producers to the extent that HELCO's system can feasibly incorporate it.

For its long-term resource strategy, HELCO has identified several alternative resource strategies that involve geothermal, renewable, and pumped storage hydropower resources. HELCO's selection of these resources will depend on whether future conditions can sustain them.

In response to your comment about wind and photovoltaics, Section 2 of the Revised Draft EIS discusses these two options. Neither wind nor photovoltaics is a firm capacity solution to the immediate power need.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89\034.51

P.O. BOX 2685
KAILUA-KONA, HI 96740

OCTOBER 7, 1993

MR. DON HORIUCHI
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION & ENVIRON. AFFAIRS
1151 PUNCHBOWL STREET, ROOM 131
HONOLULU, HI 96813

RE: KEAHOLE POWER PLANT EXPANSION

DEAR MR. HORIUCHI:

I AM A REALTOR AND LIVE VERY NEAR THE POWER PLANT AT KEAHOLE AND I AM VERY CONCERNED ABOUT MANY ISSUES CONNECTED WITH THE PROPOSED EXPANSION. I AM INVOLVED IN THE TOURIST INDUSTRY, AGRICULTURE AND I LIVE IN THE AREA. MY LIVLIHOOD, MY HOME AND MY HEALTH ARE ALL IMPACTED BY THE PROPOSED EXPANSION.

VISUAL IMPACT

WHAT MESSAGE DOES A 15-ACRE POWER PLANT AT THE GATEWAY TO KONA AND THE KOHALA COAST SEND TO VISITING TOURISTS? THE 104' SMOKESTACK AND 2 MILLION GALLON DIESEL FUEL STORAGE TANKS, BATTERY STORAGE PLANT, STEAM TURBINE BUILDING AND ALL THE OTHER ASSOCIATED FACILITIES CANNOT BE HIDDEN FROM INCOMING AND OUTGOING AIRCRAFT. THE SMOKE CANNOT BE HIDDEN FROM VISITORS OR RESIDENTS.

(REVISED DRAFT EIS, VOL. I, P. V) "THE LOCATION OF THE PROPOSED PROJECT WILL CREATE AN ADVERSE VISUAL IMPACT, ALTHOUGH THE IMPACT WILL NOT BE SIGNIFICANT." THERE ARE A LOT OF PEOPLE WHO FEEL THIS WILL HAVE A SIGNIFICANT IMPACT ON OUR VISITOR'S FIRST AND LAST IMPRESSION OF THE BIG ISLAND. IF THE BIG ISLAND IS "BIG", WHY WOULD HELCO CHOOSE TO PUT AN OFFENSIVE, POLLUTING, ANTI-TOURIST, ANTI-COMMUNITY POWER PLANT AT KEAHOLE? WHY PUT AN UGLY WART ON THE TIP OF YOUR NOSE?

TRAFFIC

WHEN YOU LIVE ON A LARGE ISLAND WITH ONLY ONE MAJOR TWO-LANE ROAD, YOU START TO WONDER HOW ALL THE GARBAGE TRUCKS AND OIL TANKERS WILL IMPACT OUR LIFESTYLE. WILL SOME OF THESE TRUCKS AND TANKERS BE GOING THROUGH RESIDENTIAL NEIGHBORHOODS OR JUST CLOG THE HIGHWAY? THE INTERSECTION OF KEAHOLE AIRPORT/KEAHOLE POWER PLANT IS THIS ISLAND'S MOST DANGEROUS AND DEADLY ROAD. WILL HELCO BE RESPONSIBLE FOR THE "LOSS OF LIFE" CONTRIBUTED TO DRIVERS WHO PASS TANKERS ON THE HIGHWAY OR ADDITIONAL ACCIDENTS AT THE AIRPORT/POWER PLANT TURN OFF? ALSO WHY DOES THE POLICE DEPARTMENT'S TRAFFIC REPORTS DIFFER FROM THE EIS?

PROPERTY VALUES

IF HOMEOWNERS NEAR THE PROPOSED POWER PLANT MUST DISCLOSE POLLUTANTS ARE IN THE AIR, SOIL AND WATER, WON'T THIS AFFECT HOME PRICES AND REDUCE THE NUMBER OF BUYERS WANTING TO BUY AND LIVE IN THE AREA? AREN'T POWER PLANTS TYPICALLY SURROUNDED BY OTHER INDUSTRIAL USERS SO THEY CAN POLLUTE EACH OTHER? THEY AREN'T NORMALLY LOCATED IN AGRICULTURAL/RESIDENTIAL/UNIVERSITY AREAS. NOISE POLLUTION WOULD ALSO HAVE TO BE DISCLOSED.

THE PROPERTY VALUE STUDY AS EXPLAINED IN THE DRAFT EIS, VOL. II: APPENDICES; THESE APPRAISERS DID NOT QUALIFY THEIR STATEMENTS SO THEIR OPINIONS ARE NOT ADEQUATELY SUPPORTED. DOESN'T IT MAKE SENSE TO COMPARE COMMUNITIES WITH POWER PLANTS TO COMMUNITIES WITH POWER PLANTS? INSTEAD HELCO'S "APPRAISERS" COMPARE A LOCAL NEIGHBORHOOD NEAR A LARGE ELEMENTARY SCHOOL (KEALAKEHE) TO A MORE AFFLUENT NEIGHBORHOOD WITH A POWER PLANT (KONA PALISADES). BELIEVE IT OR NOT, THERE ARE NEIGHBORHOODS WITH POWER PLANTS THAT SHOW PROPERTY VALUES DECLINING. THE ENCINO POWER PLANT IN CARLSBAD, CA IS AN EXCELLENT EXAMPLE. THEREFORE, WOULDN'T IT BE APPROPRIATE TO PREPARE A FORMAL APPRAISAL COMPARING LIKE PROPERTIES?

MANY OF MY NEIGHBORS AND I HAVE INVESTED THOUSANDS OF DOLLARS AND YEARS OF OUR LIVES DEVELOPING OUR FARMS AND NOW HELCO WANTS TO POLLUTE THE AG PARK. IF POWER PLANT POLLUTANTS CAN PIT THE PAINT ON NEW CARS, WHAT WILL IT DO TO OUR CROPS? OUR HEALTH? WILL HELCO REIMBURSE US FOR OUR LOSSES?

COMMUNITY VALUES

WAIMANA ENTERPRISES HAS AGREED TO PAY $1,000,000 PER YEAR TO LEASE LAND FOR THEIR POWER PLANT TO BENEFIT THE HAWAIIAN HOMELANDS AND WILL BUILD A DESALINATION PLANT TO BRING WATER TO KAWAIHAE SO THIS AREA MAY DEVELOP AND GROW. DOES HELCO PLAN TO GIVE ANYTHING TO HAWAIIAN HOMELANDS OR THE COMMUNITY FROM THEIR PROFITS? WILL HELCO BUILD A DESALINATION PLANT TO HELP THE KALAOA AREA WITH THEIR WATER SHORTAGE? WHAT GUARANTEE WILL THE AG PARK GET FROM THE COUNTY THAT THEIR WATER NEEDS FOR THEIR LIVLIHOOD WILL HAVE PREFERENCE OVER HELCO'S NEEDS?

FUTURE EXPANSION

HELCO HAS EXPANDED THE CURRENT POWER PLANT THREE TIMES. NOW IT WANTS TO EXPAND THREE-FOLD. WITH ALL THE VACANT LAND SURROUNDING THE PLANT, WHAT GUARANTEES DO WE HAVE THAT THEY WON'T EXPAND AGAIN AND AGAIN?

I WOULD JUST LIKE TO POINT OUT THAT WHETHER YOU ARE INVOLVED IN THE TOURIST INDUSTRY, AGRICULTURE OR IF YOU LIVE NEARBY THE POWER PLANT, YOU WILL BE IMPACTED BY POLLUTION IN THE AIR, WATER AND SOIL, LOSS OF INCOME, LOSS OF PROPERTY VALUES AND TRAFFIC AND NOISE.

THANK YOU FOR ADDRESSING MY CONCERNS.

SINCERELY,

Linda Bradley

LINDA BRADLEY
KONA RESIDENT

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Linda Bradley
P.O. Box 2685
Kailua-Kona, HI 96740

Dear Ms. Bradley:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Why would HELCO choose to put an offensive, polluting, anti-tourist, anti-community power plant at Keahole? What message does it send to visiting tourists?

We do not agree with your characterization of the project. The selection of the Keahole site was the result of a thorough siting study (described in Section 2 of the Revised Draft EIS). In addition, the time frame within which additional generating capacity is needed can only be met by expansion at the Keahole site. Without additional capacity in early 1995, HELCO may be unable to meet peak demands for electricity. Such a situation would have significant impacts on Hawaii Island residents and businesses, as well as on the tourism industry. None of the other alternatives evaluated (see Section 2 of the Revised Draft EIS), including other sites and independent power producers, would be able to[address this need in 1995.

It is important to remember that HELCO is not putting a <u>new</u> facility at Keahole; it is expanding an existing facility that has been at that location since the mid-1970s. HELCO's Keahole facility was in existence before many of the surrounding land uses were developed.

As stated in the Revised Draft EIS (Section 3.3.4), the project is not expected to have an impact on tourism or the tourism industry. Land uses surrounding an airport are not likely to affect vacation destination planning. The Keahole site is not a vacation destination site. In general, it is not uncommon to encounter industrial land uses adjacent to airports.

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Will some of the garbage trucks and oil tankers be going through residential neighborhoods or just clog the highway?

Solid waste from the Keahole Generating Station will be transported to the new County landfill for West Hawaii, located approximately 7.5 miles northeast of Keahole Generating Station. HELCO has no control over the routes solid waste contractors use, and cannot comment on whether or not garbage trucks will travel through residential neighborhoods while carrying solid waste from Keahole. However, fuel tankers from Hilo or Kawaihae will use Queen Kaahumanu Highway and will not pass through residential areas.

Will HELCO be responsible for the "loss of life" contributed to drivers who pass tankers on the highway or additional accidents at the airport/power plant turn off?

Your comment makes a speculation that future potential accidents involving tanker trucks will be the fault of the truck and not other vehicles. The party at fault in each accident is unique to that accident and cannot be predicted beforehand. In the unlikely event that an accident were to occur and were proven attributable to HELCO, any damages not covered by insurance would be borne by HELCO stockholders.

Why do the police department's traffic reports differ from the EIS?

The traffic safety study prepared for the Revised Draft EIS is based on State Department of Transportation (DOT) traffic accident summary reports. The DOT data were compiled from Hawaii County Police accident reports over a 5-year period, from 1986 to 1990. The only difference between the two data sets is the lack of the graphical accident diagram prepared by the Police Department. More recent data reported by the Police had not been entered into the State's database at the time the accident study was prepared. Accident reports are available only through the Police Department. Because of the confidential nature of these current reports, the Police Department does not release them.

Won't homeowner disclosures to potential buyers affect home prices and reduce the number of buyers wanting to buy and live in the area?

The project will not contribute toxic substances to soil, air, or water such that crop damage or other adverse impacts would occur. Therefore, notification to potential buyers would not be required.

Aren't power plants typically surrounded by other industrial users so they can pollute each other?

Power plants are often sited adjacent to other industrial uses. In this case, the airport, related airport uses, the Natural Energy Laboratory of Hawaii, the Hawaii Ocean Science Technology Park, and the existing HELCO generating facility are considered industrial uses.

With regard to the property value study as explained in the Draft EIS, Volume II, Appendices: Doesn't it make sense to compare communities with power plants to communities with power plants? Neighborhoods with power plants show declining property values (e.g., the Encino power plant in Carlsbad, CA).

The study to which you refer in the Draft EIS, Volume II (Appendix H) was designed to determine whether the existing generating station has had an impact on property value. To conduct such a study, it is necessary to establish a "control"—a community (i.e., Kealakehe) that is nearly identical to the one being studied (i.e., Kona Palisades) with the exception of the factor under consideration (visual proximity to the power plant). Comparing Kona Palisades with Carlsbad, California, which is not located in the same geographic area but which does have a nearby power plant, would not have achieved the desired result of determining whether the Keahole plant has affected property values in the Kona area. Property values have generally been declining in general in California since the late 1980s, regardless of location or nearby facilities.

If power plant pollutants can pit the paint on new cars, what will it do to our crops? Our health? Will HELCO reimburse us for our losses?

Although no formal complaint regarding pitting of automobiles by HELCO facilities has been filed, we understand that there have been concerns in the Hilo area relative to the Kanoelehua Plant. As stated in the Revised Draft EIS, the Kanoelehua Plant is in compliance with all applicable federal and State emissions and air quality requirements. Several studies were conducted to determine the impact of the proposed plant on crops at the Agricultural Park. These studies indicated that the proposed unit addition would not pose a harmful threat to neighboring vegetation. These studies and a summary of the results are included in Section 9 of the Revised Final EIS.

Does HELCO plan to give anything to Hawaiian Homelands or the community from their profits?

HELCO does make contributions to non-profit and community programs. However, HELCO has no specific plans regarding Hawaiian Homelands.

Will HELCO build a desalination plant to help the Kalaoa area with their water shortage?

HELCO does not intend to build a desalination plant at its Keahole facility.

What guarantee will the Agricultural Park get from the County that their water needs for their livelihood will have preference over HELCO's needs?

The water that the County has committed to HELCO for the proposed unit addition to the Keahole Generating Station will be provided from the Honokohau production well, which is currently being developed. HELCO is paying a portion of the development costs for this

well, as well as for the related distribution and storage facilities. During a drought, the County would present water rationing plans, which would require conservation measures by all members of the community, including HELCO.

With all the vacant land surrounding the plant, what guarantees do we have that they won't expand again and again?

The land surrounding the existing Keahole facility is not owned by HELCO. The property is in State ownership, and it will be up to the State to decide how it is used.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

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DLNR
OCEA

Dear Sirs,

This letter is in regards to the proposed HELCO plant across from the Keahole Airport.

I am a homeowner in that area and I am not satisfied that this interim plant is neccessary in light of the alternatives available.

My first question relates to HELCO's existing and forecasted demand for power which is being used as the greatest reason to push this interim plant through before the scheduled opening of an I.P.P. in Kawaihae. Is this study based on the power demands of proposed developments along Queen K highway (ie Four Season Hotel, golf courses etc...) which are now no longer a factor at this time?

Is the scheduled retirement of existing HELCO plants really as important as HELCO would have us believe, based on the change in the development future of that area It has been downscaled considerably.

Is HELCO aware of the water shortage already in the Kona Highlands subdivision?

If the county promises to supply HELCO with the thousands of gallons of water necessary to operate this plant, are they aware of the impact on the homes in the area that have existing water shortages now?

Does the proposed well that HELCO proposes give any relief in the future to the residences in the area.

It appears, according to the EIS, that this well will only supply water for Phase II + III of HELCO's plant. Is this true?

Is county water going to a permanent obligation?

Besides the obvious eyesore of this proposed plant's location, I certainly have to question HELCO's minimizer the safety factor involved with 12 or more fuel trucks going in + out of this plant daily. The intersection at the airport entrance is bad enough now. Does HELCO believe

that there will be no additional danger?

And how can HELCO's study possibly say that the smokestack proposed and the ensuing pollution will not have an impact on plant life or air quality in that area?

One only has to live in the area to see what the fog and airline pollution has done. It does not blow away with so called trade winds as HELCO would have us [redacted] bel

All you have to do is look out your window to see how the pollution settles in this area. Or better yet look right on your own window sill.

Does HELCO know that certain AG land there is a proposed site for a "kiddie" park?

It appears to me and most of my neighbors, that the rush to approve the plans for HELCO's propose plant in that area, was not in conside of the residence of HI. but an attempt to supercede any & all attempts of alternat

power proposals by independent companies.

There is not one redeeming factor in the proposal that HELCO has submitted, based on the time frame that they seem to be concerned about.

Please address these questions before any decisions are made. We do not want this plant at this location and intend to fight it every step of the way.

Sincerly

Dianne Fayette
Highlands Resident
73-4177 ALAKA PL
KAILUA-KONA, HI
96740

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Dianne Fayette
73-4177 Alaha Pl.
Kailua-Kona, HI 96740

Dear Ms. Fayette:

Thank you for your letter (received October 8, 1993) concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Is the demand projection based on demands of proposed developments that are no longer a factor?

HELCO did not include projects that were not considered "certain" in its demand forecasts. HELCO forecasts electrical demand by estimating future peak demand and kilowatt-hour sales from several different perspectives. Final forecasts are selected by the Forecast and Planning Committee (FPC) and can be corroborated by more than one analytical method. Although mathematical trending of historical kilowatt-hour sales data is one form of analysis used in the forecasting process, HELCO does not depend solely on mathematical trending to forecast the future. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place. Following is a description of the demand forecasting methodology.

Short-Term Peak Demand Forecasting

Generally, historical monthly morning and evening peak data are used in the short-term peak demand forecasts (e.g., for 1993-98). These forecasts are derived by multiplying the forecasted annual peaks by a morning monthly peak factor and an evening monthly peak factor. These factors are derived from actual monthly morning and evening peaks averaged over the most current 5 years. The system peak forecasts are then analyzed in relation to the energy sales forecasts and the projected load factor, which is the ratio of the average hours of operation to the total annual hours available.

Another major portion of the short-term forecasted increase in demand can be directly attributed to large-scale construction projects currently under way. Such large-scale projects reflect the increasing competition among discount retailers for larger market shares and are not necessarily dependent on tourism or population increases. These projects, all scheduled to come on-line in 1993 and 1994, include:

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Kealakehe Sewer Treatment Plant and Pump Station	2,000 kilovolt-amperes (kVA)
COSTCO Pacific Distribution Center	1,500 kVA
Keauhou Shopping Center Phase 2	2,000 kVA
Safeway/ACE/Ben Franklin	1,500 kVA
Lanihau Center Phase 2	4,000 kVA
K-Mart/Queen Liliuokalani Trust	3,000 kVA
Mauna Kea Prince Hotel	2,000 kVA
Royal Vista Golf Course Irrigation Pumps	3,000 kVA

Short-Term Sales Forecasting

Short-term energy sales forecasting at HELCO is performed through analyses of the marketplace: rate schedule analyses, system analyses, market analyses, economic analyses, and customer service analyses.

- Rate schedule analyses consider a spectrum of mathematical analyses of the patterns and trends in the number of customers and kilowatt-hour sales to the individual rate schedules using linear, Box-Jenkins and exponential models, econometric analysis, and other traditional curve-fitting methods.

- System analyses use a number of mathematical analyses and trending techniques of the patterns and trends in total system kilowatt-hours (kWh).

- Market analyses are based on survey analyses of the market conditions influencing the different rate schedules, with special emphasis on customer-by-customer accounting of loads in Large Power Rate Schedule P. Also considered are influences on Residential Schedule R, including new construction outlook, resort development, and government-supported or -sponsored housing.

- Economic analyses include judgmental analyses and considerations of the potential for future economic growth in the HELCO service area, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- Customer service analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month.

The inputs into these analyses are diverse and include such items as personal income, visitor count, population growth, national and state economic conditions, new construction, inflation factors, oil prices, conservation measures, and weather patterns.

Long-Term Sales Forecasting

The long-term sales forecasts for HELCO's electricity sales are the result of econometric equations, developed by HELCO, that relate historical patterns of energy usage to independent economic and weather variables. Care is taken to ensure that as many county-specific data as possible are used, rather than state-wide information. Sources for historical economic data include:

- Department of Business, Economic Development and Tourism's (DBEDT) State Data Book
- DBEDT's Quarterly Statistical and Economic Reports
- County of Hawaii's Department of Research and Development Data Book
- Bank of Hawaii's Annual Report
- Updated data from the Hawaii Visitors Bureau
- National Oceanic and Atmospheric Administration's (NOAA) weather data summaries from the State Department of Land and Natural Resources

The econometric models are validated using statistical tests for:

- Residual autocorrelation (Durbin-Watson Test)
- The goodness of fit (coefficient of determination or R-Squared Value)
- Statistical significance of the independent variables (t-Test)
- Heteroskedasticity of the residuals
- Multicollinearity of the independent variables

In addition, the reasonableness of the relationship between the independent and dependent variables for each model is evaluated.

The results of these models are reasonable predictors of long-term trends. The econometric models are not, however, responsive to rapid changes in the short-term conditions; for this reason, they are not used for the short-term forecasts.

On the other hand, the customer and market analyses described above examine the short term very carefully and are more likely to account for the near-term conditions that drive

electricity sales. A combination of the short-term detailed analyses and the long-term econometric model has shown itself to be a reasonable method for projecting sales over a 20-year period. This is generally done by applying the rates of growth resulting from the econometric models to the short-term analyses forecasts.

Effects of Conservation

Potential effects of customer conservation and Demand-Side Management (DSM) activities are also factored into the forecasting process. The extent that customers have practiced load shifting and conservation in the past would be reflected in the historical database. For example, the FPC included 700 kW and 300 megawatt-hour (MWh) peak demand and energy forecast adjustments, respectively, beginning with the 1993 forecasts, for the impact of the Pilot Commercial Lighting Program. As other DSM programs move from the planning to implementation stage, the forecasts will be adjusted to account for the estimated demand and energy savings. However, the precise levels of future conservation and reduction in usage due to DSM programs are difficult to predict because a consumer's personal conservation rate is affected by a number of other factors that are difficult to reliably forecast. These factors include:

- The actions of the city, state, federal, and foreign governments
- Oil prices, which affect electricity prices
- Overall inflation
- Economic factors
- Weather variables
- Public acceptance of new energy-efficient appliances
- Public willingness to make lifestyle choices that encourage conservation

Economic and Population Inputs Used

Economic conditions and their possible influences on forecasted demand are regularly reviewed during deliberation on the forecasts for each rate schedule. The figures contained within Table 1-1 in the Revised Draft EIS were adopted by the HELCO Forecast and Planning Committee in March 1993 and reflect economic and population data up to that time. Concerns regarding the extent and duration of the state-wide economic slump, the drop in Big Island tourism, the eventual closing of Hamakua Sugar, the slowdown of Hilo Coast Processing Company, and the slowdown of new construction were all factored into the methodology. As a result of the state-wide recession and the downturn in new construction, HELCO's near-term kWh sales growth was projected at lower levels than the previous year's projections.

General population growth is but one element of the overall model, and the population figures used in the HELCO models are provided by HELCO. County population estimates included in the 1989 General Plan and the State Department of Business, Economic

Development and Tourism population projections Series M-K, developed in 1988, were not used to project the short-term peak demand for 1993 to 1998. For demand forecasts from 1998 to 2010, HELCO used the most recent population and tourism data available and the recommended modifications to the individually metered residential accounts developed by the Consumer Advocate's Office, which were incorporated into HELCO's Integrated Resource Planning proposal. The following table shows the population and visitor census projections used in developing the demand projections shown in Table 1-1 of the Revised Draft EIS.

Population and Visitor Census Projections

	1992 Base and Projections	
Year	**Population**	**Visitors**
1992	129,610	14,718
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874

Source: HELCO Long Term Sales & Peak Forecast March 1993, page 3-65.

The forecasting of system peak demand is more complex than the forecasting of kilowatt-hour sales. In general, peak loads are much more sensitive to changes in weather patterns than to changes in visitor arrivals or population changes. This was evidenced during the prolonged hot and humid weather on Oahu in September 1993. During this period, new high-peak demands were placed on Hawaiian Electric Company, Inc. (HECO) generating equipment, independent of any sudden increases in population or tourism. In addition, the peak demand is much more sensitive to the timing of a major project, such as a hotel, or large commercial use, than is the overall kWh sales forecast. For example, a 2-MW hotel that starts operating in December would contribute only one month of kWh sales, annualized over the entire year. However, the full 2 MW of electrical demand on the system peak would need to be met.

Accuracy of Forecasts

Historically, the FPC's recommendations have been reasonably close to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast. In 1989, the system peak of 130.4 MW was 1.6 MW below the forecast. In 1992, the recorded peak of 150.2 MW was 0.8 MW below the forecast.

The FPC's projection of future growth is frequently revised. In the 1987 forecast, an increase in system peak of 4 MW per year was projected on the basis of slightly pessimistic economic and visitor industry climates. In 1988, this forecast was revised to a 5-MW-per-year increase to reflect improved economic conditions. In 1989 and 1990, the strong influence of Japanese visitors and developers led to forecasts being revised upward to as much as a 9-MW-per-year increase. By 1991, the softened economy, lingering effects of the Persian Gulf War, and the beginning of a downturn in visitor arrivals led to a revision in the 5-year projected growth to only 5.8 MW. Current demand through November 1993 has been approximately 5 MW below the projected 157 MW.

Table 1-1 in the Revised Draft EIS reflects the following growth: 1993, 8 MW; 1994, 6 MW; 1995, 6 MW; 1996, 7 MW; 1997, and 1998, 7 MW. Possible reductions in demand, due to the adoption and implementation of the DSM programs contained in HELCO's proposed Integrated Resource Plan before the Public Utilities Commission (PUC), are incorporated in these forecasts. Some of the specific assumptions in the various HELCO schedules that compose these forecasts include:

- Persistence in the national economic recession
- Dropping of visitor arrivals in second half of 1993
- Further softening in resort condominium sales
- Decline in multi-family construction
- Sliding of 1994 proposed projects into 1995 and 1996
- Impact of Commercial Lighting Program
- Similar weather patterns

Alternative Scenarios

In addition to the demand forecasts presented in Table 1-1 of the Revised Draft EIS, HELCO has also examined alternative scenarios that explore the impact of other events on the peak demand. One such scenario is the possible impact of the Model Energy Code as reflected in the latest update of the Hawaii Building Energy Efficiency Standard developed in 1992 for the Energy Division of DBEDT.

The scope of the Energy Efficiency Standard encompasses the design of new residential and nonresidential construction as well as major renovations. DBEDT estimates the impact of the proposed building standards on electricity demand in the year 2010 for the State of

Hawaii to be a cumulative savings of 114 MW and 404 gigawatt-hours (GWh). The breakdown of the savings is estimated to be 51 percent from nonresidential, 8 percent from the nonresidential renovations, and 41 percent from the residential sector. Based on the percentage of total state electricity consumption, the cumulative savings for the Island of Hawaii in the year 2010 are estimated at 10.3 MW and 36.6 GWh. This assumes that Hawaii County's electricity reductions are 7.2 percent of total state savings in nonresidential, 7.2 percent from nonresidential renovations, and 11.8 percent from the residential sector.

The adoption of the Energy Efficiency Standard for Hawaii County requires legislative action on the part of the Hawaii County Council. Currently, an advisory committee is reviewing the Model Energy Code for submittal to the Hawaii County Council. Adoption of the new standards is anticipated by 1995. Following adoption of the standards in their final form HELCO will factor into its demand forecasts any estimated energy reductions that may result.

Summary

In summary, the peak demand forecasts contained in Table 1-1 reflect conservative, rather than optimistic, assumptions about the level of visitor arrivals and general economic growth for Hawaii County. Population projections are only one of the elements of the overall forecasting model; other elements include such items as weather patterns, conservation efforts, and projects under construction. These projections are frequently reevaluated to maintain accuracy and adequateness of HELCO's planning efforts. State Series M-K and County General Plan population projections are not used in the HELCO demand forecasts reflected in Table 1-1. Short-term projections are based mainly on the historical peak demand data and on the ongoing construction projects for those developments advanced enough in the planning process to be considered "certain." Long-term projections from 1998 to 2010 use population projections developed by the Consumer Advocate's Office for use in the Integrated Resource Planning process. Appropriate changes have been made to Section 3.3.3 of the Revised Final EIS. This discussion and a summary of the March 1993 Forecast and Planning Committee Meeting have been included in Section 9 of the Revised Final EIS.

Is the scheduled retirement of existing HELCO plants really as important as HELCO would have us believe?

The addition of new capacity to allow for the retirement of HELCO's older generating units is very important. The postponement of retirement of these generating units has already increased maintenance costs and the likelihood of equipment failure. Additional postponement will further increase maintenance costs and the risk of equipment failure. This is a situation that HELCO cannot allow to occur in light of HELCO's responsibility to provide reliable service at the lowest practical cost to customers. HELCO is obligated by

the PUC to have adequate and dependable generation reserve to cover the loss of the two largest units in the system. Between 1991 and mid-1993, without power from Puna Geothermal Venture (PGV), HELCO was forced to rely on these older units and had to curtail power to customers when one of these older units failed. Even with the aggressive DSM programs proposed by HELCO, HELCO has concluded that the associated risk of deferred retirement in lieu of providing new generating capabilities is too great to be considered a reasonable or desirable alternative.

Thus, although HELCO could defer retirement of these units until they can no longer be operated, without newer replacement generation in the short term, breakdowns in these older units become more likely, which increases the possibility of repeating the rolling blackouts experienced in 1991-92. Given HELCO's responsibility to provide reliable service to the public, HELCO has concluded that it cannot assume such a risk and that the deferred retirement of the Waimea units is neither reasonable nor desirable.

Is HELCO aware of the water shortage already in the Kona Highlands subdivision?

HELCO is aware of the water shortage in the Kona Highlands subdivision. The County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

If the County promises water to HELCO, are they aware of the impact on homes that have water shortages now?

The County Department of Water Supply is providing HELCO with an allocation of its future supply to ensure that the Island of Hawaii does not again experience rolling blackouts similar to those experienced in 1991-92. HELCO is paying a portion of the development costs for the well, and for the related distribution and storage facilities. The additional power provided by the plant will aid the County in its development of potable water sources.

Does the proposed well that HELCO promises give any relief in the future to the residences in the area? It appears, according to the EIS, that this well will only supply water for Phases 2 and 3—is this true?

The onsite brackish supply well will be developed for use by the Keahole Generating Station. The water would be unsuitable for offsite potable use.

Is County water going to a permanent obligation?

County supply of an average of 90 gallons per minute (gpm) of potable water will be a permanent obligation under the water agreement under discussion between the Department of Water Supply and HELCO. As a part of this agreement, HELCO will pay its share of the cost of developing the Honokohau well.

Does HELCO believe that there will be no additional danger at the airport entrance?

Yes. The State Department of Transportation (DOT) intends to install a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway before the end of 1993. In addition, Queen Kaahumanu Highway is currently being master planned by DOT, with further widening and channelization proposed.

The installation of a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway would precede Phase 1 of the proposed unit addition to Keahole Generating Station. This improvement, along with the long-term improvements described above, is expected to mitigate traffic safety problems currently associated with the Keahole Airport intersection. HELCO will coordinate its planning efforts with the DOT Highways Division to ensure that roadway improvements will accommodate fuel tanker trucks.

How can HELCO's study possibly say that the stack and ensuing pollution will not have an impact on plant life or air quality in that area?

The Prevention of Significant Deterioration (PSD) air quality impact analysis determined that the maximum concentrations resulting from the proposed project were within the U.S. Environmental Protection Agency (EPA) and State Department of Health (DOH) air quality standards. This determination was performed using representative meteorological and background air quality data, collected and analyzed in accordance with EPA and DOH requirements. Through adherence to EPA's regulatory permitting program, in which pollutant concentrations are conservatively modeled (i.e., above what would actually be expected), the proposed facility is considered not to have a significant impact to the area. Recent air quality monitoring performed at the Keahole Agricultural Park confirms the conservativeness of the modeling, indicating that pollutant concentrations are below the predicted levels for nitrogen oxide (NO_x) and sulfur dioxide (SO_2).

Does HELCO know that certain agricultural land there is proposed for a "kiddie" park?

HELCO is aware that there is a private initiative to establish a community park within State lands south of the Agricultural Park. One proposed site for this park is at the southern end of Laui Street adjacent to the southern boundary of the Agricultural Park, approximately 4,000 feet from the Keahole facility. An alternative site under discussion is located approximately 200 feet south of the makai border of Kona Palisades and approximately 2,000 feet south of Kaiminani Drive, roughly 4,500 feet from the Keahole plant. Both sites are located south of the generating facility. No impacts to the potential park location from the proposed generating facility expansion are expected.

It appears that the rush to approve HELCO's plans is an attempt to supersede IPPs.

HELCO's attempts to get its Keahole plant on-line consistent with its schedule are not an attempt to "supersede IPPs." Rather, it is part of HELCO's performance of its franchise obligation to serve the residents of the Island of Hawaii and to provide them with electricity when needed. The fact is that the need for additional capacity is in early 1995, and no IPP has a proposal that could potentially displace the need for the plant to be built at Keahole.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

Department of Land and Natural Resources
Office of Conservation and Evironmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813.

Attention: Mr. Don Horiuchi

Dear Mr. Horiuchi.

I have a question about the EIS of the proposed expansion of the Keahole power plant by Helco.

My husband and I live in the Kona Acres subdivision and we have a concern about whether there has been any studies about alternate ways of producing power rather than increasing the present plant and using the same old methods that have been used for years and years? Surely in this day and age there are ways of producing power more efficiently and with less side effects than have been used in the past. In the New York Stock Exchange book there is a company listed that produces power by burning garbage. It seems to me that that would take care of our two biggest problems we have on this island. I am sure there are many other ways of producing electricity that would be more economical and maybe be able to cure more than one problem. Has there been any experts asked to give advise on the production of power on the island in a more inventive way than it is presently done?

I am also concerned about Fire Protection. Several years ago there was a grass fire on the south side of the main Kaiminani Street down by the highway. It was a really hot day and there was a dry wind blowing from the ocean straight up the hill. The fire spread quickly and burned quite a large area before the fire trucks were able to get there and control the fire before it could come up the hill and damaged some of the houses closest to the grass land. It would seem to me that with the added storage tanks expected to be installed at expanded plant that the fire fighting equipment will have to be increased to take care of any sort of an emergency. Is more fire equipment going to be available on site at the new expansion? Will fire equipment from the Airport be able to be used if there is a fire? Will there be plans for a fire station closer to the facility than the one at Palani Road? There was a fire in the Palisades area a year ago and by the time the fire department got there the house was burned to the ground.

We have been told that the University of Hawaii plans a West Hawaii Campus close to the expanded plant in the not too distant future. It doesn't seem to me that an expanded power plant right in their back yard would be very advantagous. Has the company given any thought to the future of the area? What a 104 foot smokestake would mean to a community surrounding the univesity which has been toted to be one of the largest in the pacific basin? I think that Helco owes some respect to the community and their plans

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should be compatable to the plans for the whole community instead of worrying if the company will be making a profit so that their stockholders will get a dividend.

Sincerely,

Irma J. Gilger

Irma J. Gilger
Concerned Home Owner

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mrs. Irma J. Gilger
c/o Tropical Breeze Orchid Farm
73-4348 Laui Street
Kailua-Kona, HI 96740

Dear Mrs. Gilger:

Thank you for your letter (received October 8, 1993) concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Have there been any studies about alternate ways of producing power (e.g., burning garbage) rather than increasing the present plant and using the same old methods that have been used for years and years?

Yes. HELCO has extensively studied alternative ways of producing power. HELCO has recently issued the *Supply-Side Resource Option Portfolio Development Final Report*, prepared by Black & Veatch, which outlines various alternative energy resources and their applicability to the Island of Hawaii. Although alternative methods of generating power have been studied and considered, none of these methods could be developed within the time frame required to meet the current energy demand. In examining the alternatives, the proposed project remains the most viable option for the short-term requirements.

The Black & Veatch report evaluated the potential for power generation applications for municipal solid waste. As a general rule, waste-to-energy plants are considered primarily a method of waste reduction, with electric energy as a by-product. The County of Hawaii is currently drafting the *Integrated Solid Waste Management Plan* to provide decision-making guidance on solid waste management on the Island of Hawaii. Recommendations on waste diversion programs are addressed in the plan, but none include waste-to-energy technologies. Garbage-to-energy plants have become more problematic for the following reasons:

- A relatively low volume of energy is available in garbage.
- The amount of energy generated from burning garbage is decreasing because of increased recycling efforts.
- The ash resulting from the burning of garbage may soon be classified as hazardous waste, requiring more costly disposal.

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Have any experts been asked to give advice on the production of power on the island in a more inventive way than it is presently done?

As stated in the response to your previous question, several experts were involved in the comprehensive identification and study of alternative generation methods presented in the *Supply-Side Resource Option Portfolio Development Final Report*. A copy of this report is available from HELCO for review. In addition, the Integrated Resource Planning process involved both industry and community experts in the development of its Demand-Side Management and resource plans.

Is more fire equipment (than is now available) going to be available on site at the new expansion?

An additional fire protection system is being installed with the project. The fire protection system being added consists of 250,000 gallons of stored water, a sprinkler system, a 2,000-gallons-per-minute (gpm) electric fire pump, a 2,000-gpm backup diesel fire pump, and a 500-gpm brackish water supply pump, all in accordance with guidelines provided by the National Fire Protection Association and HELCO's insurance agent, Industrial Risk Insurers. The plant currently has a fire main and hydrants connected to the County system.

Will fire equipment from the Airport be able to be used if there is a fire?

The manager of the Keahole Airport and County Fire Department would determine whether airport equipment could be used in the event of a fire at the Keahole facility.

Will there be plans for a fire station closer to the facility than the one at Palani Road?

No, there are no plans for a fire station closer to the Keahole facility than the one at Palani Road.

Has the company given any thought to the future of the area, and what a 104-foot stack would mean to a community surrounding the university?

Yes. There is analysis in the Revised Draft EIS of the impacts of a 104-foot high stack on both surrounding properties and vehicles passing by. The facility will be screened with landscaping, and neutral colors, such as an earth tone, will be used for the stack and the buildings.

HELCO owes some respect to the community, and their plans should be compatible to the plans for the whole community instead of worrying if the company will be making a profit so stockholders will get a dividend.

HELCO is making every effort to make the best siting decision for all parties involved by taking into consideration all relevant factors. The purpose for expanding the Keahole plant is to provide needed power to the community by the time it is needed in 1995.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

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October 6, 1993

Department of Land & Natural Resources
Office of Conservation & Environmental Affairs
1151 Punchbowl Street Room 131
Honolulu, Hi. 96813

RE: Revised Draft of Environmental Impact Statement
Keahole Generating Station Exp.
Kailua-Kona, Hawaii

Attention: Don Horiuchi

Dear Mr. Horiuchi,

After studying the Revised Draft of the EIS on the Keahole Generating Station Expansion I am left with unanswered questions especially in the area of safety. As I am a resident in the area of this expansion proposal I am especially concerned about this as well as the use of potable water. The questions are as follows:

1. Why was the alternative sites, technologies and power sources meeting of Thursday Sept. 23rd at the King Kam Hotel in Kona not given advance publicity? It was only in the paper the day of the meeting.

2. Did the above meeting fufill a requisite for a public forum mandated by the IRP, PUC and/or DLNR?

3. There are proposed plans for landscaping around this plant: who will monitor the completion and maintenance of these plans, State, County or why? How do you landscape a 104' smokestack?

4. Water is a precious commodity in Kalaoa at present and especially during a drought. The following are very important questions about HELCO use of water:
   a. How much potable water daily is presently being used by the plant?
   b. How much water will be needed daily on completion of phase I, II and III from the Dept of Water Supply?
   c. How much brackish converted water will be created from the proposed wells? Is this information known at this time?
   d. When a drought of severe propostions comes will the plant still expect the same amount of potable water from DOW in spite of community needs or is there a conservation plan in place in the event of this eventuallity?
   e. Has there been any negotiations with DOW about water needs, the community and the plant, when a drought situation exists?
   f. Bottom line, during a drought who will get the water HELCO or the community?

5. It appears HELCO and Waimana in Kawaihae are in neck to neck race to develop a power plant. Will the construction of the Keahole plant increase our electric bills more than buying power from Waimana? By how much?

6. In view of lower power needs due to unanticipated slowdown in the economy and the coming on line of PGV and Hamakua still producing 10 Megawats of power, why is HELCO still rushing forward with its original plans

without taking into consideration of the above change in power demands?

7. Since the original EIS was written, a contract has been signed by Hawaiian Homes and Waimana in Kawaihae for land to develop and alternative power site. Why after two years has HELCO not been abble to negotiate a contract with Waimana for the purchase of power from them? What evidence is there that HELCO can come on line sooner than the Waimana plant?

8. Why is ethanol not seriously considered an alternative energy source while the sugar industry is still a viable source of this? There is a group on the big island involved in its creation, has there been serious discussions between HELCO and this group about the feasibility of obtaining ethanol from them? What have been the outcome of these discussions?

9. Why is it necessary to retire the Waimea facility by 1995 thereby creating an emergency in power source? Granted the equipment needs upgrading, is one year extension of its use unsafe, dangerous or in some real way impossible?

SAFETY:

1. There will be several 1.5 million gallon fuel storage tanks and extensive battery storage systems on the grounds. In the event of a fuel spill, airplane or helicopter crash, grass fire, earthquake or volcanic eruption and a fire ensues, what is the size and capacity, on site, of the fire extenguisher system?

2. Does HELCO have a policy and proceedure manuel to handle the above disaster possibility until the fire department arrives? Where is this plan and who developed it? Was the fire department involved in its development?

3. What are the dimensions of the buffer zone around the plant after the completion of phase III?

4. What is the specific nature and amount of solid waste created by the plant and how will this be disposed of?

5. What specifically are the hazardous wastes generated by the plant now and what will they be on the completion of phase III? What is the amount to be expected and where will it be disposed of?

6. Where are the present waste waters being discarded? Who monitors this disposal?

7. Different numbers are projected in the EIS for the number of fuel tanker trucks needed to provide fuel to the plant. What is the actual number for phase I, II, and III? Where will these trucks be coming from?

8. The airport intersection where the fuel tanker trucks will enter the plant is eventually to be altered for different egress to the airport. Nevertheless the airport traffic and however many tanker truck plus service vehicles will be turning in front of each other. What are the specific plans to prevent serious accidents in this less than one mile

9. What will HELCO do if it is found by EPA or State Health Dept. the COMBINED smoke emissions, V-O-G and eventually jumbo jet emissions exceed safe air standards? Has a contingency plan been developed of such an senerio occuring? Who will be monitoring this combined atmospheric soup as it occurs uniquely in the Kona basin?

10. What will HELCO do when a storage tank leaks or a spill of any size occurs about the fuel seepage into the ground and eventually reappearing in the ocean? Has there been a contingency plan been made to handle such a possiblility?

Your serious answers to these questions will be greatly appreciated.

Sincerely,

Alice Goo

Alice Goo
73-1444 Ihumoe St.
Kailua-Kona, Hi. 96740

Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Alice Goo
73-1444 Ihumoe St.
Kailua-Kona, HI 96740

Dear Ms. Goo:

Thank you for your October 6, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Why was the alternative sites, technologies, and power sources meeting (September 23 at the King Kamehameha Hotel in Kona) not given advance publicity? Did the meeting fulfill a requisite for a public forum mandated by the IRP, PUC, and/or DLNR?

To the best of our knowledge, no official HELCO meeting took place at the King Kamehameha Hotel in Kona on September 23. However, special meetings to gather public input on HELCO's Integrated Resource Plan (IRP) were held at that location on September 24. Press releases announcing these meetings were distributed by HELCO to newspapers, television stations, and radio stations on the Island of Hawaii. The meetings were informational and not formal public hearings mandated by any agency.

Who will monitor the completion and maintenance of landscape plans? How do you landscape a 104-foot smokestack?

HELCO is willing to have the implementation of a landscape plan, including maintenance of the landscaping, as a condition of its approvals. The Department of Land and Natural Resources (DLNR) would be responsible for monitoring compliance with Conservation District Use Permit conditions.

The stack itself will be painted a neutral color, such as an earth-tone color, to fit into the surrounding environment. Other than a light at the top, the Federal Aviation Administration (FAA) requires no special markings for the stack.

How much potable water is now used daily by the plant?

As stated in the Revised Draft EIS, Volume I, Section 3, page 3-20, the Keahole Generating Station currently uses an average of 20 gallons per minute (gpm) for potable use.

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Why isn't ethanol seriously considered an alternative energy source? Has there been serious discussion between HELCO and the Big Island group involved in this regarding the feasibility of obtaining ethanol? What has been the outcome of these discussions?

The Big Island group has not yet identified a source of ethanol. Although HELCO has had discussions with this group, HELCO believes that ethanol use as a fuel for the Keahole project is not a feasible alternative at this time.

The *Supply-Side Resource Option Portfolio Development Final Report* (Black & Veatch, 1993) compares ethanol and other supply-side resource options. It is estimated that ethanol costs almost 2.5 times more per gallon than diesel fuel. In addition, ethanol has a heat content of 0.0843 million British thermal units (MMBtu)/gallon, whereas diesel has a heat content of 0.1393 MMBtu/gallon. This would mean that almost twice the amount of ethanol would have to be used in place of diesel to obtain an equivalent heat energy output from the combustion turbine. These factors combine to make the cost of ethanol as a fuel for the Keahole facility prohibitive at this time.

Discussions with General Electric (GE), manufacturer of the LM 2500 combustion turbine that is to be installed at Keahole, indicate that use of ethanol as a fuel may be possible; however, extensive design changes to the hardware would be required. These changes would include redesign of the fuel and lubrication systems. Significant design changes would require an extensive testing and evaluation program at GE facilities because of the lack of experience on combustion turbine performance using ethanol fuel. In the absence of such testing, HELCO would incur substantial risk since any mechanical failure would not be covered by the manufacturer's warranty. In the absence of performance data, there would be significant uncertainties regarding the cost and reliability of this fuel/equipment combination. The aforementioned risks and uncertainties cannot be accepted by HELCO or its customers.

Why is it necessary to retire the Waimea facility by 1995? Is a one-year extension of its use unsafe, dangerous, or in some real way impossible?

The Waimea units scheduled to be retired in 1995 were actually scheduled for retirement several years ago. However, Puna Geothermal Venture's (PGV) inability to provide firm capacity until mid-1993 resulted in deferment of these planned retirements. Rather than be retired, these units were operated on a continuous basis to provide baseload generation. This meant that these smaller diesel units were unable to be taken off-line during that time to be properly maintained. In addition, the Waimea units require manned-operation, which increases the units' costs and lowers their efficiency.

With the addition of PGV's baseload power in mid-1993, HELCO has been able to bring several of its units down for maintenance. However, during this maintenance it has become apparent that several of the older units are no longer cost effective to maintain. In addition, this wear and tear has greatly increased the risk of unit malfunction in the future. The three older Waimea units were manufactured during World War II and are currently incapable of operating at their full capacity because the additional stress could cause a breakdown. Given that parts for some of these units are no longer manufactured, the next loss of a unit could result in a longer than necessary repair time as replacement parts are special-ordered, manufactured, and delivered to HELCO. Lengthy repair periods would result in even greater stress on HELCO's generating system, and would greatly increase the likelihood of a repeat of the rolling blackouts that occurred in 1991-92.

HELCO's generation planning criteria require that HELCO still meet the peak demand should the largest available unit fail while another unit is off-line for maintenance. Currently, HELCO is meeting this requirement. However, as demand for electricity grows, and the reserve margin provided by PGV diminishes, HELCO has concluded that it cannot rely on the use of these older units to provide emergency generation over an extended period of time. This loss of adequate reserve margin is anticipated to occur by 1995, well before any known independent power producer can come on-line with replacement capacity.

Although HELCO could defer retirement of these units until they can no longer be operated, without newer replacement generation in the short term, the likelihood of breakdowns in these older units increases, as does the possibility of a repeat of the rolling blackouts experienced in 1991-92. Given HELCO's responsibility to provide reliable service to the public, HELCO has concluded that it cannot assume such a risk, and that the deferred retirement of the Waimea units is neither a reasonable nor a desirable alternative.

What is the size and capacity of the onsite fire extinguisher system?

The fire protection system being added consists of 250,000 gallons of stored water, a sprinkler system, a 2,000-gpm electric fire pump, a 2,000-gpm backup diesel fire pump, and a 500-gpm brackish water supply pump, all in accordance with guidelines provided by the National Fire Protection Association and HELCO's insurance agent, Industrial Risk Insurers. The plant currently has a fire main and hydrants connected to the County system.

Does HELCO have a policy and procedure manual to handle a fuel spill, airplane or helicopter crash, grass fire, earthquake or volcanic eruption and ensuing fire until the fire department arrives? Where is the plan and who developed it? Was the fire department involved in its development?

HELCO does have an Oil Spill Contingency Plan, as required by the 1990 Oil Pollution Act. The pipelines and power plants fall under the jurisdiction of the U.S. Department of Transportation, Research and Special Programs Administration (RSPA) and the U.S. Environmental Protection Agency (EPA), respectively. The plan provides a detailed explanation of the various cleanup techniques that would be employed in the event of a major oil spill.

HELCO does not have a specific procedure for dealing with events such as an airplane crash; such events are catastrophic in nature and do not occur frequently enough to warrant specific procedures. In the unlikely event that such an event would occur, HELCO would respond as directed by the appropriate agency (police, fire, FAA, etc.) with any personnel and/or equipment required. It is important to note that the Keahole facility is not located within either the clear zone or the accident prevention zone for Keahole airport.

What are the dimensions of the buffer zone around the plant after the completion of Phase 3?

At project completion, there will be landscape buffers on all four sides of the completed facility. There is a 50-foot buffer to the west (makai), a 25-foot buffer to the south, a 50-foot buffer to the east (mauka) along the Agricultural Park, and a 15-foot buffer to the north.

What is the specific nature and amount of solid waste created by the plant and how will this be disposed of?

HELCO's construction management consultant, Stone & Webster Engineers (SWEC), estimates that, during the construction phase of the project, approximately 15 cubic yards of construction debris per month will be generated and hauled to the County landfill. During the plant's normal operation, it is anticipated that there will be up to 5 cubic yards per month of solid waste typical of a power plant. HELCO will recycle wastes whenever possible, with the remainder being disposed of at the County landfill.

What specifically are the hazardous wastes generated by the plant now and what will they be on the completion of Phase 3? What is the amount to be expected and where will it be disposed of?

At present, the only hazardous waste at the plant is the used engine oil from the diesel units. This oil is collected and tested for suitability to be burned. The same approach would be taken for any oil-based waste produced from the new CTs. The amount is expected to be less than 200 gallons per month. All other wastes identified as hazardous

would be handled in accordance with State and federal laws. Currently, hazardous waste from the Island of Hawaii is shipped to the U.S. mainland for disposal.

Where are the present waste waters being discarded? Who monitors this disposal?

Wastewater currently generated by the Keahole Generating Station is disposed of through a septic settling basin in accordance with DOH regulations. HELCO monitors this wastewater.

What is the actual number of fuel tanker trucks for Phases 1, 2, and 3? Where will these trucks be coming from?

The number of fuel trucks has been revised and has decreased. This revision is reflected in the Final Revised EIS. For Phases 1 and 2, there will be about three to four trucks per day. The maximum number of trucks anticipated after completion of Phase 3 is seven to eight trucks per day.

Fuel is currently trucked to the Keahole Generating Station from Hilo Harbor via Route 19, through Waimea to the Queen Kaahumanu Highway. This route will remain until 1995, when HELCO expects to be trucking fuel from Kawaihae Harbor. If the fuel cannot be trucked from Kawaihae by the time the proposed unit addition is completed, fuel will continue to be trucked from Hilo.

What are the specific plans to prevent serious accidents involving fuel tanker trucks, service vehicles, and airport traffic in the less than 1 mile area near the airport egress?

The State Department of Transportation (DOT) has undertaken several improvements in the last 2-3 years to increase safety at the airport intersection. These improvements have reduced accidents from approximately eight per year to three within the last year. DOT further intends to install a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway before the end of 1993. In addition, Queen Kaahumanu Highway is currently being master planned by DOT, with further widening and lane channelization proposed.

The installation of a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway would precede Phase 1 of the proposed unit addition to Keahole Station. This improvement, along with the long-term improvements described above, is expected to further mitigate traffic safety problems currently associated with the Keahole Airport intersection. HELCO will coordinate its planning efforts with the DOT Highways Division to ensure that roadway improvements will accommodate fuel tanker trucks.

HELCO's contractors have not experienced any accidents in hauling fuel to the Keahole facility since it began operating in 1974, and HELCO has no reason to believe that the additional fuel tanker traffic to Keahole will cause a traffic hazard.

What will HELCO do if it is found by EPA or the State Health Dept. the combined smoke emissions, vog, and eventually jumbo jet emissions exceed safe air standards? Who will be monitoring this combined atmospheric soup as it occurs uniquely in the Kona basin?

No special or unique interaction is expected with power plant emissions or vog. Concerning the "combined" interaction of various pollutants in the air, we would offer the following comments. The seawater-generated hydrogen chloride ("laze"), which results from lava entering the ocean, and the geothermal hydrogen sulfide are essentially minimal in Kona because of Kona's distance from the sources of these emissions in Puna. The increasing number of automobiles in Kona will increase automotive pollutants in the long run and most likely contribute to a change in Kona's air quality. However, at the present time these impacts are limited to discrete "hot spot" intersections. Limited automotive-related air quality data for the Kona area indicate that levels are currently well below health-based ambient standards.

Power plant emissions will simply be another contributor to ambient pollution levels within the impact area and must comply with health-based ambient standards. They will be chemically different from vog constituents. As these emissions move downwind, some of them will undergo chemical transformation to sulfates and nitrates. Because of dispersion, however, the addition is not likely to be noticeable within the normal variation in vog concentrations.

In summary, "laze" and geothermal emissions do not factor into the air quality of Kona. Automotive emissions will contribute to the overall pollution burden in Kona but have no unique interaction with vog or power plant emissions. Power plant emissions are initially distinct from vog and within health standards, and they will eventually contribute insignificantly to aerosol acidity on a downwind area basis. In terms of potential adverse health effects, vog will continue to be the primary contributor for years to come. Therefore, HELCO has no reasonable basis to believe that there will be any exceedance of the federal or State ambient air quality standards as a result of the expansion at Keahole. Any monitoring of the air quality situation will be conducted through DOH, acting in accordance with EPA.

In the event of a spill or leak, what will HELCO do about the fuel seepage into the ground and eventually reappearing in the ocean? Has a contingency plan been made to handle such a possibility?

A bermed area with an impermeable surface capable of containing the contents of the tank will be constructed around each storage tank. In the event of a leak into the bermed area, the oil would be reclaimed by pumping the oil from the bermed area into a tanker truck. The reclaimed oil will be disposed of in compliance with all applicable State and federal regulations. Because design features, preventive maintenance procedures, and spill containment protocols are in place and will be expanded with the unit addition to the Keahole Generating Station, there will be no fuel seepage into the ground and no impacts to the ocean.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

73-i489 Ihumoe Street
Kailua Kona, Hawaii 96740
October 5, 1993

Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, Hawaii 96813

Attention: Mr. Don Horiuchi

Dear Mr. Horiuchi,

As a concerned citizen, I wish to submit the following comments and questions on the revised draft Environmental Impact Statement on HELCO's proposed Keahole Generating Station expansion.

1. Question on Executive Summary

On page V of volume I,the second to the last paragraph begins, "The proposed project has no significant adverse effects on air quality, geology, plants, animals, archeological resources or property values..."

I suppose the key word in that sentence is "significant". It means different things to different people. For example, to a large corporation like HELCO, airborne contaminants that will damage or destroy the crops of a handful of nearby farmers may not be significant. But, to the farmers who depend on these crops for a living, the adverse effects are very significant. The same thing can be said of people with respiratory illnesses.

The question I want to ask is: if the word "significant" were left out of the sentence quoted above, will the statement still be true?

2. Mechanism for corrective measures for adverse impacts

If the answer to the above question is "no", then what mechanism does HELCO have in place to properly compensate parties adversely affected by the plant expansion? And how will this plan (to compensate damaged parties) affect the rate payers?

3. Table 1-1 (page 1-5)

HELCO's insistence that additional power generating capacity must be increased by the end of 1994 is based on the schedule outlined in Table 1-1 on page 1-5 of volume I. But the accuracy of some of the assumptions made for Table 1-1 is questionable.

A. It assumes annual Peak demand will increase from 157 megawatts in 1993 to 165 megawatts in 1994, then to 177 in 1996, and 184 megawatts in 1997. This assumes growth in demand of 5.1% for 1994, 3.6% for 1995, 3.5% for 1996, and 3.9% for 1997.

Under the present economic conditions, these projections of

growth appear to be highly inflated.

B. It also assumes that HELCO's much heralded demand side management program will reduce the island-wide power demand by only one megawatt for the years 1994 and 1995.

In reading the summary of HELCO's demand side management program on page 2-11, it is plain that HELCO is assuming that only its PUC approved programs will save energy. Other customer-initiated conservation practices such as solar home water heaters also reduce energy use.

In the area where I live, people with solar water heaters typically experience a 50% drop in their electric bills. When one considers that the monthly bills include certain fixed charges, solar water heaters reduce household electric use by more than half. At least this is true in our locality.

Ignoring this source of energy conservation adds to the inaccuracies in Table 1-1.

C. The Hamakua facility

The table assumes that the Hamakua generation plant will stop producing power in 1994. What is the reason for not keeping this unit in service until 1997?

D. Age of units scheduled to be retired in 1995

Kanoelehua D-11, Shipman 1, and Kanoelehua CT-1 are all units scheduled for retirement in 1995. How long have these units been in service? Why can't these units be kept in service until 1997?

E. Why must Waimea D-12 be retired in 1995? Table 1-2 on page 1-6 shows it will be only 25 years old in 1995. The other Waimea units, D-8, D-9, and D-10 will be 41 years old in 1995. Why the difference in retirement ages?

F. The combined capacity of the units mentioned in paragraphs C, D, and E above is 45.15 megawatts. Except for the Hamakua unit, they are all direct-fired diesel units that can be started up in relatively short time.

If these units were to be retained as stand-by reserve units to take care of peak demands until 1997 when Waimana Enterprise's 58 megawatt plant should come on line, won't power shortages be averted, and won't HELCO and its customers save a lot of money (in the vicinity of 95 million dollars) by not having to build a plant that will become redundant spinning reserve capacity after Waimana comes on line?

G. Why are the newer generating units scheduled for retirement after relatively short periods of service? Keahole's D-18 and D-19 will be 25 years old at scheduled retirement. D-20 thru 22 will be only 17 years old. And D-23 will be only 13 years old.

Is HELCO installing progressively inferior equipment? Is the equipment unable to meet emission standards? Is maintenance being neglected? Surely equipment is not being retired prematurely to justify new power plants?

4. The Waimana Plant

Under the heading "Parallel Path Planning" on page 1-8, independent power producers are discussed. It is noted with interest that Waimana Enterprises, Inc has concluded a land lease agreement for their proposed power plant with Hawaiian Homes Commission in July 1993, but that no contractual agreements have been reached between HELCO and Waimana for purchasing power.

In view of the impending dire energy generating shortfall predicted by HELCO in its EIS, and HELCO's professed concern about meeting the public's energy needs, why aren't negotiations progressing more rapidly for purchase of Waimana's power?

Rapid conclusion of negotiations should shorten Waimana's lead time and enable them to begin producing power in time to avert theforecasted energy shortage.

5. The Dr. Greenberg report

On page 3-11 of volume I, the revised draft EIS states that a Dr. Alvin Greenberg of Risk Science Associates of California was contracted to evaluate the potential impacts of SO_2 and NO_x and combinations of these pollutants on orchids. It goes on to state that although Dr. Greenberg was not able to conclusively evaluate the risks of these compounds because of a lack ofdata, he indicated that "modeled results were about 100 to 700 times below the concentrations at which adverse impacts had been reported in literature".

I am unable to find Dr. Greenberg's report in the appendix. Has his report been included in the appendix? If not, why not?

6. The Ogden Environmental and Energy Services report

On page 3-11, the revised draft EIS refers to a literature study made for HELCO by Ogden Environmental and Energy Services on the effects of pollutant gases on plant life, and reports that according to this

study "all concentrations that caused effects... were at least double the projected concentrations, and in most cases they were much more than twice the projected concentrations. This independent review further substantiates the view that federal air quality standards are protective of vegetation".

From my reading of the report from Ogden Environmental and Energy Service which appears as attachment A to the letter from CH2M HILL to the Keahole Agricultural Park Community Association in volume II of the revised draft EIS, I see the following:

The various pollutant gases, sulfur dioxide (SO_2), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2) and particulates, when acting alone in concentrations expected from the expanded generating facility will not damage plants.

However, the second to the last paragraph of the same report says, "Some pollutants can act together to cause plant injury at concentrations lower than those needed with only a single pollutant .... Data regarding combinatory effects of gaseous pollutants indicate that the concentrations needed to induce damage in a variety of species, including flowers, ornamentals and citrus fruit, are below the expected concentration levels ..."

The last statement indicates to me that the various pollutant gases when combined can cause damage to plant life even in concentrations expected from the expanded generating facility.

The exhaust from the turbines will be a mixture of the various products of combustion. Unless HELCO has a way of separating the various gases and discharging them separately and at different times, the gases being discharged from the stack will be a mixture of pollutant gases. Add to this mixture water vapor, which is another component of the products of combustion of diesel fuel, and it is very likely that acids will be emerging from the stack; not pure SO_2 or CO or NO_2.

The Ogden report continues, "The interactions of the various pollutants of concern can be almost infinitely complex, given the number of compounds, varying concentration levels, exposure durations and range of sensitivities of different plant species. It is therefore not possible to guarantee that certain responses will or will not occur in relation to proposed project..."

Then, as if realizing what they were being paid to do, the report concludes, "However, based on a review of the literature available at this time, the typical levels needed for negative effects on plants, and the low levels of projected concentrations, it appears that the agricultural park will not be adversely affected by emissions from the proposed HELCO expansion."

For HELCO to imply from this information that the Ogden report gives their plant a clean bill of health with regards to potential damage to plant life at the agricultural park is stretching the truth.

HELCO's conclusion on page 3-11 should be amended to reflect the truth that emissions from the expanded facility is very likely to damage plant life in the Keahole Agricultural Park.

7. Water allotment

According to information on page 3-20, the new facility will require 90 gpm of potable county water and 160 gpm of brackish water from their well which they propose to purify by reverse osmosis and demineralization processes. This process creates contaminated waste water which HELCO proposes to dispose of by reinjecting into the ground.

According to the revised draft EIS, "The potential impacts to ground-water resources from the operation of a supply well and reinjection well have been evaluated, and no adverse impacts have been identified at this time".

But we all know that sometimes things can go wrong.

If, after the facility is operating, the monitoring program reveals that HELCO's waste water reinjection program is indeed causing undesired changes to the ground water or to the coastal waters off the NELHA facilities, what corrective measures are there that can be taken?

It is the concern of this writer and others that HELCO will propose switching from their brackish wells to the county's potable water supply to solve the problem. Potable water is not abundant in West Hawaii.

If HELCO were to be allocated 250 gpm (90 gpm plus 160 gpm) they will be using 360,000 gallons of water per day, about 48% of the production capacity of the Kalaoa Mauka well. Clearly, this is not a good solution.

Therefore, HELCO should describe in the EIS how it plans to solve this potential problem without using any potable water beyond its 90 gpm allotment.

8. Impact on property values at the Agricultural Park

In the discussion of the project's impact on property values at the top of page 3-75, the second sentence reads, "Because the ground rents are substantially below market rents, it may not be difficult to find a purchaser willing to pay the leaseholder's out-of-pocket expenses or current value for improvements, regardless of the presence of the proposed unit addition".

This statement assumes that potential purchasers will be willing to invest in an agricultural venture even after the seller discloses (as required) that emissions from the nearby plant will damage his crop. Is this a logical assumption? These people have to produce goods that are marketable.

9. Need to protect the agricultural park

The second paragraph on page 3-75 says, "Because there are more than 1000 people on the waiting list for a lease, the proposed unit addition is not expected to affect the demand for agricultural leases at the Keahole Agricultural Park".

The fact that there are so many people on the waiting list indicates a serious shortage of available agricultural land. This shortage reconfirms the need to safeguard agricultural land; not degrade available land through air pollution harmful to crops.

10. Financial Impact on rate payers

The revised draft EIS fails to address the rate increases that HELCO's customers will have to bear to finance this plant expansion. Is this not a topic that should be addressed as it impacts every oneof HELCO's customers?

The impact should be stated in dollars per average household customer per month.

In closing, I wish to thank you for this opportunity to make input to this process.

Yours truly,

Keichi Ikeda

Keichi Ikeda

CC: Office of Environmental Quality Control
HELCO
CH2M HILL
Keahole Defense Coalition
Kona Acres Property Owners' Association
The Public Utilities Commission

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Keichi Ikeda
73-1489 Ihumoe Street
Kailua-Kona, HI 96740

Dear Mr. Ikeda:

Thank you for your October 5, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

If the word "significant" were left out, would the statement "no significant adverse effects on air quality, geology, plants, animals, archeological resources or property values" still be true? If not, what mechanism does HELCO have to properly compensate parties adversely affected by the project? How will such compensation affect ratepayers?

The statement is true without the word "significant." Several studies have been conducted during the EIS process. On the basis of these studies, HELCO and its consultants have concluded that no adverse impacts to the items you listed will occur.

Demand growth projections of Table 1-1 appear highly inflated.

The forecasted annual peak power demand shown in Table 1-1 of the Revised Draft EIS was not based on the population growth estimates contained in Section 3.3.3. HELCO forecasts electrical demand by estimating future peak demand and kilowatt-hour sales from several different perspectives. Final forecasts are selected by the Forecast and Planning Committee (FPC) and can be corroborated by more than one analytical method. Although mathematical trending of historical kilowatt-hour sales data is one form of analysis used in the forecasting process, HELCO does not depend solely on mathematical trending to forecast the future. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place. Following is a description of the forecasting methodology.

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Short-Term Peak Demand Forecasting

Generally, historical monthly morning and evening peak data are used in the short-term peak demand forecasts (e.g., for 1993-98). These forecasts are derived by multiplying the forecasted annual peaks by a morning monthly peak factor and an evening monthly peak factor. These factors are derived from actual monthly morning and evening peaks averaged over the most current 5 years. The system peak forecasts are then analyzed in relation to the energy sales forecasts and the projected load factor, which is the ratio of the average hours of operation to the total annual hours available.

Another major portion of the short-term forecasted increase in demand can be directly attributed to large-scale construction projects currently under way. Such large-scale projects reflect the increasing competition among discount retailers for larger market shares and are not necessarily dependent on tourism or population increases. These projects, all scheduled to come on-line in 1993 and 1994, include:

Kealakehe Sewer Treatment Plant and Pump Station	2,000 kilovolt-amperes (kVA)
COSTCO Pacific Distribution Center	1,500 kVA
Keauhou Shopping Center Phase 2	2,000 kVA
Safeway/ACE/Ben Franklin	1,500 kVA
Lanihau Center Phase 2	4,000 kVA
K-Mart/Queen Liliuokalani Trust	3,000 kVA
Mauna Kea Prince Hotel	2,000 kVA
Royal Vista Golf Course Irrigation Pumps	3,000 kVA

Short-Term Sales Forecasting

Short-term energy sales forecasting at HELCO is performed through analyses of the marketplace: rate schedule analyses, system analyses, market analyses, economic analyses, and customer service analyses.

- Rate schedule analyses consider a spectrum of mathematical analyses of the patterns and trends in the number of customers and kilowatt-hour sales to the individual rate schedules using linear, Box-Jenkins and exponential models, econometric analysis, and other traditional curve-fitting methods.

- System analyses use a number of mathematical analyses and trending techniques of the patterns and trends in total system kilowatt-hours (kWh).

- Market analyses are based on survey analyses of the market conditions influencing the different rate schedules, with special emphasis on customer-by-customer accounting of loads in Large Power Rate Schedule P. Also considered are influences on Residential Schedule R, including new construction outlook, resort development, and government-supported or -sponsored housing.

- Economic analyses include judgmental analyses and considerations of the potential for future economic growth in the HELCO service area, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- Customer service analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month.

The inputs into these analyses are diverse and include such items as personal income, visitor count, population growth, national and state economic conditions, new construction, inflation factors, oil prices, conservation measures, and weather patterns.

Long-Term Sales Forecasting

The long-term sales forecasts for HELCO's electricity sales are the result of econometric equations, developed by HELCO, that relate historical patterns of energy usage to independent economic and weather variables. Care is taken to ensure that as many county-specific data as possible are used, rather than state-wide information. Sources for historical economic data include:

- Department of Business, Economic Development and Tourism's (DBEDT) State Data Book

- DBEDT's Quarterly Statistical and Economic Reports

- County of Hawaii's Department of Research and Development Data Book

- Bank of Hawaii's Annual Report

- Updated data from the Hawaii Visitors Bureau

- National Oceanic and Atmospheric Administration's (NOAA) weather data summaries from the State Department of Land and Natural Resources

The econometric models are validated using statistical tests for:

- Residual autocorrelation (Durbin-Watson Test)
- The goodness of fit (coefficient of determination or R-Squared Value)
- Statistical significance of the independent variables (t-Test)
- Heteroskedasticity of the residuals
- Multicollinearity of the independent variables

In addition, the reasonableness of the relationship between the independent and dependent variables for each model is evaluated.

The results of these models are reasonable predictors of long-term trends. The econometric models are not, however, responsive to rapid changes in the short-term conditions; for this reason, they are not used for the short-term forecasts.

On the other hand, the customer and market analyses described above examine the short term very carefully and are more likely to account for the near-term conditions that drive electricity sales. A combination of the short-term detailed analyses and the long-term econometric model has shown itself to be a reasonable method for projecting sales over a 20-year period. This is generally done by applying the rates of growth resulting from the econometric models to the short-term analyses forecasts.

Effects of Conservation

Potential effects of customer conservation and Demand-Side Management (DSM) activities are also factored into the forecasting process. The extent that customers have practiced load shifting and conservation in the past would be reflected in the historical database. For example, the FPC included 700 kW and 300 megawatt-hour (MWh) peak demand and energy forecast adjustments, respectively, beginning with the 1993 forecasts, for the impact of the Pilot Commercial Lighting Program. As other DSM programs move from the planning to implementation stage, the forecasts will be adjusted to account for the estimated demand and energy savings. However, the precise levels of future conservation and reduction in usage due to DSM programs are difficult to predict because a consumer's personal conservation rate is affected by a number of other factors that are difficult to reliably forecast. These factors include:

- The actions of the city, state, federal, and foreign governments
- Oil prices, which affect electricity prices
- Overall inflation

- Economic factors
- Weather variables
- Public acceptance of new energy-efficient appliances
- Public willingness to make lifestyle choices that encourage conservation

Economic and Population Inputs Used

Economic conditions and their possible influences on forecasted demand are regularly reviewed during deliberation on the forecasts for each rate schedule. The figures contained within Table 1-1 in the Revised Draft EIS were adopted by the HELCO Forecast and Planning Committee in March 1993 and reflect economic and population data up to that time. Concerns regarding the extent and duration of the state-wide economic slump, the drop in Big Island tourism, the eventual closing of Hamakua Sugar, the slowdown of Hilo Coast Processing Company, and the slowdown of new construction were all factored into the methodology. As a result of the state-wide recession and the downturn in new construction, HELCO's near-term kWh sales growth was projected at lower levels than the previous year's projections.

General population growth is but one element of the overall model, and the population figures used in the HELCO models are provided by HELCO. County population estimates included in the 1989 General Plan and the State Department of Business, Economic Development and Tourism population projections Series M-K, developed in 1988, were not used to project the short-term peak demand for 1993 to 1998. For demand forecasts from 1998 to 2010, HELCO used the most recent population and tourism data available and the recommended modifications to the individually metered residential accounts developed by the Consumer Advocate's Office, which were incorporated into HELCO's Integrated Resource Planning proposal. The following table shows the population and visitor census projections used in developing the demand projections shown in Table 1-1 of the Revised Draft EIS.

Population and Visitor Census Projections

	1992 Base and Projections	
Year	**Population**	**Visitors**
1992	129,610	14,718
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874

Source: HELCO Long Term Sales & Peak Forecast March 1993, page 3-65.

The forecasting of system peak demand is more complex than the forecasting of kilowatt-hour sales. In general, peak loads are much more sensitive to changes in weather patterns than to changes in visitor arrivals or population changes. This was evidenced during the prolonged hot and humid weather on Oahu in September 1993. During this period, new high-peak demands were placed on Hawaiian Electric Company, Inc. (HECO) generating equipment, independent of any sudden increases in population or tourism. In addition, the peak demand is much more sensitive to the timing of a major project, such as a hotel, or large commercial use, than is the overall kWh sales forecast. For example, a 2-MW hotel that starts operating in December would contribute only one month of kWh sales, annualized over the entire year. However, the full 2 MW of electrical demand on the system peak would need to be met.

Accuracy of Forecasts

Historically, the FPC's recommendations have been reasonably close to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast. In 1989, the system peak of 130.4 MW was 1.6 MW below the forecast. In 1992, the recorded peak of 150.2 MW was 0.8 MW below the forecast.

The FPC's projection of future growth is frequently revised. In the 1987 forecast, an increase in system peak of 4 MW per year was projected on the basis of slightly pessimistic economic and visitor industry climates. In 1988, this forecast was revised to a 5-MW-per-year increase to reflect improved economic conditions. In 1989 and 1990, the strong influence of Japanese visitors and developers led to forecasts being revised upward to as much as a 9-MW-per-year increase. By 1991, the softened economy, lingering effects of the Persian Gulf War, and the beginning of a downturn in visitor arrivals led to a revision in the 5-year projected growth to only 5.8 MW. Current demand through November 1993 has been approximately 5 MW below the projected 157 MW.

Table 1-1 in the Revised Draft EIS reflects the following growth: 1993, 8 MW; 1994, 6 MW; 1995, 6 MW; 1996, 7 MW; 1997, and 1998, 7 MW. Possible reductions in demand, due to the adoption and implementation of the DSM programs contained in HELCO's proposed Integrated Resource Plan before the Public Utilities Commission (PUC), are incorporated in these forecasts. Some of the specific assumptions in the various HELCO schedules that compose these forecasts include:

- Persistence in the national economic recession
- Dropping of visitor arrivals in second half of 1993
- Further softening in resort condominium sales
- Decline in multi-family construction
- Sliding of 1994 proposed projects into 1995 and 1996
- Impact of Commercial Lighting Program
- Similar weather patterns

Alternative Scenarios

In addition to the demand forecasts presented in Table 1-1 of the Revised Draft EIS, HELCO has also examined alternative scenarios that explore the impact of other events on the peak demand. One such scenario is the possible impact of the Model Energy Code as reflected in the latest update of the Hawaii Building Energy Efficiency Standard developed in 1992 for the Energy Division of DBEDT.

The scope of the Energy Efficiency Standard encompasses the design of new residential and nonresidential construction as well as major renovations. DBEDT estimates the impact of the proposed building standards on electricity demand in the year 2010 for the State of Hawaii to be a cumulative savings of 114 MW and 404 gigawatt-hours (GWh). The breakdown of the savings is estimated to be 51 percent from nonresidential, 8 percent from the nonresidential renovations, and 41 percent from the residential sector. Based on the percentage of total state electricity consumption, the cumulative savings for the Island of Hawaii in the year 2010 are estimated at 10.3 MW and 36.6 GWh. This assumes that Hawaii County's electricity reductions are 7.2 percent of total state savings in nonresidential, 7.2 percent from nonresidential renovations, and 11.8 percent from the residential sector.

The adoption of the Energy Efficiency Standard for Hawaii County requires legislative action on the part of the Hawaii County Council. Currently, an advisory committee is reviewing the Model Energy Code for submittal to the Hawaii County Council. Adoption of the new standards is anticipated by 1995. Following adoption of the standards in their final form, HELCO will factor into its demand forecasts any estimated energy reductions that may result.

Summary

In summary, the peak demand forecasts contained in Table 1-1 reflect conservative, rather than optimistic, assumptions about the level of visitor arrivals and general economic growth for Hawaii County. Population projections are only one of the elements of the overall forecasting model; other elements include such items as weather patterns, conservation efforts, and projects under construction. These projections are frequently reevaluated to maintain accuracy and adequateness of HELCO's planning efforts. State Series M-K and County General Plan population projections are not used in the HELCO demand forecasts reflected in Table 1-1. Short-term projections are based mainly on the historical peak demand data and on the ongoing construction projects for those developments advanced enough in the planning process to be considered "certain." Long-term projections from 1998 to 2010 use population projections developed by the Consumer Advocate's Office for

use in the Integrated Resource Planning process. Appropriate changes have been made to Section 3.3.3 of the Revised Final EIS. This discussion and a summary of the March 1993 Forecast and Planning Committee Meeting have been included in Section 9 of the Revised Final EIS.

Ignoring customer-initiated conservation practices (as evidenced by discussion on Demand-Side Management [DSM]) adds to the inaccuracies in Table 1-1.

We do not share your characterization of Table 1-1 as inaccurate. HELCO has included some measures of future conservation in its forecasting. In addition, as we explained above, current customer-initiated conservation measures are included in the forecasting base and help to shape the future estimated demand. Historically, HELCO's demand forecasts have been reasonably close to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast. In 1989, the system peak of 130.4 MW was 1.6 MW below the forecast. In 1992, the recorded peak of 150.2 MW was 0.8 MW below the forecast.

What is the reason for not keeping the Hamakua plant in service until 1997?

HELCO does not own Hamakua Sugar or the generating units at Hamakua and, therefore, does not control the timing of the Hamakua sugar operations, nor the length of time they will provide power. Hamakua Sugar is scheduled to cease all operations at its plant following the final harvest in 1994. The status of the Hamakua generating units is too uncertain to allow for its inclusion in HELCO's planning process at this time.

How long have Kanoelehua D-11, Shipman 1, and Kanoelehua CT-1 been in service? Why can't they be kept in service until 1997? Why must Waimea D-12 be retired in 1995 at age 25? Other Waimea units to be retired at age 41—why the difference? Why not keep these units as stand-by reserve units until Waimana comes on-line in 1997? Won't this cover peak demands and save a lot of money? Why are newer units scheduled for retirement after relatively short periods of service (D-18 through 23)? Is equipment inferior? Unable to meet emission standards? Is maintenance being neglected? Is equipment being retired prematurely to justify new units?

Kanoelehua D-11 and CT-1 were installed in 1962 and are 31 years old. Shipman 1 was installed in 1943 and is 50 years old. The postponement of retirement of these older generating units will increase the costs of maintenance and the likelihood of equipment failure. Were such a failure to occur, the reserve margin within the HELCO system would not be capable of meeting the forecast demand, and another series of rolling blackouts similar to those that occurred in 1991-92 would most likely occur.

The Waimea units, although of different ages, have become too costly to operate. These units require manned-operation and higher levels of operation and maintenance than newer units. Units 8, 9, and 10 were manufactured during World War II and are more than 40

years old. Their retirement has been postponed because of delays in PGV providing power and delays in constructing new baseload generating facilities in West Hawaii. These units can no longer be operated at full capacity because of their age and condition. Waimea Unit 12 is scheduled for retirement in 1995 at the age of 25 years; this is the normal life of that type of electro-motive diesel. As the Waimea units require manned startups and operation, the resulting higher operating costs and lower efficiency do not make them economically feasible to operate as peaking units.

With regard to the other units (D-18 through D-23), many factors affect the need to retire a generating unit. Violation of HELCO's generation planning criteria reserve margin is evaluated in determining whether or not a HELCO generating unit should be retired. In addition, any one or a combination of the following factors are evaluated:

- Parts availability
- Reliability
- Operations and maintenance expenses
- Environmental concerns

HELCO's generation planning criteria require HELCO to be able to meet the peak demand should the largest available unit fail while another unit is off-line for maintenance. Currently, HELCO can meet this requirement. As demand for electricity grows and the reserve margin diminishes, however, HELCO cannot rely on the use of these older units to provide emergency baseload generation over an extended period of time. This conclusion is true even with the most optimistic appraisal of what HELCO could theoretically achieve through its DSM programs.

The availability of major parts and components of the generating unit is critical in maintaining the generation unit for operations. Units are considered for retirement if parts are not readily available or will take an unreasonable amount of time to be special-ordered, manufactured, and delivered to HELCO. Currently, parts for several of the older diesel units cannot be purchased and must be specially made, which increases the down time of these units for maintenance and repair.

Reliability of the unit must also be taken into account. A generating unit that is constantly out of service reduces the generation reserve margin.

Another factor considered before a unit is retired is its maintenance expenses. Operations and maintenance expenses include fuel efficiency and the cost to keep the unit "available" to meet the dispatcher's needs. Generally, the electro-motive diesels operated by HELCO are more costly to maintain and operate than the combustion turbines, which results in a higher overall kilowatt cost.

The final factor considered is environmental concerns. Several of the diesel units are considered noisy, or they may add to local air quality degradation. HELCO places a priority on replacing such generating units as soon as possible.

In summary, an individual generating unit's retirement rests on many factors, including those items you mention: equipment that is no longer practical, high maintenance, higher emissions, and the need to maintain adequate reserve margins. No units are retired permanently to justify new units. In regard to D-18 through D-23, the 1999 and 2000 retirement years reflect the age of the unit. These units were actually purchased from other users to meet immediate peaking needs in 1983. By their planned retirement dates, these units will be 25-35 years old and at the end of their expected life spans.

Why aren't negotiations with Waimana progressing more rapidly, in view of impending generating shortfall? This would shorten their lead time.

During the time that HELCO has been in discussions with Waimana, a number of legitimate business issues and other considerations have prevented an agreement from being reached. From HELCO's perspective, the issues that have been raised with Waimana, and with other independent power producers (IPPs) as well, are all critical to meeting the needs and protecting the interests of its customers.

Waimana's negotiations with HELCO are only one part of Waimana's overall schedule for developing a generating facility at Kawaihae. Other factors include Waimana's lease with the Department of Hawaiian Home Lands (DHHL), environmental documentation, and obtaining appropriate permits. Thus, "more rapid" negotiations with HELCO would not necessarily shorten Waimana's "lead time" in its development process.

Why wasn't Dr. Greenberg's report included in the appendix?

Dr. Greenberg's studies had not been completed at the time of distribution of the Revised Draft EIS. A copy of the report is included in Section 9 of the Revised Final EIS.

The Ogden Environmental and Energy Services literature review indicates that emissions in combination can damage plant life at expected concentrations. Also, emissions will be acids, not the gases assessed. Interpreting this as a clean bill of health is stretching the truth. The conclusion on page 3-11 should be revised to indicate that emissions are very likely to damage plant life at the Keahole Agricultural Park.

Combinatory gaseous pollutant studies identified in the literature search did not examine pollutant scenarios that are directly applicable to the Agricultural Park. Since completion of the literature search, HELCO has conducted additional air quality studies at the Agricultural Park to examine site-specific issues raised by Agricultural Park residents. These studies are summarized and included in Section 9 of the Revised Final EIS. The *Plume Impact Study*

determined whether emissions from existing operations were reaching the Agricultural Park. The short-term meteorological and air quality data collected indicate that emissions from the existing Keahole generators affect the Agricultural Park less than 1 percent of the time, with impacts well below air quality standards. A review of long-term meteorological data for the area suggests a similar long-term (annual) frequency. The *Acid Aerosol Study* determined that levels of acid aerosols measured in the Agricultural Park were comparable to what is being measured at Captain Cook, roughly 20 miles away. There was no indication of elevated levels which might be attributable to current power plant operations. Additional study of ethylene emissions impact on the Agricultural Park was inconclusive, showing that ethylene emissions from the power plant were not reaching the Agricultural Park. Given these findings, the lack of any vegetation damage directly attributable to the current power plant operations, and the low levels of projected additional pollutant concentrations due to the proposed project, it has been concluded that no adverse effects would occur at the Agricultural Park.

If monitoring reveals that impacts are occurring, what corrective measures are there that can be taken? Switching to County water is a concern because of scarcity of potable water.

Corrective measures, if required, would be based on the results of monitoring. The County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

Why would potential purchasers at the Agricultural Park be willing to invest after the seller discloses (as required) that emissions from the plant will damage crops?

The project will not contribute toxic substances to soil, air, or water. Therefore, damage to crops is not expected to occur and notification to potential buyers would not be required. Demand for the Agricultural Park lots, with below-market lease rents, exceeds supply, and new lessees are expected to acquire Agricultural Park lots as they become available.

Size of the waiting list reconfirms the need to safeguard agricultural land, not degrade it through air pollution harmful to crops.

The project will not contribute toxic substances to soil, air, or water and adverse impacts to agricultural land are not expected to occur. Therefore, the project is not in conflict with the need to safeguard agricultural land.

DEIS should address the rate increases needed to finance the project, stated in dollars per average household customer per month.

PUC Docket No. 7623, regarding HELCO's application for approval of CT-5 and ST-7, estimates the impact to ratepayers to be 1.76 cents per kilowatt-hour in 1998. This information has been included in Section 1 of the Revised Final EIS.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

RECEIVED
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DLNR
OCEA

From: Jim Klieforth
P.O. Box 383857
Waikoloa, HI 96738

To: Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, HI 96813

Dear Sir or Madam,

I would like to comment on the proposed expansion of the power plant at Keahole.

After carefully considering the conditions surrounding this proposal, I can see no justification for proceeding with it. The environmental and economic impacts of this project are overwhelmingly negative and the argument for it's necessity is without merit. Virtually all our power shortfalls for the foreseeable future can be dealt with through Demand Side Management, simple energy conservation programs and new technologies.

I've enclosed an article about one of these technologies which should be of special interest not only to HELCO, but also the State of Hawaii. The installation of usage meters that can be read by a power company every 15 seconds allows for the institution of sliding rates, meaning that a ratepayer can adjust his usage towards the low peak, low cost hours of the day. The result is dramatic reduction of power demand at high peak, making for a grid that has greater stability, flexibility and, in effect, greater capacity. It should be noted that this is achieved with less oil dependency or pollution than exists today, and at a fraction of the cost of the proposed project.

There is an additional aspect of this new technology that makes it an extremely compelling prospect, and that is, the fiber optic cables that link the meters to a power company computer. You've no doubt heard a

great deal of talk about the "information superhighway" that is being developed. While it is too vast a subject for me to address here, it is projected to be a 3 trillion dollar industry within a decade, and will likely change the way we we live. The "information superhighway" is dependent on a fiber optic network for distribution, and the same cables that are run to the aforementioned power usage meters could link Big Island residents to a massive data stream. Connection to this system will be a requirement for all future high tech industries, and the early placement of such a system would be a powerful economic lure for the area.

Needless to say, it would seem short sighted to allow the development of a project as controversial as the Keahole expansion when an intelligent and environmentally benign alternative such as this is available. I urge you to weigh the impact of these two possibilities on our land and our economy before concluding your assessment of HELCO's proposal.

Sincerely,

J. Klieforth

Jim Klieforth

While The Cable And Phone Companies Fight...

Look Who's Wiring the Home Now

BY STEVEN R. RIVKIN

FOR MONTHS GOING ON YEARS, it has seemed certain that the electronic war of the decade would be fought between cable television and the telephone companies. One or the other, people have been saying, will build the new national information superhighway that President Clinton, and just about everyone else, keeps talking about.

Bet on cable, some investors say confidently. The cable companies might not have as much capital, but they are new and nimble, not encumbered by billions of dollars sunk into copper wire. No, other experts say, bet on telcos: the established local telephone companies have billions more to invest, and besides, they'll be able to use all that copper wiring much more efficiently.

As the debate flares, the right answer may well turn out to be a surprise: neither. For there is yet another, barely recognized entrant in the Information Highway Sweepstakes: the country's electric power companies.

The *what*?

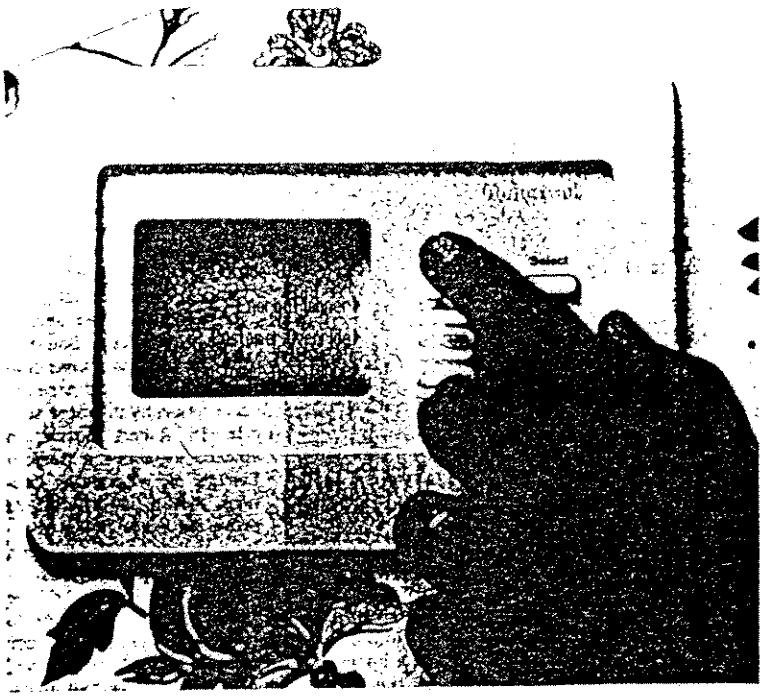
The power companies. They already run their own wires to almost every house and apartment in America. For them to add information-carrying capability to their lines could be cheaper, easier and more socially constructive than for either the cable or phone companies, especially if done in cooperation with the other. To see why, it's necessary only to look at Entergy, a large New Orleans-based electric and gas utility that was driven near bankruptcy by nuclear problems a few years back.

Fifty families in Chenal Valley

Families in Little Rock, Ark., are plugging into a network to save money and get onto the information superhighway.

PHOTOGRAPHS BY ANNE STATES/SABA, FOR THE NEW YORK TIMES

Steven R. Rivkin is a Washington communications lawyer.



The new home computer that helps conserve energy and transmit information.

Ark., near Bill Clinton's hometown, have volunteered to link up their electric service to a computer and telecommunications network with the ability to save considerable energy and money. This Little Rock neighborhood was chosen, in part, because its houses are so big the residents would readily appreciate such savings. And the results will be so beneficial that the power company intends to extend the service to nearly a third of all its customers, more than 440,000 homes in Arkansas, Mississippi and Louisiana. Then it will be able to forgo building any new power plants for at least 20 years.

The advantanges will be so obvious that most other power companies will have good reason to follow suit. With one swift, elegant stroke, companies like Entergy can sharply reduce the future costs of making power at the same time they are capitalizing the cost of building the great information superhighway.

The source of this magic lies in reducing demand and conserving energy. Powerful home computers, linked by fiber-optic cable, will enable consumers and utilities to work together for the first time to accomplish these savings. Enough will be saved in unnecessary generating plants and in monthly utility bills to make the fiber-optic cable practical. And that means that avenues for dozens or hundreds of additional channels will have been created virtually free.

I know a bit about this. I've been practicing communications law in Washington for more than two decades, and I have been urging the power companies for years to get into the great race. Some have paid me for my advice, but, until recently, most of them have done little about it. Some of them have bought into cable TV in a big way — but only to invest in the entertainment business. They haven't fully grasped the enormous potential that the cable itself gives them:

To read meters remotely, instead of sending out the meter reader once a month . . . To conserve energy by charging fees flexibly . . . To save everybody money. Last summer in a paper for the Progressive Policy Institute of the Democratic Leadership Council, Jeremy Rosner and I proposed this as a benign way to pay for Bill Clinton's commitment to build the superhighway. Now, in Chenal Valley, it's about to happen.

One thing new here is the ability to transmit information by laser, or focused light, over fiber-optic cable (thin strands of glass) in close proximity to power lines — or even braided into a power company's copper or aluminum wires. Before now, an electric power line would destroy communications if it was too close.

In Chenal Valley, Entergy uses "fiber to the feeder," that is, new fiber optics from the power company's main computer to the edge of the neighborhood, and TV's coaxial cable from there to the home. Such TV cable is already in place on the street in front of 97 percent of the nation's houses.

The primary objective is to create a telecommunications link to and from everybody's electric meter so that power demands can be adjusted on a moment-to-moment basis. Signals can actually be sent back and forth from the house to the power company every 15 seconds or so. This will enable the power company to reward the customer for shifting electricity consumption from peak times to off-peak times when power plants are often idle. Estimated monthly bills can be called up at any time on the new home computer screen, and at the end of the month the customer will have an itemized running cost of each appliance.

Moreover, as an enormous added bonus, the power company will have built a digital state-of-the-art telecommunications system over which vast amounts of additional information can flow. It's an asset the company can then rent to other providers, like telephone companies (both local and long-distance) and cable TV companies. For starters, Sprint, the feisty long-distance phone company, signed up just last month.

Once the new highway is in place consumers will be able to send or receive vast amounts of information with great speed — transmitting entire, up-to-the-minute electronic encyclopedias, receiving messages worldwide, seeing current movies as well as the full range of cable and network TV, sending out color images, hearing the sounds of La Scala from Milan.

A LOOK AT ENTERGY'S NUMbers tells why, suddenly, while most people weren't looking, the power companies have barged onto the scene. Its subsidiary, Arkansas Power and Light Company, says hitching up its central computer to each house will save it from having to build 1.5 kilowatts of capacity per house. Over 20 years, building and operating that much additional plant would cost $1,257 per house. But it should cost Entergy only about $585 per house to install the telecommunications system, counting in the additional efficiency advantages that technology will enable in both the power and telecommunications businesses. That way the *electric* ratepayer can pay for much of the superhighway, and the sooner the better.

To telephone companies, this outcome is perverse, because the phone companies have been laboring mightily to get permission to charge the *telephone* ratepayer to pay for the highway. Unless they gain access to information and video businesses, phone companies say, they say they will not be able to pay the $300 billion it could cost to modernize for 30 more years. By contrast, in Japan, Nippon Telegraph and Telephone Corporation, the national telephone company, is aiming to install complete fiber networks by the year 2015, with government help likely.

The American companies have been urging Congress to repeal the "telco-cable cross-ownership rule," which bars them from providing cable TV in their home territories. Until the rule is changed, or until the phone companies accept the role of being common carriers for others, state regulators will not require that telephone customers pay for the modernization. And fighting the rule change every step of the way have been newspapers, broadcasters and cable companies, who view the phone companies as potentially dangerous competitors.

Curiously, the power, cable and even the phone companies are working in one way or another with similar designs, though the phone companies are still trying to get the country to pay for modernizing their existing plant at a much greater cost. Entergy has invested in a former Southwestern Bell affiliate — First Pacific Networks — a Silicon Valley manufacturer of telecommunications switching gear. First Pacific has invented, and has installed in Chenal Valley, a way of bypassing a phone company's central exchange, by putting switching intelligence in everybody's house and linking those houses with a bountiful communications network — emulating what small personal-computer networks have done to render the mainframe obsolete. And several American cable and phone companies, hedging their bets, are jointly building similar slimmed-down systems in little-noticed partnerships in England — in one instance using First Pacific's technology.

But Chenal Valley will be the dramatic breakthrough in terms of energy as well as telecommunications. Residential electricity customers in the United States for the most part, pay flat rates for power, averaging between 5 and 8 cents per kilowatt-hour. Participants in the Chenal Valley experiment will pay rates that could range from as low as 4 cents at times of low use to 24 cents at very infrequent peaks in summer. Computers with the feel of automated bank teller machines will be installed in the Chenal Valley homes to help the customers fine-tune their cost and comfort.

Prior tests elsewhere in the country, with more than 1,000 participants using equipment that's less user-friendly have realized savings of up to 33 percent on customers' bills and have won overwhelmingly positive customer reaction. Residential electric bills nationwide totaled about $76 billion in 1991; saving a third of that is no trivial amount.

The trick will be to cajole the telephone and cable companies into joint ventures with the power companies. That way all three and their customers can share in the savings. No grand legislation is needed, only common sense all around. ■

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Jim Klieforth
P.O. Box 383857
Waikoloa, HI 96738

Dear Mr. Klieforth:

Thank you for your letter (received October 4, 1993) concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Virtually all our power shortfalls for the foreseeable future can be dealt with through Demand-Side Management, simple conservation programs, and new technologies.

HELCO disagrees with your position that conservation programs, Demand-Side Management (DSM), and new technologies can deal with the expected energy shortfalls. HELCO has included estimates of energy savings from DSM proposals in its peak demand forecasts (shown in Table 1-1 of the Revised Draft EIS). Even with the inclusion of these savings, reserve margins are anticipated to fall to unacceptable levels by 1995 without additional power generation units. In addition, no new technologies or independent power producers (IPPs) will be available to meet this near-term energy need.

The integration of the DSM savings with the forecast and Integrated Resource Plan (IRP) elements was supported by scenario and sensitivity analyses, which examined optimistic and depressed economic scenarios and IRP sensitivity to a variety of items, including the loss of 25 megawatts (MW) of power from Puna Geothermal Venture (PGV), implementation of an energy tax, different levels of DSM projects, DSM transmission and distribution credits, and externality costs. In all cases, the analyses indicated that HELCO should proceed with CT-4, CT-5, and their conversion to a dual-train combined cycle (DTCC) at Keahole. The timing for CT-5 and the DTCC varied slightly depending on the scenario examined. HELCO's IRP, submitted recently to the Public Utilities Commission (PUC) and entitled *HELCO Resource Integration Plan: 1994-2013*, describes the results of this planning process in detail. HELCO must wait for PUC approval before implementing the elements of the IRP.

HELCO does not consider its work in the development of cost-effective DSM programs to be finished. The recent filing with the PUC was only the first. HELCO plans to continue DSM program development with its customers by convening "focus groups" in various

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DSM areas. HELCO recently had a series of focus group meetings in Hilo to discuss DSM with industry representatives in lighting, water heating, air conditioning and refrigeration, and new construction design. Such meetings will help HELCO find even more effective ways to implement DSM programs for greater energy savings for the Island of Hawaii.

HELCO also evaluated numerous alternative technologies in developing its Integrated Resource Plan. The *Supply-Side Resource Option Portfolio Development Final Report* (Black & Veatch, July 1993) documents this alternative resource assessment. The selection of resource options for HELCO's IRP is based on a screening process, where a large number of potential supply-side options are considered and then screened to eliminate resources that are clearly infeasible and not appropriate for Hawaii or the HELCO system. The screening process is a detailed process with significant input from an advisory group, which was convened to ensure maximum participation from the public sector in the overall IRP process.

HELCO does not assume that intermittent energy sources are not viable. However, HELCO is required by law to use its best efforts to provide electricity when and where it is needed. For planning purposes, electric utilities cannot include intermittent or nondispatchable sources of energy production as assured system generating capacity. HELCO does use electricity from hydroelectric power and wind energy when it is available. To the extent that electricity is available for these sources, it allows HELCO to avoid burning fossil fuels.

Before HELCO undertook its Integrated Resource Planning, the Public Utilities Commission issued a framework for the planning process. One of the governing principles stated in the framework is the consideration of a plan's impact on the utility consumer, environment, culture, community lifestyles, the State's economy, and society. The framework stated that the external costs and benefits should, to the extent possible and feasible, be quantified and expressed in dollar terms. When it is neither possible nor feasible to quantify any cost or benefit, such cost or benefit should be qualitatively measured.

HELCO followed the PUC framework in preparing its IRP and considered externality costs as part of resource evaluation. Monetized externalities were used to assess air emission impacts, and other externalities were assessed qualitatively. Even considering externality costs, the combustion turbine technology was the most cost-effective resource that could provide the amount of generation capacity needed within the required time frame.

In its first cycle of Integrated Resource Planning, HELCO selected a resource plan within the context of short- and long-term resource strategies. For the short term, HELCO selected conventional oil-based technologies because of the costs and uncertainties associated with renewable energy sources. The short-term role for renewable/alternative energy resources, therefore, will continue to be in power purchased from IPPs to the extent that

HELCO's system can feasibly incorporate it. However, no IPPs have plans that can meet the near-term energy shortfall estimated for 1995.

For its long-term resource strategy, HELCO has identified several alternative resource strategies that involve geothermal, renewable, and pumped storage hydropower resources. HELCO's selection of these resources will depend on whether future conditions can sustain them.

Usage meters should be evaluated as an alternative, and linkage of the meters via fiber optics would be a powerful economic lure for the area.

Usage meters are only now being test-marketed in an area outside Atlanta, Georgia. Utilities across the country, including HELCO, are awaiting the test market results. HELCO will examine the results of the pilot testing to determine any transferability to its markets.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

H. Manago Hotel

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HAROLD MANAGO, Manager

November 8, 1993

Editor
West Hawaii Today
P.O. Box 789
Kailua-Kona, Hawaii 96745

Dear Editor,

I've been reading with some amusement recent letters criticizing HELCO for trying to add power to their plant at Keahole.

It seems like the same people who criticized HELCO when the lights kept going off are now criticizing HELCO for trying to keep the lights on.

I also find it somewhat humorous that people are saying that tourists won't like the power plant near the airport. Frankly, I have never talked to a tourist who complained about the existing power plant near the airport. In fact, I haven't talked to many people who even know the plant is there! Generally, I think folks realize that industrial uses of land around airports is common practice. It's not a big deal.

We could argue forever about where to put the power plant, just as has happened with many other projects. Only this time, we better finish the talk in time to get it built as wisely as possible or **WE** (not some faceless development company) will face rolling blackouts again. If adding power at Keahole is what's needed to prevent rolling blackouts, my guess is the "silent majority" of Big Islanders (since not just the people in Kona will be affected) are overwhelmingly in support of it.

Sincerely,

Harold Manago

Harold Manago

Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Harold Manago, Manager
H. Manago Hotel
P.O. Box 145
Captain Cook, HI 96704

Dear Mr. Manago:

Thank you for your November 8, 1993, letter in support of the Keahole Generating Station Expansion. Please feel free to contact us if you have any other comments or questions regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89\071.51

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Mr. Don Horiuchi
Office of Conservation and Environmental Affairs
Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96809

October 7, 1993

Re: Revised Draft EIS for HELCO's Keahole Generating Station

Dear Mr. Horiuchi,

The Revised Draft EIS response to questions about the feasibility of using compact fluorescent lights to reduce peak electricity demand was inadequate. The economic analysis used several assumptions which artificially increased the cost and reduced the analyzed benefit of this alternative.

Specifically, when analyzing the cost/benefit of providing every household one compact fluorescent lamp, Mr. Lymon assumed:

1. 50,000 lamps would be purchased at the full retail cost of $20, with an additional $5 shipping charge for a $25 per bulb cost. Assuming a 40% margin, even the wholesale Hawaii price is most likely closer to $12. 50,000 bulbs is an immense order and it is not unreasonable to assume that 50,000 bulbs could be delivered to Hawaii for $8 each and delivered to each household for an additional $2, thus a total cost of $10 per bulb.

2. Mr. Lymon assumed that an average of 60% of these bulbs are in service over the five years. According to the manufacturers, these bulbs typically last 9,000 hours. If they were used 4 hours per day every day of the year the bulbs would still be likely to last 6.2 years. A 75% use over the whole five years is a more reasonable, but still conservative assumption. (In my residence I have had 8 of these bulbs in service for over six years and they are all still going).

3. Lets accept the remaining assumption, 75% of them being on during peak use and enter the figures in a spreadsheet for comparison. We can also add to the analysis a slight cost decrease for doubling the program to two lights per household, and assume $19 for two lights. The spreadsheet calculations are as follows:

A reconsideration of the cost/benefit of distributing compact fluorescent lights.

	Cost per compact fluorescent	Watts replaced	Percentage in service over 5 years	Number of households	% of lamps on during peak	Peak megawatts saved	Cost per peak megawatt
HELCO EIS	$25	52	60%	$50,000	75%	1.17	$1,068,376
One bulb analysis	$10	52	75%	$50,000	75%	1.46	$341,880
Two bulb analysis	$18	104	75%	$50,000	75%	2.93	$307,692
						Proposed Keahole Expansion	$1,785,714 per megawatt plus op. costs

The above sheet shows the likely cost of a massive compact fluorescent program to be from one fifth to one sixth the of the proposed per megawatt cost. Clearly, the least cost alternative is conservation. The two bulb alternative would result in an immediate reduction of over ten percent of the proposed generation capacity increase.

The interesting conclusion to be drawn is that even with HELCO's assumptions the cost of distributing compact fluorescent lights is less than the capital cost of the proposed generating plant. Adding operational costs will make this option even more appealing. The "thousands of kilowatts" term used by CH2M Hill to describe the savings is more appropriately termed "megawatts". This approach, combined with other efficiency approaches, should be the firs step towards reducing the need for new generation.

The questions to be asked are:

Has HELCO investigated the actual costs of a very large purchase of compact fluorescents?

Has HELCO suggested ways in which it could be compensated through the rate structure for the cost of such a program?

Are there additional cost effective approaches to increase our efficiencies and reduce the demand for more generation?

What are the ongoing costs of operation, including fuel, depreciation, and externalities which should be added to the five year analysis of the generating facility versus the bulbs?

Thank you for the opportunity to comment on the Draft EIS.

Sincerely,

Kelly Moorhead

Kelly Moorhead

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Kelly Moorhead
73-4445 Old Government Road
Kailua-Kona, HI 96740

Dear Mr. Moorhead:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Comments on compact fluorescent light assessment: that HELCO should have assumed $10/bulb and $19/2 bulbs, not $25; 75 percent in-service rather than 60 percent; cost is well below new plant costs.

The $25 cost per compact fluorescent bulb is a figure that is intended to include the cost of the bulb in addition to the costs of administering the program. These costs include expenses related to program planning; advertising, marketing, and education; administration; measurement or evaluation; and shipping, handling, and postage.

The characteristics of the type of compact fluorescent bulb purchased are related to the purchase price. There are less costly lamps available. However, they generally have less desirable features, such as a low power factor and design or size constraints that may limit their applicability and consumer acceptance. HELCO feels that, in order to properly stimulate the Hawaii market, it is imperative that a high-quality product be selected for a program, which translates into a higher cost product.

The percentage of lamps in service after 5 years relates to the number of these lamps actually left in place and not removed by the homeowner, for whatever reason. This percentage is not necessarily directly related to the rated life of the lamps. There are many reasons a homeowner might remove or discontinue using the lamp; for example, personal preferences, inappropriate size, change in home ownership, or the lamps burning out because of inappropriate use. On the basis of these factors, as well as the fact that all 50,000 households are not occupied year round, HELCO believes that the 60 percent figure for lamps left in place for 5 years is reasonable.

Finally, whatever the exact numbers turn out to be, HELCO recognizes that a properly designed and implemented compact fluorescent light program is a cost-effective program to conduct, and HELCO is now conducting a pilot program. The program objectives go beyond immediate kilowatt (kW) savings; they also involve effectively stimulating the compact fluorescent market in Hawaii. Because stimulating the market includes educating retailers as well as consumers, the retailers must be considered in long-range program planning. By leaving out the retailers in a very large program, as you proposed, not only does HELCO dampen the possibilities of a continuing retail trade in compact fluorescent bulbs in Hawaii, but it also faces possible antitrust issues.

Has HELCO investigated the actual costs of a very large purchase of compact fluorescents? Has HELCO suggested ways it could be compensated through the rate structure for the cost of such a program?

Yes, HELCO has recently discussed the possibility of large purchases of compact fluorescent lamps with major lighting distributors. The lamp costs for a large purchase range from $10 to $16 per lamp, depending on what type of lamp is selected and its related characteristics and quality.

HELCO has proposed program cost recovery mechanisms to the Public Utilities Commission (PUC) in the Integrated Resource Plan (IRP) filed on October 15, 1993, in addition to the programs filed earlier. The cost recovery mechanisms related to the already-filed pilot programs have been approved by the PUC. The other program cost recovery and net lost margin mechanisms, as well as a proposal for shareholder incentives, have not yet been approved by the PUC.

Are there additional cost effective approaches to increase our efficiencies and reduce the demand for more generation?

Yes. HELCO has proposed several different approaches to reduce the demand for electricity. These approaches are outlined in HELCO's IRP (filed with the PUC in October). Specific elements of the IRP were described in Section 2.5 of the Revised Draft EIS, pages 9-12. Some of the components included a commercial lighting program, a residential lighting program, a residential water heating program, interruptible rates, and an air conditioning program. In addition, HELCO currently works with resorts and companies to develop ways to reduce electricity consumption, and provides energy awareness programs and materials for teachers and the public.

What are the ongoing costs of operation, including fuel, depreciation, and externalities, which should be added to the 5-year analysis of the generating facility vs. the bulbs?

A comparison of externalities between the proposed generating facility and any Demand-Side Management (DSM) program (including compact fluorescent lamps) cannot be made at this time. Through the Integrated Resource Planning process it is expected that a more thorough review of anticipated costs connected with various program implementation will be conducted. The overall review of the IRP program proposed by HELCO is being conducted now by the PUC.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono ~~Lyman~~
Senior Project Manager

TROPICAL BREEZE ORCHID FARM

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October 7, 1993

Mr. Don Horiuchi
Department of Conservation and
Environmental Affairs
P.O. Box 621
Honolulu, HI 96809

Subject: Comments on Revised Draft Environmental Impact Statement for Keahole Generating Station Expansion by HELCO

Dear Mr. Horiuchi:

After reviewing the Revised Draft EIS, I have the following comments and questions:

HELCO makes the following statements in the Revised Draft EIS (Vol. I, p. v): "The location of the proposed project will create an adverse visual impact," and (Vol. I, p. 5-1) "The exhaust stack and related facilities are not anticipated to have a significant impact on the visual quality of the surrounding area." Which of these statements is true, and why?

(Vol. I, p. iii) "In letters dated July 1 and July 12, 1993, DLNR requested supplemental information regarding recent developments by independent power producers. In order to provide DLNR with the requested information, HELCO is submitting this Revised EIS as a Draft for review." If this document is full disclosure, why did they not mention the letter from the OEQC dated July 30, 1993, which stated, "We would deem the July 1, 1993 letter to be an official rejection of your EIS by DLNR ... If you do not want to appeal the non-acceptance and if you do not want to withdraw the EIS, you may resubmit for acceptance a revised Draft EIS"?

From the study by Cowell & Co., Inc.: "For the purposes of our study we have assumed that emissions from the generating station expansion will not adversely affect animal or plant life at Keahole Ag Park. Based on the foregoing, it is concluded that there will be no impact on property values due to air quality."

Response to Keahole ag Park, p. 5: "Finally, as shown in the PSD application, a stack height of 104' will not contribute in any significant way to existing pollution levels in the Ag Park." Conversely, in response to Natural Energy Laboratory of Hawaii, they said, "New meteorological data are currently being collected at the proposed stack height of 104' for a period of one year, which began in February, 1993." The letter to Keahole Ag Park and the one to the Natural Energy Lab are both dated 6/21/93. This means that HELCO does not yet have the scientific data to back up the statement to the Ag Park that they made saying "a stack height of 104' will not contribute in any significant way to existing pollution levels in the Ag Park." Therefore, it is not a true statement.

Jim Russell, P.E., Mechanical Engineer, said, "Existing pollution levels is not a criteria to go by. It should be tested in areas that aren't already being supplied by pollution from diesel generators and a combustion turbine generator. Existing pollution levels are not satisfactory to clean air within one mile either side of this range. That's what it should be based on. Not the fact that we're already polluting the air, and we're not going to make it any worse."

(Vol. I, p. 3-70) "The agricultural park lots were developed primarily for agricultural use. Industrial projects of this type typically have less effect on the value of properties used primarily for agricultural purposes than on properties used primarily for residential purposes." Is this still true if the emissions damage the crops?

HELCO did not address my concerns in DEIS Vol. II, p. 3-11, "Post-construction air quality monitoring will be performed continuously for one year after the initial start up." This is too late. By that time the Ag Park could be destroyed. After the fact is too late. Why can't these long-term studies be made now to prevent any problems such as this?

HELCO has failed to address emissions (pollutants) as unresolved issues. (See p. 6-1.) However, they do not have the data to show that there will be none. Up to now, everything has been assumed.

The Ag Park is already experiencing "fallout" problems from the existing generators. But, as usual, the burden of proof has been left to the individuals. Why are some of the palms and plants around the existing Keahole Plant dead or dying?

(Response letter to Keahole Ag Park, p. 3, Impacts to Vegetation.) "The air quality analysis indicates that the location where the proposed project will cause the greatest reduction in air quality is approximately .4 miles northeast of the Keahole facility. No exceedances of applicable federal and state standards or allowable pollutant levels are projected to occur at this location." The Keahole Ag Park is south of the proposed project. Therefore, impacts to the area will be less than those to the northeast of the project, where the impacts will not be significant."

At the Keahole Ag Park Community Association Meeting on June 1, 1993, CH^2M Hill put up a chart that showed the winds blowing northeast. There is some discrepancy with that, because I recorded north to south winds on October 1, 2, 3, and 5, in the daytime.

Also see FEIS Revised Acoustic Study of Potential Noise Impacts Associated with the Proposed Expansion of the Keahole Generating Station prepared by Y. Ebisee & Assoc., p. 31, "The meteorological conditions generally become unfavorable (cool ground cover, cooler air, and north winds during the night ..."

DEIS states that air quality monitors are .8 miles and in Kealakekua and in Waiakea. Are these adequate and accurate? What is the basis of the computer model, assumptions, etc.? Will there be synergistic effects with VOG & POLLUTION?

Also see comments from Clare Hachmuth Natural Energy Laboratory of Hawaii, p. 3, "2) The wind rose, Figure 3-1 on p. 3-2, should indicate the data source and time period upon which it is based. We are surprised that the data differ significantly from wind measurements downslope at NELHA."

FEIS, p. 3-1, "HELCO has operated air quality monitoring station approximately .8 miles southeast of Keahole Generating Station." I question this location because at the Keahole Ag Park Association Meeting June 1, 1993, HELCO said the monitoring station is in Kona Palisades. In either case, it is not in the Ag Park where the most adverse effects are likely to occur.

(Response to Keahole Ag Park, p. 4,) Kanoelehua Generating Plant — "Although there have been allegations of pitting on automobile finishes at dealerships adjacent to the Kanoelehua facility, no cause and effect relationship has been established between Kanoelehua emissions and the alleged damage. Kanoelehua is in compliance with all federal and state emissions and air quality requirements. There are a variety of other emission sources in the area that may be associated with these allegations." This is exactly the point. This dispute will go on for years costing the dealerships many hours, lots of money and aggravation. Look where the burden of proof lies. Not with HELCO, but with the car dealerships. Is

that what you are going to allow at Keahole? Accept this glossed-over EIS without substantiating the facts. Then when it is built, if it destroys the Ag Park, the burden of proof will be on the Ag Park. Something is very wrong if this is the way our system works.

The Ogden Environmental and Energy Services review says that "some pollutants can act together to cause plant injury at concentrations lower than those needed with only a single pollutant. In this way the chemical entities are set to act in an additive or synergistic manner. Data regarding combinatory effects of gaseous pollutants indicate that the concentrations needed to induce damage in a variety of species, including flowers, ornamentals and citrus fruit are below the expected concentration levels."

P. 3-20, "The project will generate an average of 128,000 gallons of wastewater per day (89 gpm)."

90 gpm of potable water plus 160 gpm brackish water = 250 gpm.
(250 gal/min) (60 min/hr) (24 hr/day) = 360,000 gallons per day.

If there is only 128,000 gallons of wastewater generated per day, what happens to the other 232,000 gallons per day?

If this is evaporated with the Sulfur Dioxides, doesn't this combine to produce sulfuric and sulfurous acids? The emissions then are acids rather than gases that were addressed in Ogden's report on the effects of emissions on plants.

PROPERTY VALUES

(Vol. I, p. 3-70) "The project is not expected to adversely affect property values at the Keahole Agricultural Park. What local realtors, developers, lenders, appraisers were consulted to determine this conclusion?

Re: Cowell & Co., Inc., the Real Estate Consultants' Counseling Study Regarding the Anticipated Effect of the Proposed Keahole Generating Station Unit Addition on the Market Value of Keahole Ag Park Lots.

Since the subject matter is the Market Value, why wasn't the value of the crops included in the study? That is the crux of the matter.

Does the State Department of Agriculture "rules" on transfer have any legal effect since the "rules" and statutes were established after most of the leases were made? Can the State legally withhold consent to a transfer based on "anti-speculation rules" now?

HRS 171-36 (5) (E) is also applicable to leases signed after the effective date of the law re: improvement value and consideration for assignments.

(Vol. I, p. 3-92) "HELCO recommends that future land development for residential use adjacent to the station be discouraged; that development of commercial, industrial or other less noise sensitive uses be encouraged; and that adequate disclosure of the expected noise levels from Keahole Generating Station be provided in all real estate transactions and rental or lease agreements involving lands near the station?

How can HELCO make this statement and at the same time plan no mitigation measures for existing residents?

WATER

(Response to Mr. Keith Ahue, Chairperson, DLNR, June 21, 1993) "The water supply for the proposed Keahole Generating Station expansion will be provided from two sources: the County of Hawaii Department of Water Supply and an onsite nonpotable supply well tapping a brackish aquifer. The County currently provides 20 gallons per minute (gpm) to HELCO for operation of the existing combustion turbine and related facilities. The County has indicated it will increase its supply of County water to HELCO to an average rate of 90 gpm, which will be used to operate the proposed addition of the first 20-MW combustion turbine."

(90 gal/min) (60 min/hr) (24 hr/day) = 129,600 gal/day potable water)

Comparison with capacity of Kalaoa Mauka well - #4358-01, which is one of the best wells in the area. Capacity of well = .7 million gal/day = 700,000 gallons per day. (From Table 1, p. 12, Appendix C of DEIS, Vol. II.)

The proposed power plant's water requirement is equal to 129,000/700,000 = .1851 or 18-1/2% of the Kalaoa Mauka well's production capability. While it is understood that the Keahole Station's water requirements are not going to be supplied from the Kalaoa Mauka well, this calculation shows the enormity of the proposed plant's potable water requirements as compared to the production capacity of an entire well.

(Letter from William W. Paty, Chairperson, DLNR, Jan. 21, 1993): "Division of Water and Land Development is to conduct a water management plan for this area to identify land uses, sustainable yield and demand. The proposed plant will require water use and would appear to be premature without this study."

(Response to Mr. Keith Ahue, Chairperson, DLNR, June 21, 1993) "The volume (of water) to be supplied by the County is relatively small, in terms of regional demand ... the proposed project will not adversely affect regional water resources."

How can this statement be true when the area goes on water rationing frequently? Building permits have been denied due to water shortage.

The county has said it will provide 129,600 gallons of potable water per day. Please identify the source and details of any water source agreement.

In light of limited supplies and transmission facilities, why is HELCO being given commitments for water as stated? What rule, statute, document is the basis for this commitment?

Is the county going to allow HELCO to use the potable water to burn fossil fuel while restricting the use of the homeowners from watering their plants which supply oxygen?

FIRE

(Vol. I, p. 3-94) "The fire/service water tanks can be replenished from the brackish supply well in 8 hours." Isn't this an awfully long time when you are talking about this type of fire, and also given the fact that very dry grass surrounds the plant?

FUEL HANDLING

What does "training of employees" include and what emergency plan is proposed specifically? Was there any Civil Defense input? There is no indication that the Civil Defense Agency was consulted. Also, in regard to air quality and emergencies, etc. There appears to be no consultation with Civil Defense or Fire Department. Why?

NOISE

In your response letter to Yukio Kitagawa, Chairperson, D.O.A., "When feasible, prior notice will be given to nearby residents of anticipated, but unavoidable, temporary loud noise events." Has HELCO given notice to date of the existing temporary loud noise events?

(Vol. I, 3-81) "Note (c) states that the allowable noise level limits applied at the boundary between, for example, agricultural and residential uses shall be the higher limit (i.e., agricultural limit) if the agricultural operations were initiated before the building permit was obtained for the residence."

Does this mean that HELCO does not care about the well being of the residents?

(Response to Keahole Ag Park, p. 2, Predominant Background Noise.) "At Site Z (Figure 3-31 of the Draft EIS) when the generating station was operating, the louder noise events and dominant noise sources were associated with aircraft operations at Keahole Airport. Many factors, including topographical features and existing buildings that provide shielding, and timing of noise events, determine what the dominant noise sources are at each receiver." This is exactly the point. Look at Figure 3-31 of the DEIS and see where the noise levels were recorded. Why aren't noise levels being recorded throughout the Ag Park?

"The addition of the 56-MW unit will enable HELCO to reduce the operation of the noisier diesel units." When, and by whose authority?

BATTERY STORAGE

Is there a reason why no safety measures have been addressed for the battery storage building? How many batteries does it take to generate 10 MW of energy? How dangerous is it?

WASTEWATER

(Letter from Harold S. Masumoto, Office of State Planning, Jan. 22, 1993) "We recommend that the applicant develop or participate in a water quality monitoring program to ensure maintenance of the State's water quality standards and develop a mitigation plan in the event that the water quality standards are exceeded."

"The Natural Energy Laboratory of Hawaii Authority, located at Keahole Point directly makai of the proposed expansion site, depends on pristine water quality for its research and business ventures."

Isn't it possible that the NELH could suffer from wastewater below the water quality standards since they must have pristine water quality?

If a water quality monitoring program is developed, isn't it possible that if wastewater affects OTEC business it will be too late and then the burden of proof will be on them and not HELCO (such as the case in Hilo with the new car dealers)?

Is it significant that the lava tubes in the area run in the direction of NELHA?

COUNTY ZONING

If county land use approvals are not required because county zoning does not apply, why is the County General Plan cited for support? And, if the County General Plan is relevant, shouldn't all parts and elements be cited, including the provisions relating to scenic view regulations?

VISUAL

(Vol. I, p. v.) "A landscape mitigation plan is being developed which will include a vegetative buffer around the perimeter of the site." What guarantee is there of this promise? Look at the existing landscape.

The 1988 CDU Application was supposed to be the last time for HELCO at Keahole. What evidence is there that the Kawaihae site could or could not have been used via an IPP and why did HELCO feel it and not an IPP had to build at Kawaihae?

HELCO tried unsuccessfully to acquire a lease from HHL at Kawaihae. Why now are they stalling in negotiations with Maimana who has acquired a lease at that location? What has HELCO done to use Kawaihae via an Independent Power Producer — negotiations, etc.? Or are they stalling because that would mean they would have to purchase power from an IPP?

Need Forecast — When was the need forecast and population trend first identified for West Hawaii's increase and what specific plans were taken re: the same?

Flora — Char & Associates did a botanical study that failed to reveal the naupaka plant. Is this report accurate?

Integrated Resource Planning (Vol. I, p. 6-1) "HELCO will submit a 5-year action plan to the P,.U.C. in September, 1993." Has this been done? Will it be part of the Final EIS's full disclosure?

RE: Full Disclosure — would you please include in the final EIS detailed permits submitted to any and all government agencies related to this project?

(Vol. I, p. iv) "Together these components will constitute a 56 MN (net or 58 MW gross). What does this mean?

Who is the accepting authority for the EIS and under what statute or rules was DLNR designated?

(Response letter to Yukio Kitagawa, Chairperson, D.O.A., page 2) "This independent review further substantiates the view that federal air quality standards are protective of vegetation."

What about the generators in Hilo that are pitting the car paint on the new cars?

Same letter, p. 2 — "HELCO is also encouraging the same consideration of a buffer zone for the land immediately adjacent to the generating station on the north and east."

After the proposed build-out, will there be a buffer left between the plant and the Ag Park? If not, why not?

(Vol. I, p. 4-12) "Agricultural Lands of Importance to the State of Hawaii." "The U.S.D.A. Conservation Service has classified the agricultural lands of the Hawaiian Islands. The area of the proposed project is not designated for agriculture nor is the project area designated as Prime Agricultural Land according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) classification."

Why then did the State of Hawaii put a 179-acre agricultural park in this location?

The relatively young industry of Dendrobium Orchids is an $8 million-per-year industry. Of approximately 80 to 90 acres of dendrobiums in the state, 25 of these acres are in the Keahole Ag Park. The reason is that this is one of the best locations in the state to grow dendrobiums due to climate and drainage.

(Response to Mr. Keith Ahue, Chairperson, DLNR, June 21, 1993) "HELCO expects to experience a potential loss of 52.1 MW of power during the next two years as a result of delays in the delivery of geothermal power, loss of power supply by Hamakua Sugar Co., and has no alternative but to develop immediate, additional capacity to meet current demand and reserve capacity requirements."

We know Hamakua and PGV are on line now. What is the firm capacity for PGV? Can it provide 20 MW+ now to cover short-term needs? What effect would there be on this proposal if PGV can do so? Why is PGV now viewed negatively despite all the early hoopla by HIGA?

(Vol. 1, p. v) "The projected time frame for these IPP projects, however, does not address the immediate generating requirements identified by HELCO's resource plan."

Isn't the EIS supposed to be full disclosure? Why aren't the immediate generating needs being identified?

Please note in all letters and resolutions in the EIS that are in favor of the Keahole generating expansion, the reason for this is because of their understanding that there is a "near term generating capacity shortfall."

However, according to HEI and HECO's own 1992 annual report that is filed with the U.S. Securities and Exchange Commission, we are not under a threat of rolling blackouts with Hamakua on line. At the time of this report PGV was not on line. Does this mean that PGV is reserve power?

(Vol. I, p. v) "The proposed project has no significant adverse effects on air quality, geology, plants, animals, archaeological resources or property values." "In addition, no adverse noise or traffic impacts are anticipated from the proposed expansion of the existing facilities."

Is it O.K. for HELCO to represent this as the truth when there are so many unresolved issues? EIS laws require that the DEIS summarize unresolved issues and provide:

"Either a discussion of how such issues will be resolved prior to the commencement of the action or what overriding reasons there are to proceed without resolving the problems ... " (Section II - 200-17 [n])

Shouldn't these issues have been provided in the DEIS for public and agency review and if omitted, shouldn't these issues have been addressed as an unresolved issue pursuant to Section II-200-17 [n]?

What is the rationale for the determination that air quality, property values, water, noise, traffic need not be addressed as unresolved issues in the DEIS?

If HELCO is truly concerned with the Big Island having electricity, why are they refusing to negotiate with Waimana to purchase power from them? There is a PUC Rule #6-74-15(a) that states if they cannot reach an agreement within 75 days the utility shall file a petition to the PUC asking that the PUC conduct a hearing on the matter. Waimana started the negotiations July 1991 and to this day HELCO has turned a deaf ear.

Also when HELCO wanted to build a power plant in Kawaihae, they ran a one-year study on air data which is required for the permitting process. Was this cost passed on to the consumers? If so, why wasn't the information turned over to Waimana when they requested to buy it? HELCO said it was proprietary information. Is it? If Waimana had had the information they would have been able to be on line by the end of 1995.

Do you think that HELCO's real reason for the Keahole expansion is to enable them to produce their own power instead of having to purchase power from an independent power producer?

Is it true that if HELCO is allowed to expand Keahole first, Waimana will not be built — or vice versa, if Waimana is built first, then the Keahole expansion won't happen?

All things added up indicate that, in fact, HELCO needs the Keahole expansion to put more almighty dollars in HELCO's pocket.

Sincerely,

Peggy Ratliff

Peggy Ratliff

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Peggy Ratliff
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Dear Ms. Ratliff:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

"The . . . project will create an adverse visual impact"; "The . . . [project is] not anticipated to have a significant impact on the visual quality of the surrounding area." Which statement is true, and why?

The perceived inconsistencies in statements about the nature of visual resource impacts in the Revised Draft EIS have been corrected in the Revised Final EIS. Visual impacts are expected to be adverse, but not significant. This is because the unit addition would not alter the dominance of the Keahole facility within the viewsheds analyzed. As discussed in Section 3.3.4 in the Revised Draft EIS, the existing facility is characterized as being codominant from two viewpoints, subordinate from one viewpoint, and dominant from two viewpoints. Dominant, codominant, and subordinate are defined as follows:

- Dominant — The viewer's attention will be focused on the facility.
- Codominant — The viewer's attention will be divided among other features in the landscape of equal interest to the viewer.
- Subordinate — The facility will constitute a minor component of the landscape. The viewer will not be aware of the presence of the facility unless specifically looking for the facility.

The analysis of visual impacts concluded that the dominance of the facility with the proposed unit addition would not change significantly over existing conditions. If the proposed facility's dominance were expected to increase from subordinate to codominant or dominant, or from codominant to dominant, a determination that the impact would be significant would have been made.

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If the EIS is full disclosure, why wasn't the July 30, 1993, OEQC letter mentioned?

The referenced Office of Environmental Quality Control (OEQC) letter was administrative in nature and was not required to be included in the Revised Draft EIS. We have included it as an attachment to this letter for your use.

Cowell & Co., Inc., assumes no adverse impact from emissions, therefore no impact on property values.

The assumption made by Cowell & Co., Inc., that emissions will not adversely affect animal or plant life is an appropriate and valid one. A real estate appraiser must rely on the professional expertise of scientists for the assessment of environmental impacts. In this case, technical expertise, in the form of air quality standards, has been provided by scientists in the U.S. Environmental Protection Agency (EPA) and the Hawaii State Department of Health (DOH).

As explained in our June 21, 1993, letter to you, federal Primary Air Quality Standards are based on protection of human health. Federal Secondary Air Quality Standards (which, in most cases, are no less stringent than the primary standards) are based on human "welfare," which includes such considerations as impacts to vegetation, animals, visibility, and comfort. On the basis of the air quality modeling, which indicates that primary and secondary air quality standards will not be exceeded, HELCO has concluded that no significant impacts to vegetation will occur.

Modeling has demonstrated that federal Primary and Secondary Air Quality Standards will not be exceeded at the Agricultural Park. To further support the conclusion of no adverse impact at the Agricultural Park, the air quality analysis demonstrated that the location where the proposed project will cause the greatest reduction in air quality is approximately 0.4 mile northeast of the Keahole facility (no exceedances of applicable federal and State standards or allowable pollutant levels are projected to occur at this location). The Keahole Agricultural Park is south of the proposed project. Therefore, impacts to this area will be less than those to the area northeast of the project, where the impacts will not be significant.

Response to Keahole Agricultural Park says PSD shows no impacts, but response to NELHA says data are being collected. Therefore, first statement can't be true.

The statement you referenced from the response to Keahole Agricultural Park is true. The results of the modeling, which are provided in the Prevention of Significant Deterioration (PSD) application, show that a stack height of 104 feet will not contribute in any significant way to existing pollution levels in the Agricultural Park. The modeling was based on data collected at a height of 33 feet, to allow modeling of existing sources at the generating station as well as the proposed unit addition. The model, developed by the EPA, contains a formula that extrapolates meteorological data to the height of the proposed source. The

model was developed for use in support of permit application reviews and, like most regulatory support models, is conservative because it will overestimate rather than underestimate impacts.

The statement you referenced from the response to the Natural Energy Laboratory of Hawaii Authority (NELHA), that new meteorological data are currently being collected, is also true. However, you did not cite the complete context for the statement, which would explain why you concluded that the two responses are inconsistent. As explained in the next sentence in the response to NELHA, the new monitoring data, collected at a height of 104 feet, are being collected to confirm that there are no significant differences between the two sets of data that would affect predicted ground-level pollutant concentrations.

Existing pollution levels should not be criteria; should look at clean air.

With regard to your quote from Mr. Russell, we acknowledge his and your disagreement with the accepted method for analyzing air quality impacts. However, HELCO is obligated to follow federal regulatory requirements for collecting and analyzing data as part of the PSD permitting process.

Industrial projects have less effect on properties primarily used for agriculture than for residential purposes. Is this true if emissions damage crops?

Emissions from the proposed unit addition are not expected to affect the Agricultural Park because of the stack height and plume rise.

Post-construction monitoring is too late. Why not do studies now?

HELCO has conducted studies within the Agricultural Park in order to determine whether the park is impacted by a plume from the generating station. The studies indicated that the Agricultural Park is not at risk. These studies are included in Section 9 of the Revised Final EIS. At present, meteorological data are being collected for a period of one year at the Keahole Generating Station, and the PSD application is being reviewed by federal and State agencies. Typically, the review of the PSD application is extensive and takes up to 18 months to complete.

Your previous comment regarding post-construction monitoring was addressed on page 5 of CH2M HILL's June 21, 1993, letter to you. We understand your comment to indicate that you believe the post-construction monitoring is intended to determine whether there are "any problems." As we explained in our previous response, the purpose of the monitoring is to understand the relationship between the modeled predictions and the monitored results. The modeling is very conservative; the monitoring would, in all likelihood, confirm that pollutant levels are lower than predicted.

HELCO has failed to address emissions (pollutants) as unresolved issues. Everything is assumed.

Emissions are not defined as an unresolved issue because data on project emissions are available from equipment manufacturers, who guarantee that their equipment will not exceed specified maximum emission rates. These data are provided in Table 3-3 of the Revised Draft EIS. An analysis of emissions impacts was conducted using EPA guideline dispersion models ISCST2 and COMPLEXI.

Additional emissions analyses were also performed that were targeted specifically at impacts to vegetation at the Agricultural Park. These studies are included in Section 9 of the Revised Final EIS. No significant adverse impact could be ascertained as a result of the potential emissions. However, because HELCO is continuing to discuss the results of these studies with the Department of Agriculture, the Agricultural Park residents, and independent reviewers, the clarification of these results to the satisfaction of all involved remains an unresolved issue.

The Agricultural Park is already experiencing "fallout" problems from existing generators. Why are some of the palms and plants around the existing station dead or dying?

A malfunction in the irrigation system, which was not immediately detected, led to insufficient watering of the landscape vegetation at the Keahole Generating Station. A new drip irrigation system will be installed with the proposed addition. Emissions are not predicted to affect the vegetation or productivity of the Keahole Agricultural Park. HELCO has not received any complaint concerning "fallout."

Discrepancy with wind data presented vs. observed and at NELH.

The statement you refer to, which was on page 3 of CH2M HILL's response letter to the Keahole Agricultural Park, was not intended to imply that wind blew only toward the northeast. The air quality analysis considers pollutant concentrations in all directions. This analysis is based on wind data (speed and direction) collected over a full year, as well as on ambient temperature, topographic analysis, and other factors that affect atmospheric stability.

Are air quality monitors at 0.8 mile, Kealakekua, and Waiakea adequate and accurate?

Yes. DOH concluded that data from the air quality monitors are adequate for purposes of determining the background concentrations from existing facilities and sources not included in the modeling. The air quality monitoring stations meet all DOH and EPA requirements for accuracy, and they use quality assurance procedures that require regularly scheduled equipment checks and calibrations.

What is the basis of the computer model, assumptions, etc.?

All air quality modeling was performed in accordance with EPA guidance. A description of the modeling used in the air quality analysis, taken from the Keahole PSD permit application, is attached.

Will there be synergistic effects with vog and pollution?

No special or unique interaction is expected with power plant emissions and vog or emissions from cars and geothermal activities.

Vog is primarily an acid aerosol composed of fine particles made up of sulfuric acid and its neutralization products. In addition, when lava flows into the ocean, its interaction with seawater results in the generation of hydrogen chloride at rather high concentrations in the immediate vicinity.

These emissions differ from those of automobiles, geothermal production, and the power plant. Emissions from cars consist primarily of carbon monoxide, nitrogen oxides, and hydrocarbons with lesser amounts of particulate matter and very small amounts of sulfur oxides. The principal pollutant associated with geothermal emissions is hydrogen sulfide. Emissions from the power plant include particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and hydrocarbons, all of which (except hydrocarbons) must meet health-based ambient air quality standards.

Concerning the interaction of these various pollutants, we would offer the following comments. The seawater-generated hydrogen chloride ("laze") and the geothermal hydrogen sulfide are essentially minimal to Kona due to the distance from the sources. Increasing automotive pollutants will contribute, in the long run, to a change in Kona's air quality, but at the present are limited to discrete "hot spot" intersections. Limited automotive-related air quality data for the Kona area indicate that levels are currently well below health-based ambient standards.

Power plant emissions will simply be another contributor to ambient pollution levels within the impact area and must comply with health-based ambient standards. They will be chemically different from vog constituents. As these emissions move downwind, some of them will undergo chemical transformation to sulfates and nitrates. Because of dispersion, however, the addition is not likely to be noticeable within the normal variation in vog concentrations.

In summary, "laze" and geothermal emissions do not factor into the air quality of Kona. Automotive emissions will contribute to the overall pollution burden in Kona but have no unique interaction with vog or power plant emissions. Power plant emissions are initially distinct from vog and within health standards, and they will eventually contribute

insignificantly to aerosol acidity on a downwind area basis. In terms of potential adverse health effects, vog will continue to be the primary contributor for years to come.

Wind rose (Figure 3-1) should indicate the data source and time period upon which it is based.

Background meteorological data were collected for the Keahole site from February 1984 through January 1985 at an air quality monitoring site located in Kona Palisades, 0.8 mile southeast of the Keahole Generating Station. A wind rose of these data is presented in Figure 1-3, Revised Draft EIS, Volume 1, Section 3. In addition, onsite meteorological data are currently being collected for a period of one year.

Is HELCO monitoring station 0.8 mile southeast of the station or at Kona Palisades? It should be in the Agricultural Park.

The air quality monitoring station is 0.8 mile southeast of Keahole Generating Station in Kona Palisades. HELCO established a monitoring station in the Agricultural Park as part of short-term studies to evaluate potential impacts on Agricultural Park properties. These studies and a summary of the results are included in Section 9 of the Revised Final EIS.

If there are problems with the project, the burden of proof will be on the Agricultural Park. This is wrong.

The federal and State standards for air quality are designed to prevent impacts from occurring. The PSD application includes consideration of other pollutant sources and the cumulative impacts of these sources. Agency review of the PSD application will include an evaluation of HELCO's ability to comply with these standards, but it will ultimately be HELCO's responsibility to demonstrate compliance with these standards once the unit addition is operating.

If significant unmitigable problems with the proposed project are identified before construction, a permit will not be granted by DOH. If a permit is granted (i.e., no significant problems were identified at the time of permit issuance), DOH will monitor permit compliance after construction prior to issuance of a permit to operate. Again, the burden of proof to show compliance with the standards will be on HELCO, not the Agricultural Park.

What happens to water used that is not generated as wastewater? If it is evaporated, doesn't it combine with sulfur dioxides to produce sulfuric and sulfurous acids? These weren't addressed in the Ogden report.

Sulfur dioxide that has been oxidized to sulfur trioxide quickly reacts with atmospheric water vapor to form sulfuric acid. The relative humidity in Kona is high enough (because of the surrounding ocean) to provide all the water necessary to facilitate this reaction.

Thus, while your observation is partially correct, the contribution of power-plant-related water would be insignificant, compared with already existing atmospheric water vapor.

The potential risks associated with acid aerosols have been addressed in two recent studies. These two studies, as well as a summary report, have been included in Section 9 of the Revised Final EIS. Although the ecological risk assessment of acid precipitation study was inconclusive, the acid aerosol study demonstrated that levels of acid aerosol measured in the Agricultural Park were comparable to what is being measured about 20 miles south at Captain Cook. There was no indication of elevated levels that might be attributable to current power plant operations.

What local realtors, developers, lenders, appraisers were consulted to determine conclusion of no adverse impact?

The methodology used to assess impacts is described on page 2 of the Cowell & Co., Inc., report contained in Volume II, Section 10 of the Revised Draft EIS.

Why wasn't the value of the crops included in the study?

Crop value was not included for the same reason described previously; that is, Cowell & Co., Inc., assumed appropriately that emissions will not adversely affect animal or plant life. This conclusion was based on the professional expertise of scientists who develop federal and state ambient air quality standards.

As explained in the June 21, 1993, response letter to you, federal Primary Air Quality Standards are based on protection of human health. Federal Secondary Air Quality Standards (which, in most cases, are no less stringent than the primary standards) are based on human "welfare," which includes such considerations as impacts to vegetation, animals, visibility, and comfort. On the basis of the air quality modeling, which indicates that primary and secondary air quality standards will not be exceeded, HELCO has concluded that no significant impacts to vegetation will occur.

Do the State Department of Agriculture rules on transfers have any effect since leases were in place prior to the rules? Can the State withhold consent based on "anti-speculation rules" now?

Discussions with a representative of the Department of Agriculture (DOA) indicate that it is DOA policy to prevent speculation involving any agricultural park lot. HELCO cannot respond for DOA regarding how it would implement this policy, and HELCO cannot comment on the State's legal rights regarding the lease.

How can HELCO recommend disclosures in agreements and not plan mitigation for existing residents?

HELCO has incorporated mitigation measures to reduce noise impacts into the development plans for the project. These mitigation measures were described on page 3-89 of the Revised Draft EIS.

The plant has an enormous potable water requirement (equal to 18.5 percent of Kalaoa Mauka well capability). How can HELCO say that volume used is relatively small when the area goes on water rationing and building permits have been denied due to water shortage?

The County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

Please identify source of water to be provided by the County and details of any water source agreement.

The source of the water was identified as the Department of Water Supply's Honokohau Production Well, which is currently being developed. HELCO will pay its share of the costs for development of this well. In return, the County will receive a reliable and adequate source of electricity necessary to maintain existing pumps and to develop additional potable water sources.

In light of limited supplies and transmission facilities, why is HELCO being given commitments for water? What rule, statute, document is the basis for this commitment?

Chapter 174C, Hawaii Revised Statutes, mandates the creation of a Hawaii Water Plan, which, among other things, shall consist of water use and development plans for each county. A Hawaii County Water Use Plan has been developed under the direction of the Hawaii County Department of Water Supply. The 1989 plan was adopted by the Hawaii County Council under Chapter 29, Hawaii County Code. This plan is currently being revised under the direction of the Hawaii Commission on Water Resource Management, Department of Land and Natural Resources, for incorporation into the State Water Plan.

The County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

Is the County going to allow HELCO to use potable water to burn fossil fuel while restricting homeowners from watering plants that supply oxygen?

The County Department of Water Supply is working with HELCO to ensure that the Water Department and the Island of Hawaii do not again experience rolling blackouts similar to those experienced in 1991-92, when the residents, resort owners, businesses, PUC, and State legislature demanded to know, "What is HELCO doing to correct this situation?" With the Keahole project, HELCO is retiring older equipment (with greater air emissions) and locating new generating equipment near demand in order to maintain an adequate margin of reserve capacity. In return, the County Water Department receives adequate and reliable water to maintain existing water supplies and to develop new supplies.

These are important steps taken to avoid future capacity shortfalls of both electricity and water. The efforts involved to complete these steps are time-consuming and costly. HELCO and the County Water Department will continue these efforts in an attempt to avoid disruption of service similar to what the Island of Hawaii experienced in 1991-92.

Isn't 8 hours to replenish fire/service water tanks a long time considering type of fire and surrounding dry grass?

The Hawaii County System Standards require a fire flow of 2,000 gallons per minute (gpm) for 2 hours, which will be provided to the generating station by the fire/service water tank of 240,000 gallons. Alternative water sources are available during refilling of the fire/service water tank.

What does employee training include and what emergency plan is proposed specifically? Was there Civil Defense input? Why weren't Civil Defense or the Fire Department consulted?

All fuel handling from the tanker into the bulk storage is the responsibility of the trucking contractor. The present contractor, Kuwaye Bros., complies with all training requirements imposed by the State Department of Transportation (DOT). All drivers are required to complete the annual Driver Improvement Program. In addition, all drivers have completed a Hazardous Material Safety Course and attend short training seminars whenever they are provided by our diesel fuel supplier, Chevron USA.

HELCO employees are trained in the proper use of fuel extinguishers and in the use and maintenance of the emergency oil spill response equipment provided onsite. Any spilled fuel cannot escape beyond the boundaries of the tank berms. The Civil Defense and Fire Department were not consulted directly concerning the training issue, but the Fire Department can offer comments on the final equipment layout, as it must approve the site and building plans.

The State Department of Defense (of which Civil Defense is a part) received a copy of the Revised Draft EIS and had no comments regarding employee training. The Hawaii County

Civil Defense and the Hawaii County Fire Department were asked whether they wished to become consulted parties to the EIS process. Neither organization responded.

Has HELCO given notice to date of existing temporary loud noise events?

Loud noise events that happened in the past were unanticipated and, thus, notice could not have been given. The problems that led to these events have been corrected.

Allowable noise limit based on the preexisting use. Does this mean that HELCO does not care about the well being of the residents?

HELCO has worked with Agricultural Park residents throughout the EIS process to identify and address concerns. Note (c) (page 3-81 of the Revised Draft EIS) to which you refer is, in fact, a reference to Hawaii Administrative Rules Title 11, Chapter 43, Section 3 (Community Noise Control for Oahu). The fact that this state regulation was passed does not reflect in any way that HELCO is not concerned about the well being of residents.

Why aren't noise levels being recorded throughout the Agricultural Park?

Monitoring points were selected to obtain the best possible data for input into the computer model. Noise is a predictable physical phenomenon that can be simulated with computer modeling. However, modeling simulates noise levels in a flat, open environment. As you correctly pointed out, topographic features and buildings can affect actual noise levels. The effect of these features is to reduce noise levels. Because modeling does not take these mitigating features into consideration (except when these features are added into the model), noise levels generated by modeling are more conservative than actual noise levels. In other words, the model will tend to overstate the station's noise levels.

When will noisier diesel units be retired, and by whose authority?

The planned retirements of the diesel units are included in Table 1-1 of the Revised Draft EIS. The recommendation for retirement of a unit comes from the Hawaiian Electric Company, Inc. (HECO) Systems Planning Department following input from various HECO and HELCO departments. The ultimate authority for decision making at HELCO is HELCO's management.

Why aren't safety measures addressed for the battery storage building? How many batteries does it take to generate 10 MW of energy? How dangerous is it?

The battery storage facility will have one battery composed of 2,808 modules with 8,424 cells configured in three parallel strings.

The following safety measures are designed into the battery storage building and system. Because of the safety measures identified, the battery energy storage plant is not considered dangerous.

- The valve regulated lead acid (VRLA) batteries do not emit significant levels of hydrogen gas under normal operating conditions, and the hydrogen levels in the battery room will not exceed one-tenth of 1 percent by volume. Hydrogen is flammable at 4 percent by volume and explosive at 18 percent by volume. The charge voltage and cell temperatures will be carefully monitored to ensure that the BESP adheres to normal operating conditions.

- The VRLA batteries are enclosed in an explosion-resistant casing and use an absorbed electrolyte material that make them virtually spill-proof and leak-proof.

- The battery storage building includes a hydrogen detection system consisting of six hydrogen monitors set to alarm at 1 percent by volume. If any monitor should alarm or fail, all charging will stop.

- The battery storage building will include a fire protection system and adhere to all National Fire Protection Association (NFPA) codes.

- The battery system will include ground fault protection to prevent incidental short-circuitry from contact with grounded items.

- The battery storage building will include a heating, ventilating, and air conditioning (HVAC) system for ventilation and cooling.

Couldn't NELH suffer from wastewater below the water quality standards since they must have pristine water quality?

No impact is expected to NELHA from the use of an injection well at the Keahole Generating Station (see Revised Draft EIS, Volume I, Section 3.1.4). A groundwater monitoring program has been developed, as required by EPA and DOH. The development of this program has been coordinated with NELHA.

If wastewater affects OTEC business won't it be too late and the burden of proof will be on them?

No impact is expected to ocean thermal energy conversion (OTEC) businesses from the use of an injection well at the Keahole Generating Station (see Revised Draft EIS, Volume I, Section 3.1.4).

Is it significant that lava tubes run in the direction of NELHA?

Formation of lava tubes and the movement of groundwater are both subject to the forces of gravity. It has been acknowledged in the Revised Draft EIS that the groundwater movement is toward NELHA. Extensive studies based on existing data were evaluated and are detailed in Appendices C and D of the Draft EIS, Volume II, and summarized in Volume I, Section 3.1.4, of the Revised Draft EIS.

Why is the County General Plan cited for support if County approvals are not required? If the General Plan is relevant, shouldn't all parts and elements be cited (e.g., scenic views)?

The County General Plan is cited because an EIS is required to contain a statement of the relationship of the proposed action to land use plans, policies, and controls for the affected area. The sections of the General Plan cited in the EIS are the relevant sections that the County of Hawaii Planning Department concurred should be cited.

What guarantee is there of landscape mitigation plan implementation?

HELCO is committed to implementation of the landscape plan in order to mitigate visual impacts. HELCO is willing to have implementation of the landscape plan as a condition of the Conservation District Use Application (CDUA) approval.

What evidence is there that Kawaihae could or could not have been used via an IPP and why did HELCO feel it and not an IPP had to build there?

HELCO initially sought to acquire a site in Kawaihae after two sites in that location were identified for further evaluation as part of the 1988 *West Hawaii Site Study*. Subsequent to the study, the Department of Hawaiian Home Lands (DHHL) identified a third site and eliminated the other two sites from consideration. HELCO's discussions with DHHL spanned a period of 5 years (1988 to 1992). These efforts ended in February 1992, when the Hawaiian Homes Commission approved a 40-acre site above the Kawaihae Harbor for power plant use, but determined that native Hawaiian corporations would be given first preference to negotiate or bid on the site. DHHL stated that only after consideration of native Hawaiian corporations would entities such as HELCO be considered.

On July 27, 1993, the Hawaiian Homes Commission ratified the granting of a land lease to Waimana Enterprises, Inc., indicating DHHL's willingness to allow a site to be used for power generation. The question of whether the site actually can be used for this purpose will depend on the outcome of Waimana's site evaluations, environmental report, and the decisions of permitting agencies.

HELCO did not assume that it, rather than an independent power producer (IPP), had to develop a facility at Kawaihae. As explained in the Revised Draft EIS in the section entitled Parallel Path Planning (page 1-8), it is HELCO's policy to contract with an IPP if

the IPP's schedule would meet HELCO's resource plan timetable for new generating requirements identified in HELCO's resource plan, as well as other considerations, such as cost, technology, and location. As a contingency against IPP project delays, HELCO pursues parallel path planning for the installation of its own generating capacity. This contingency planning is terminated only when the IPP has met agreed-upon milestones and will meet the commercial operation date. HELCO cannot rely on an IPP to produce power at Kawaihae or elsewhere until these agreed-upon milestones are met. The fact is that the need for additional capacity is in early 1995, and no IPP has a proposal that could potentially provide additional power in that time frame.

Why is HELCO stalling in negotiations with Waimana? What has HELCO done to use Kawaihae via an IPP (negotiations, etc.)? Stalling because it would mean HELCO has to purchase from an IPP?

HELCO is not "stalling in negotiations" with Waimana. During the time that HELCO has been in discussions with Waimana, a number of legitimate business issues and other considerations have prevented an agreement from being reached. From HELCO's perspective, the issues that have been raised with Waimana, and with other IPPs as well, are all critical to meeting the needs and protecting the interests of its customers.

HELCO's attempts to get its Keahole plant on-line are not an attempt to supersede IPPs. As stated in our response to your previous comment, the need for additional capacity is in early 1995, and no IPP has a proposal that could potentially displace the expansion at Keahole in that time frame.

When was the need forecast and population trend first identified for West Hawaii's increase and what specific plans were taken regarding them?

The need for additional power generation facilities in West Hawaii dates back to the opening of the Mauna Kea Resort, almost 30 years ago. The Mauna Kea Resort demonstrated that resort operations were feasible in the Kona/Kohala regions. As demand for electricity grew in the West Hawaii region through the 1960s and 1970s, HELCO concluded that power generation facilities in West Hawaii would be necessary from both an efficiency and a reliability standpoint.

In the early 1970s, HELCO developed power generation facilities at Waimea and Keahole. In the mid-1980s, the need for a long-term generating site in West Hawaii to accommodate up to 200 megawatts (MW) was identified, and a study was conducted to locate a suitable site. In 1987 and 1988, a site screening and selection process determined that sites in Kawaihae and at Puu Anahulu would be suitable for such a plant. In the interim, small-scale expansions have occurred at Keahole to keep pace with demand growth.

Char and Associates did a botanical study that failed to reveal the naupaka plant. Is this report accurate?

According to Char and Associates, the naupaka plant is common along the seacoast and is often used as a component in landscape planting designs. This plant was not specifically identified in the botanical survey because it is a common plant throughout the area, and it is not listed as rare or endangered.

Was the IRP submitted to the PUC? Will it be part of the Final EIS's full disclosure?

The IRP was filed with the Public Utilities Commission (PUC) on October 15, 1993. The IRP submittal is voluminous and is not part of the Revised Final EIS. However, it is readily accessible for review at HELCO's offices in Hilo, at the PUC offices in Honolulu, and at public libraries on the Island of Hawaii.

Would you please include in the Final EIS detailed permits submitted to any and all government agencies related to this project?

A list of permits submitted to government agencies is included in the Executive Summary of the Revised Final EIS. Copies of the actual permit applications can be reviewed by contacting the permitting agencies listed in the table.

What does 56 MW (net or 58 MW gross), on p. iv, mean?

The proposed unit addition is capable of producing 58 MW of power. The operation of the combined-cycle requires 2 MW of power. Therefore, 56 MW (the net capacity of the unit) will be available to meet customer demand.

Who is the accepting authority for the EIS and under what statute or rules was the Department of Land and Natural Resources (DLNR) designated?

Chapter 343, Hawaii Revised Statutes, establishes that an EIS is required for any use within land classified as Conservation District and for other listed categories of uses. Under the Hawaii Administrative Rules (HAR) of the Department of Health Title 11, Chapter 200, the authority for accepting the EIS rests with the agency initially receiving the request for approval of the proposed use. Because the Keahole project site is in an area currently designated as part of the State Conservation District, HELCO submitted an amendment to the existing Conservation District Use Permit to DLNR under Title 13, Chapter 2, HAR. The Board of Land and Natural Resources is the approving authority for the permit amendment. DLNR is the accepting agency for the EIS.

How can you say that federal standards protect vegetation when generators in Hilo are pitting car paint?

As stated in the Revised Draft EIS, the Kanoelehua station is in compliance with all applicable federal and State emissions and air quality requirements. The source of car-pitting in Hilo is unknown and undetermined.

After build-out, will there be a buffer left between the plant and the Agricultural Park? If not, why not?

As shown in Figures 1-5, 1-6, and 1-7 in the Revised Draft EIS, within the area owned by HELCO, there will be buffers of 25 to 50 feet for landscaping along the two sides adjacent to the Agricultural Park. Landscaping will also be planted along the other two sides of the site.

If the site is not designated as Prime Agricultural Land according to the ALISH classification, why did the State put a 179-acre agricultural park there?

According to a representative of the Department of Agriculture, the primary factors involved in the State's locating an agricultural park at the Keahole site for the cultivation of tropical flowers were:

- Limited rainfall
- Lots of sun
- Location on State land
- Proximity to an airport for the transport of flowers

Because the cultivation of tropical flowers usually takes place in pots and not in the ground, the Keahole site's soil type was not a factor.

Response to DLNR said HELCO expects to experience a potential loss of 52.1 MW due to PGV delays and loss of Hamakua. Both are on-line now. What is PGV's firm capacity? Can it provide 20+ MW to cover short-term needs? If so, what effect on this project? Why is PGV now viewed negatively despite all the early hoopla by HIGA?

We do not agree with the characterizations in your comment. HELCO does not view the PGV facility negatively. PGV is currently providing 25 MW of firm capacity by contract with HELCO. This amount was factored into the system generating capacity for 1993 and is reflected correctly in Table 1-1 of the Revised Draft EIS. The inability of PGV to provide firm capacity before 1993 did result in less than desired reserve margins. Although PGV has indicated a desire to increase its contract capacity, it would not be able to supply the necessary power to cover short-term needs because of the time needed to prepare environmental reports and to complete permitting, PUC approval, and construction of the expanded capacity.

Why aren't the "immediate generating needs" being identified?

The "immediate generating needs" for commercial and residential developments currently under way, such as the COSTCO distribution center, are included in the demand forecasts. A major portion of the short-term forecasted increase in demand can be directly attributed to large-scale projects currently under construction. These projects include:

Kealakehe Sewer Treatment Plant and Pump Station	2,000 kilovolt-amperes (kVA)
COSTCO Pacific Distribution Center	1,500 kVA
Keauhou Shopping Center Phase 2	2,000 kVA
Safeway/ACE/Ben Franklin	1,500 kVA
Lanihau Center Phase 2	4,000 kVA
K-Mart/Queen Liliuokalani Trust	3,000 kVA
Mauna Kea Prince Hotel	2,000 kVA
Royal Vista Golf Course Irrigation Pumps	3,000 kVA

The U.S. Securities and Exchange Commission filing stated there was no risk of rolling blackouts, and PGV wasn't on-line at the time of this filing. Does this mean PGV is reserve power?

PGV is contributing firm power to HELCO. It is not considered a reserve power source.

How can EIS say "no significant impacts," "no adverse impacts" when there are so many unresolved issues? What was the rationale for determining that air, property values, water, noise, traffic need not be addressed as unresolved?

Unresolved issues are those that cannot be answered at the present time or that are unanswerable. During the course of the EIS process, several studies were conducted to assess the impacts of the project on the various items you mention. On the basis of these studies, HELCO and its consultants have concluded that either no adverse impacts would occur, or that the impacts would not be significant. Your questions concerning air, property values, water, noise, and traffic, on the other hand, have been answered in the EIS.

Why is HELCO refusing to negotiate with Waimana? Should have filed a PUC petition under PUC Rule #6-74-15(a).

HELCO is not "refusing to negotiate" with Waimana. During the time that HELCO has been in discussions with Waimana, a number of legitimate business issues and other considerations have prevented an agreement from being reached. From HELCO's perspective, the issues that have been raised with Waimana, and with other IPPs as well, are all critical to meeting the needs and protecting the interests of its customers.

HELCO had planned to file a PUC petition in response to a request from Waimana. However, Waimana filed a complaint with the PUC, and HELCO subsequently suspended

further action pending direction from the PUC. The PUC has since dismissed the complaint and opened a separate docket for the purpose of reviewing Kawaihae Cogeneration Partners' offer to sell energy.

Was HELCO's Kawaihae air study cost passed on to the consumers? If so, why weren't the data turned over to Waimana when Waimana requested to buy it? Is it proprietary?

The costs of the meteorological and air quality data collected by HELCO at Kawaihae have not been passed on to the ratepayers. If appropriate, HELCO may seek recovery of these costs at a later time. Whether or not information, studies, equipment, etc., are eventually paid for by ratepayers, the documents and material continue to belong to HELCO. As a public utility, HELCO is regulated by the PUC in terms of the level and method of determining rates and the utility's authorized return on equity, among other things. HELCO is not "public," however, in the sense of being a State-owned entity free of competitive business pressures. The Public Utilities Regulatory Policy Act (PURPA) opened up the utility market to non-utility generation and severely restricted utility participation in non-regulated generation. As a result, independent power producers compete directly for market share with HELCO to a certain degree. For this reason, HELCO considers the air data proprietary.

Is the real reason for the Keahole project to avoid having to purchase power from an IPP?

No. In order to ensure that HELCO has sufficient capacity to meet its obligations to serve customer needs in a timely fashion, HELCO must continue activities toward the installation of its own generating capacity unless and until such time that timely, reliable, and adequate power from other alternative sources is assured.

HELCO's attempts to get its Keahole plant on-line are not an attempt to "avoid having to purchase power from an IPP." Rather, it is part of HELCO's performance of its franchise obligation to serve the residents of the Island of Hawaii and to provide them with electricity when needed. The fact is that the need for additional capacity is in early 1995, and no IPP has a proposal that could potentially displace the need for the plant to be built at Keahole.

Is it true that if Keahole is expanded first, Waimana will not be built and vice versa?

No. If either Keahole or an IPP facility is built first, the generating capacity that would have been provided by the other would be deferred to some time in the future when the power needs on the Island of Hawaii require additional capacity.

It is important to note that, even if the Keahole expansion does not occur first, there is no assurance that Waimana would be the IPP to fill that need, as other IPPs are still proposing projects in a similar time frame. Even if a contract with an IPP were executed, HELCO has no assurance that the IPP's facility would even be built, as the IPP could decide for

business, economic, or other reasons to withdraw from the project. HELCO, on the other hand, has a legal obligation to provide reliable power to the public.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

OHN WAIHEE
GOVERNOR

BRIAN J. J. CHOY
Director

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185

July 30, 1993

Mr. Al Lyman
CH2M HILL
1585 Kapiolani Boulevard Suite 1420
Honolulu, HI 96814

Dear Mr. Lyman:

RE: FINAL ENVIRONMENTAL IMPACT STATEMENT OF THE KEAHOLE GENERATING STATION EXPANSION - FILED WITH THE DEPARTMENT OF LAND AND NATURAL RESOURCES ON OR ABOUT JUNE 3, 1993 (DLNR FILE NO. HA-487A; DOC. NO. 3052A)

There has been some question raised as to certain letters sent to you by the Department of Land and Natural Resources dated July 1, 1993, and July 12, 1993, respectively, as they relate to the processing of the Final Environmental Impact Statement for the Keahole Generating Station Expansion. Our office has reviewed these two (2) letters and discussed them with you and representatives of the Department of Land and Natural Resources, Office of Conservation and Environmental Affairs. It is apparent to us that the intent of those letters was not to reject your EIS, but to request more information. However, due to the timing of the July 1, 1993, letter (i.e., about two (2) days prior to the 30-day acceptance/non-acceptance date under §343-5, HRS) and the fact that on that date your EIS was clearly "unacceptable," we would deem the July 1, 1993, letter to be an official rejection of your EIS by DLNR. In addition, under current EIS laws, there is no authority which would specifically allow a Final EIS to be amended after the thirtieth (30th) day has passed.

If you do not want to appeal the non-acceptance and if you do not want to withdraw the EIS, you may resubmit for acceptance a revised Draft Environmental Impact Statement which includes the information as requested by the Department of Land and Natural Resources. We believe that this would be in conformity with all existing Environmental Impact Statement laws and regulations.

If you should have any questions regarding the above, please feel free to contact our office.

Sincerely,

Brian J. J. Choy
Director

c: Keith Ahue, Department of Land and Natural Resources
Don Horiuchi, Department of Land and Natural Resources
Clyde Nagata, Hawaii Electric Light Co., Inc. (HELCO)

1.3 AIR QUALITY MODEL SELECTION

The Keahole Generating Station is surrounded by terrain that gently slopes downward from the mountains east of the project site to the Pacific Ocean, which lies three kilometers west of the project site (see Figure 1.2-2). The elevation of the plant is approximately 63.6 meters (208.5 feet) above sea level. The terrain to the east of the plant gradually rises above the stack heights of the Keahole Generating Station, while in other directions, the terrain elevations are at or below the stack top elevations. There are no significant terrain features (e.g., cliffs, bluffs, hills, etc.) in the immediate project area.

The choice of appropriate dispersion modeling methods for evaluating the air quality impacts of the proposed CT additions at the Keahole Generating Station is governed by EPA's modeling guidelines and the topography of the site area. The power plant is situated with downward-sloping terrain to the west and increasing elevations to the east. Different modeling methods are required for evaluating impacts at receptors in these two terrain areas.

Ground-level concentration impacts at receptor locations with elevations equal to or lower than the lowest stack top may be evaluated by means of the EPA Guideline Model ISCST2 (formerly ISCST). Receptors at elevations above the final heights attained by pollutant plumes released to the atmosphere require the use of a model capable of addressing the effects of elevated terrain. The EPA guideline model COMPLEX I is suitable for modeling impacts at these receptors. No EPA-approved model is specifically designed to address impacts at receptors in "intermediate" terrain, i.e., at elevations above stack top, but below plume height. The proposed Supplement B to the EPA Guideline on Air Quality Models specifies that impacts at intermediate receptors are to be calculated by both simple terrain and complex terrain dispersion algorithms (i.e., ISCST2 and COMPLEX I), with the higher of the two values retained for each hour of the modeling period.

The BEESTX model, a proprietary dispersion model developed by BEE-Line Software, is designed to incorporate Supplement B guidance on intermediate terrain. BEESTX employs a decision tree to determine the appropriate dispersion algorithm for each hour and each source receptor, pair, based on computed plume heights for all modeled sources. Results for individual sources are summed at each receptor, and multiple hour averages are constructed using the appropriate concentration values determined for consecutive hours. The model is functionally equivalent to, but more computationally efficient than, EPA's

POSTIT processor program. (Note: EPA has not updated the POSTIT program for ISCST2.)

Because all receptors in the nearest PSD Class I area (Volcanoes National Park) are in elevated terrain, the impacts of the proposed projects in this area were computed by means of COMPLEX I. The EPA VISCREEN model was employed to evaluate the proposed project's impacts to visibility in the Class I area.

DATE 10-1-93 TIME 2:00 ☐ A.M. ☒ P.M. NO ASSOCIATION WITH HOKUKANO RANCH
NUMBER OF PAGES (Including Cover Letter): 1

NOTE: If you did not receive all of the pages or if you have a question, please call the verifying number (below).

TO: DLNR/CH2M Hill/Helco FROM: MATAW / NOT FOR PROFIT ORGANIZATION.

CO. NAME: ENV. Quality Control	NAME: JOHN ROSAS
ADDRESS: SUBJECT: Helco proposed	POB 1687
LOCATION: plant: KEAHOLE IN KONA	KEALAKEKUA, HI 96750
FAX NO.	VERIFYING NO. 323-2863

FAX Transmission

REMARKS:

TO WHOM IT SHOULD CONCERN:

INSTEAD OF MAKING A 5 PAGE LETTER, I'VE CONDENSED MY QUESTIONS TO THE QUESTIONS THAT EFFECT THE SUBJECT, ON DIFFERENT LEVELS:

① WHAT ARE THE HAZARDS TO BE ADDED IN BRINGING Fuel oil TO Helco proposed plant? LAND AND BY SEA HAZARDS. SPILLS AND CLEAN-UP AT SEA/LAND. AT TANK STORAGE FACILITY?

② KONA/WEST HAWAII IS CURRENTLY OVER BURDENED WITH POLLUTION FROM AIRPORT, VOLCANO ACTION AND MOTOR VECHILES. THE ADDED POLLUTION BY Helco IS ALREADY PUSHING EPA STANDARDS WHY IS MORE ADDED, AS WE ARE OVER LOADED ALREADY. Helco SHOULD MAKE ALL CURRENT Fuel oil PLANTS MORE EFFICIENT WITH COLLECTORS AND WITH AMOUNT THEY INSTALLED NOW. BEFORE SAYING A PLANT IS NEEDED (Helco) FOR KONA.

③ CHEMICALS ARE GOING TO BE PUT INTO THE SEPTIC AND GROUND WATER IN DIFFERENT WAYS, WHY ARE THEY DOWN PLAYING THE IMPACT ON WATER POLLUTION AND OCEAN ENV. POLLUTION.

④ PLEASE MAKE A COUNT ON THE TOTAL OF THE TIMES THE WORDS "EXPECT, EXPECTED, BELEIVE. THEN TELL ME, CAN A PROJECT THIS POLLUTING, POTENCIALLY HAZARDOUS TO PEOPLE, LAND, SEA AND AIR BE LEFT TO EXPECT, EXPECTED OR BELIEVED TO BE. SINCE YOU'RE ASSUMING.

{ PLEASE SEE THE DEFINITIONS FOR THESE WORDS IN THE BLACK'S LAW DICTIONARY. IF YOU DO NOT STOP ON THIS ABSURD PROPOSED PLANT. I WILL SEEK LEGAL ACTION.

I HAVE SPOKEN, YOURS TRULY

JOHN ROSAS

(YOUR REPLYS REQUESTED) MATAW

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. John Rosas
MATAW
P.O. Box 1687
Kealakekua, HI 96750

Dear Mr. Rosas:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

What are the hazards to be added in bringing fuel oil to the site (land and sea hazards, including tank storage facility; spills and cleanup)?

HELCO has not experienced a fuel-related incident at Keahole since beginning operations in 1974, and does not anticipate any new hazards to be added in bringing fuel oil to the site. All fuel handling from the tanker ship into the bulk storage is the responsibility of the trucking contractor. The present contractor, Kuwaye Bros., complies with all training requirements imposed by the State Department of Transportation. All drivers are required to complete the annual Driver Improvement Program. In addition, all drivers have completed a Hazardous Material Safety Course and attend short training seminars whenever they are provided by HELCO's diesel fuel supplier, Chevron USA. Since beginning operations, there has not been a fuel oil spill or fuel-related incident at Keahole.

HELCO employees responsible for fuel handling are trained in the use of fire extinguishers, and certain HELCO employees are trained in the use and maintenance of the emergency oil spill response equipment provided onsite. All bulk fuel handling equipment is located inside or would drain into a tank farm bermed area. Any spilled fuel cannot escape beyond the boundaries of the tank berms. As with all fuel storage facilities, there would be a protocol for switching tanks and all tanks can be isolated should a leak develop. Should there be a fire for any reason, it would be confined within the facility.

Should there be an accident on the highway involving a fuel truck and another vehicle, notification would likely be made to the proper authorities (police, fire, rescue) through a source other than HELCO. HELCO maintains no radio or other direct contact with the individual trucks. Once notified, however, HELCO would respond as directed by the appropriate agency with any personnel and/or equipment required.

HNL89\054.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

HELCO does have an Oil Spill Contingency Plan, as required by the 1990 Oil Pollution Act (OPA) legislation. The pipelines and power plants fall under the jurisdiction of the U.S. Department of Transportation, Research and Special Programs Administration (RSPA) and the U.S. Environmental Protection Agency (EPA), respectively. The Oil Spill Contingency Plan was submitted to the respective agencies for review. It provides a detailed explanation of the various cleanup techniques that would be employed in the event of a major oil spill.

Kona/West Hawaii are overburdened with pollution from airport, vehicles, and volcano action. Why is more added? HELCO should make all current fuel oil plants more efficient with collectors and why aren't they installed now before saying a plant is needed for Kona?

The Island of Hawaii is currently classified by the State Department of Health (DOH) and EPA as "in attainment" or "unclassifiable" for all air quality standards. Thus, Kona/West Hawaii is not considered overburdened according to the current ambient air quality standards. To minimize air quality impacts, DOH will impose all permit requirements deemed necessary, including the use of best available control technology (BACT).

We understand your use of the term "collectors" to mean heat recovery steam units. Heat recovery is an integral part of the proposed unit addition to the Keahole Generating Station. HELCO did consider the option of retrofitting existing facilities in order to utilize waste heat, but it was determined not to be a feasible option for the following reasons:

- The existing stack heights in most cases would have to be increased because of the decreased buoyancy of the emissions following passage through the heat recovery steam generator cycle.
- Older units are not readily adaptable for such a modification.
- Retrofit of older units would not result in a significant increase in fuel efficiency.
- Retrofit of older units would be extremely costly and would involve a lengthy down time for each unit affected.
- Retrofit of older generating units could not be accomplished within the time frame required to add additional generating capacity to the HELCO system.
- The life of the heat source and the usable life of a new heat recovery unit are economically mismatched.

Why is HELCO downplaying impacts on water pollution and ocean pollution from putting chemicals into the septic and groundwater?

HELCO has carefully evaluated this issue and reviewed the results with the Natural Energy Laboratory of Hawaii Authority (NELHA). No impacts on water quality are anticipated. The marine environment and potential impacts have been described in Appendices C and D of the Draft EIS, Volume II, and summarized in the Revised Draft EIS, Volume I, Section 3.1.4.

Please make a count on the total times for the words "expect," "expected," and "believe."

Although this request is not substantive and does not contribute to clarification of the project and its potential impacts, the words occur 3, 56, and 4 times, respectively, in the text.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

October 7, 1993

Mr. Don Horiuchi
Dept. of Land & Natural Resources (DLNR)
Office of Conservation and Environmental Affairs (OCEA)
1151 Punchbowl St. Room 131 Honolulu Hawaii 96813
FAX 587-0390

Albert Lono Lyman, CH2M Hill
1585 Kapiolani Blvd. Ste 1420
Honolulu Hawaii 96814-4530

HELCO Inc.
PO Box 1027
Hilo Hawaii 96721-1027
Att: Clyde Nagata

Office of Environmental Quality Control
220 S. King St.
Central Pacific Bank Plaza, 4th floor
Honolulu Hawaii 96813

Re: EIS input to revised draft of HELCO's proposed Generating Station Expansion in North Kona at TMK 7-3-49:36

As a citizen doing citizen's work (CDCW) here is my input of comments and questions into HELCO's revised draft EIS for the proposed expansion of its power plant at Keahole, North Kona on Hawaiiisland.

HELCO/CH2M Hill is specifically requested to NOT combine answers together as was done in its June 21 reply to my Jan.22 letter as it provides HELCO with the opportunity to appear as if they are answering all questions while in fact not doing so.

IN ORDER TO PROVIDE PRECISE ANSWERS TO SPECIFIC QUESTIONS, PLEASE NUMBER EACH ANSWER TO CORRESPOND TO THE NUMBER OF THE QUESTION SO THAT EACH AND EVERY QUESTION IS ANSWERED.

WAIMANA:AN INDEPENDENT POWER PRODUCER

1. How much money will rate payers save if Waimana builds a power plant at Kawaihae and sells HELCO the power, instead of HELCO building the plant at Keahole.

2. How much less money will HELCO earn if the plant isn't built at Keahole but rather it is built by an independent producer such as Waimana?

3. All things equal, how much more is HELCO's stock likely to be worth if it expands at Keahold instead of buying from Waimana at Kawaihae?

4. What if any are there other reason than greater dividends to HELCO stockholders that HELCO is pushing for the Keahole site when the Waimana Kawaihae site is progressing to a 1996 completion date and the net result may be lower rates to the consumer, funds to HHL, the cogeneration of potable water, and a cleaner & safer environment?

5. If Waimana builds a co-generating power plant at Kawaihae, will HELCO have to buy the power they produce according to the PURPA law?

6. What does HELCO mean in it's 10K report re "no more purchase agreements"?

7. By when does HELCO have to have its building permit in hand in order to finish building its proposed expansion by January '95, by July '95, and by Dec.'95.

8. Regarding the pending Waimana power plant at Kawaihae, at what point and under what circumstances will HELCO abandon the expansion of the Keahole site in favor of the Kawaihae site?

9. What is HELCO's position on utilizing the Mamalahoa Hwy/Waikoloa substation as a site for plant expansion?

10. In light of the fact that PGV is now operating, Hamakua Sugar is still producing power, the Hilo hydroelectric power plant is operational, (the earlier lack of which enabled HELCO to claim the immediate need for expanding the Keahole Generating Station) and the Hawaii County economy is growing at a diminishing rate with no upswing in the forseeable future, isn't Waimana's time table for completing a power plant in 1996 satisfactory? If not, please provide details.

11. Why not Waimana's planned power plant at Kawaihae since they've got the financing, a lease on the site, will benefit Hawaiian Home Lands and will cogenerate desalinized water, and a timetable to finish about the same time HELCO would finish at Keahole under the present circumstances? Please be specific and detailed about your objections to the Waimana/Kawaihae site.

12. In the Sept.15 Honolulu Advertiser article titled "Meeting for opponents of Keahole power plant HELCO official Bill Stormont says "The 15 acre Keahole site is already owned by HELCO and obtaining another more remote site would raise the cost of lthe project as well as delay it further." Does this apply to the Waimana/Kawaihae site, or to some other site that is unknown, unidentified and not even under consideration? Please explain Mr. Stormonts comment.

13. The law requires that an agreement be negotiated in 75 days yet HELCO has been stonewalling Waimana for two years. If as Mr.Stormont says in the article "It's a race against time" why is HELCO stonewalling Waimana by refusing to negotiate a purchase agreement.
13a. Is it a race against time or is it a race for whether Waimana & HHL, or HELCO's stockholders, make the profit? Please explain.
13b. What are the factors that are delaying the consummation of a purchase agreement with Waimana at Kawaihae?

14. The Sept. 22 West Hawaii Today newspaper in an article titled "Group prepares to battle power plant expansion" (aticle enclosed) concluded with the sentence "But a HELCO official (Bill Storemont) said demand is continuing to rise while its sources of electricity are diminishing." Please verify with facts and statistics how "demand is continuing to rise" and how "sources of electricity are diminishing." Please provide this information in the time frame through 1996 when Waimana would come on line at Kawaihae.

TRAFFIC HAZARD AT KEAHOLE

15. According to Police Chief Vierra's comment in recent newspaper articles in the West Hawaii Today (Tues. Sept.7), and Hawaii Tribune Herald the Keahole Airport intersection (where the Keahole generating plant is located) is THE MOST DANGEROUS INTERSECTION IN THE COUNTY OF HAWAII. Do you concur?
16. How many tanker trucks a day will it take to power a fully expanded 86 mgw power plant?

17. What impact will those tanker trucks have going in and out of the HELCO's Keahole facility.
18. What is HELCO's emergency response plan in case of an accident?
19. Why wasn't the Hawaii County Civil Defense Agency not made a consulting party?
20. When is the planned realignment of the airport access road HELCO referred to supposed to happen?
21. Did the proposed realignment survive recent budget cuts?
22. How will HELCO deal with the worst case scenario of an airplane crashing into a fuel storage tank?

AIR POLLUTION AND WIND PATTERN STUDIES AT KEAHOLE & KAWAIHAE

23. How many people do you estimate will live within a 2, 3 and 5 mile radius mauka of the proposed plant within 20 years?

24. Why did HELCO require Waimana to abandon consideration of a coal burning facility at Kawaihea when high grade coal can be cleaner burning and less polluting than fuel oil?

25. Did HELCO do a 12 month wind pattern study showing variations over a 12 month period. If so, please publish it in the final EIS.

26. If not, why not?

27. Did HELCO do any wind pattern studies at Kawaihae? If so, please publish them in the final EIS.

28. What studies have you done regading the emission of nitrogen oxide, sulfer dioxide, carbon monoxide and other deisel fuel combustion by products and their interactive effect with existing vog. If so please summarize results.

29. What is the worse case scenario for the mixing and entrapment of increased amount of vog and power plant emissions at 86mw generation?

30. How long can Madam Pele continue pumping volcanic emissions into the air which is then trapped on the west side of Hualalai which then becomes a vog sink?

31. What is the longest the volcano has been known to continually erupt and what are the dates of this extended period of continual eruption?

32. Have you taken into consideration that the "vog" can get much worse than it already is?

33. If that happens, what will you do?

34. How many people are likely to get sick per year and how many are likely to die per year as a result of increased air pollution from the combined interaction of an expanded power plant at Keahole and long term vog presence?

35. Throughout your revised draft you repeatedly state that "The American Lung Association has been studying impacts of vog in this area for more than two years. To date no adverse health effects attributable to vog have been identified."

While your statement is not untrue, it is also meaningless, misleading and self-serving because a final report on the matter has not yet been issued. It is equally true to say that "to date it has yet to be shown that vog has no adverse health effects." Considering that people on the west side of the island are leaving to live elsewhere, and that the vog is so thick at times one can barely see the top of the mountain, there is a multitude of complaints from residents, and doctors concur that there is adverse health effect on the respiratory system, it is more reasonable to state that until proven otherwise, adverse health effects ARE occurring.

When the final report is made, it is likely to say that people with existing respiratory problems such as asthma, emphysema, bronchitis etc. are adversely affected by vog, while those with healthy, normal respiratory systems are less likely to be affected.

36. Since you have repeatedly used the ALA study in your EIS in a manner that serves your purpose, will an indication in the final ALA report of adverse health impacts from vog cause you to withdraw your request to DLNR to expand at Keahole in favor of the Waimana site at Keahole?

37. If the ALA study shows that vog does have an adverse effect on a specific population, and that vog plus the emissions from fuel oil combustion added to it have an even greater adverse impact on health will you defer to the Kawaihae site?

38. Your response to Waimana's request for Kawaihae air quality data was refused on the basis of being "propietary". How can it be proprietary if you are a public utility and we ratepayers are paying for the study?

39. Will you please publish in the final EIS all the air quality monitoring data requested by Waimana that was previously withheld.

40. If as you suggest, Keahole is a better site than Kawaihae because it can come on line sooner, hasn't HELCO been blatantly responsible for the delay because it refused to provide Waimana the wind date for Kawaihae and because it has repeatedly failed to negotiate a purchase agreement contract?

41. Why was a 190 foot stack chosen in the first place?

42. What effects will there be from lowering it to 104'?

43. If you can lower it to 104' why can't you keep it at the present height?

44. Would there be any adverse effects leaving the chimney at the present height?

45. If so, what would it be?

46. Has your modeling taken into consideration the more frequently occurring times when the vog is so thick that one can't see the top of Mt. Hualalai?

47. If so, what are the results?

48. If not, why not?

49. If not when will you?

50. Please detail your plans for AGMD admissions acceptability for the current location and give your method of monitoring as provided in the law.

51. Ever since May 10, 1990 when your 18 mgw combustion turbine generator (CT-2) was first tested for emissions, it has been in constant violation of State and Federal clean air standards by as much as double the maximum standard. HELCO has been cited with a notice of violation on August 17, 1992 for its failure to bring CT-2 into compliance.

A fine of $8,100 was imposed. A written compliance schedule specifying the measures to be taken and the dates for completing such measures to insure that no further air pollution violations from CT-2 occur. Has the violation been corrected?

52. If not, why not?

53. If not, what is the status of the violation?

54. If not, when do you expect the violation to be corrected?

55. Is it possible to bring this piece of equipment into conformance with currently approved emission standards?

56. In order to remedy the violation, will you be reducing the emissions or will the emission standards for this machine be lowered to accomodate the excessive emissions should you be unable to reduce them?

57. Do ratepayers pay the fine or was it paid from company profits?

58. Please indicate what is so unusual about CT-2 that you have had so much difficulty bringing its illegal and excessive emissions under control?

59. What is the name and number of the person at HELCO and the Dept of Health that a citizen should call when he or she sees black smoke pouring out of the chimney in obvious violation of the law?

60. Your reply to the second question of my Jan.22 EIS input regarding meteorological conditions of the area, is inadequate as it ignores the issue of ADDED POLLUTANTS to the already poor air quality in Kona.

We have unusually bad conditions due to the volcanic eruption, your existing high polluting diesel generators, pollution from your #2 combustion turbine (CT2) which has been cited for a still uncorrected air pollution violation since 1990, jet plane exhaust, and Queen Kaahumanu Hwy traffic.

The Keahole, Kalaoa, Kealakehe, Kailua-Kona area may have the WORST AIR POLLUTION OF ANY AREA IN THE STATE OF HAWAII. The residents, business people, and visitors to W.Hawaii should not be subjected to ADDITIONAL DEGRADATION of the air we breathe as a result of even more emissions from your proposed expanded generating facility.

Your response focusses solely on pollutant measurements in the immediate region of your Keahole power plant and near-field computer modeling. This is wholly inadequate. Please do so.

61. Will emissions from your expanded plant make an already bad condition worse?

62. If it could be shown that it did, would you withdraw your expansion plan and defer to Waimana at Kawalhae?

63. What is the WORST CASE SCENARIO with a 25% increase in vog, full capacity 86 mw electrical generation, added traffic past Keahole due to the closure of the Kailua landfill, bigger and more frequent international aircraft due to the expansion of the airport runway, and continued failure to bring CT2 into compliance with existing air pollution standards?

64. What areas in the State of Hawaii, if any, have worse air pollution problems than the area of your planned power plant expansion?

65. What's the air pollution factor going to be at the site of the planned 500 acre UHWest campus which is in direct line with frequent winds?

66. While you tested the immediate area did you test the area up the hill where the volcanic emissions, traffic and aircraft fumes, and smoke generated by your plant emissions stay indefinitely until certain winds or rains dissipates it?

67. If so what are the results?

68. If not, why not?

69. If not, when will you?

70. What is your assessment of the margin of error of your computer modeling?

71. Blank

HIGHEST RATES TO CONSUMER

72. Is it true that HELCO's rates are the highest in the country? If not the highest, then where does it rank?

73. How do you account for this high rating?

74. What do you intend to do, if anything, to reduce these rates?

75. I have been advised that when certain equipment was depreciated down to a certain point, it was sold to company executives or to others who then leased it back to the utility company. Please discuss how this process works.

76. What is the guaranteed return on its invested capitol that the Public Utilties Commission allows HELCO to charge rate payers.

77. What is HELCO's greater priority, satisfying and serving its electric power customers or satisfying and serving stock holders?

FUEL TRANSPORTATION, STORAGE, CONSUMPTION, ETC.

78. What dock will the fuel oil arrive at?

79. Along what route will it be transported to Keahole?

80. I estimate that at full operation you can be burning upto 100,000 gallons of fuel oil a day. Is this figure accurate?

81. If not, please indicate your estimation and how you arrived at that figure.

82. How many tanker trucks a day will it take to to fuel the maximum estimated gallons of fuel oil consumed in the operation of the power plant as per your reply to questions 81 above?

83. How much fuel does a tanker truck burn hauling a load of fuel oil on a 200 mile round trip to Hilo.

84. What is the total number of gallons a day of fuel that all the tanker trucks will burn hauling fuel oil from Hilo to Kona?

HELCO's CREDIBILITY

85. Realizing the unsuitability, undesireability and inappropriatness of the Keahole site as a power plant, HELCO indicated in previous Conservation Distruct Use Permits for expanding the power plant at Keahole that electric generation on the site would be temporary, remain small, and only be operated during peak hours. Is this true?

86. Please give the dates, the circumstances of your previous commitments NOT to expand at Keahole, and the government agency before which this representation was made.

87. Why did HELCO make these statements at the time?

88. Why isn't HELCO abiding by its prior representations

89. Doesn't this pattern of behavior indicate HELCO's inclination to say whatever is needed to get what it wants, and then to do whatever it pleases?

90. What is the difference in the intensity of the operations and impacts on the community between the existing project and the proposed expanded project.

91. What is the difference in the intensity of the operations and impacts on the community between the first time HELCO made that statement and now.

92. HELCO field representative showed Keahole Ag Park people a chart indicating that prevailing winds are from a direction which they are not. You also told them that the 104' won't contribute to air pollution when the same day you told NELH officials that there was insufficient information at the time to know the answer which would have to await further studies. Explain this contradiction.

93. How can anyone believe anything HELCO says or writes or represents in light if its persistent failure to abide by its statements made under oath and its inclination to say whatever it thinks people want to hear regardless of the facts and then do whatever it wants to do.

WATER

94. How much potable water do you now use?

95. How much brackish water do you now use?

96. How much of each will you use at each phase of expansion?

97. How much will you use at full 86 mw buildout?

98. Where will this water come from?

99. Has this amount of potable water been allocated by the county yet?

100. If not, how do you know there will be sufficient water available?

101. What are the impacts to others in the community who also seek water for domestic and fire protection purposes?

102. Will HELCO have to conserve water like everyone else or will you be exempt?

103. If not exempt, how can HELCO save water?

104. What tests if any, have you done to assure that injected waste water won't contaminate aquaculture industry at nearby NELH which is makai and to the south of the Keahole plant?

105. If your conclusions are wrong and your wastewater does damage NELH aquaculture and you are sued for damage and lose, will the cost of the damages be added to ratepayers electric utility bill or be paid from profits that reduce stockpayer dividends?

106. A power plant at Kawaihea cogenerating potable water as planned, will provide 2.7 million gallons a day of fresh water. An expanded power plant at Keahole will consume hundreds of thousands of gallons of fresh water daily. Isn't it prudent to cogenerate fresh water at Kawaihae than it is to consume this precious resource at Keahole?

KEAHOLE AG PARK PLANT DAMAGE

107. Will an expanded facility have any adverse impact(s) on the adjoining ag park?

108. If so, what might they be?

109. What is your evidence that emissions from an 86mgw plant won't damage plants in the abutting Keahole Ag Park?.

110. Please discuss damage to car finishes in Hilo due to power plant emissions.

111. In previous Conservation District Use Permits HELCO stated that ethelyn emissions are caused by incomplete burning of diesel fuel and that the emissions from the power plant should be insignificant even though orchids are known to be among the most sensitive plants to ethylene damage.

112. To what degree is the existing power plant already exceeding the regulatory requirements in the existing permits?

113. What has been the level of ethylene emissions resulting from violations of the existing permits.

114. HELCO never expected the existing power plant to exceed its permits yet it does. What would be the ethylene emissions if the proposed plant were to experience similar types of problems and violations that the present power plant has?

NEGAWATTS (CONSERVATION)

115. What is HELCO's definition of "demand side management"?

116. To what extent does HELCO encourage demand side management?

117. Does HELCO encourage, invite, and welcome companies who are ready willing and able to come to Hawaii to manufacture conservation equipment (like solar panels and solar cells) to enhance demand side management?

118. PG&E in California didn't build 5 projected new power plants because they elected to save "negawatts" instead of producing "megawatts". (A Negawatt is a megawatt not made because it's not needed). By instituting demand side management and providing incentives for conserving, we would not need another power plant at this time or in the forseeable future. Please comment on this scenario.

119. If demand side management worked so well in California, it will work here too. Please comment on this statement.

120. What have you done to date to encourage substantial conservation among consumers?

121. What have you not done that you intend to do. Please provide time lines.

122. There appears to be something questionable about your "Resource Plan" (Table 1-1 page 1-5). In round figures, it shows that approximately 3 mw of energy being saved by Demand Side Management (DSM) for every 9mw increase in generation (44mw out of 176mw increase / from 171mw in 1995 to 348mw in 2013). Yet it shows no savings from DMS in regard to the 171 mw in use as of 1995. Why is there DMA DMS in regard to the incremental additions of power after '95 with no savings only with the 170 mw operating as of 1995?

123. On a forcasted peak of 348 mw in 2013 you show a savings of 44mw from DMS or a 13% DMS savings. How does that compare to Calif and the other 5 top rated states utilizing DMS. If you have a lower percentage, please explain the difference. What DMS measures have you omitted?

124. What plans if any do you have to reduce energy consumption at the resorts in Kohala that would reduce the need to provide additional power in the next two years?

125. What are your plans for heat recovery, cost avoidance, load shifting and demand side management to avoid near term expansion of energy generation?

126. Questions 127-143 are in regard to energy saving from solar hot water heater systems as per question 7 of my Jan.22 EIS input:
127. Do you concur that a five person household using solar hot water heating would save over $50 a month at 80% efficiency?
128. If not, why not?

129. Do you concur that a five person household using solar hot water heating would save about $70 a month at 90% efficiency?

130. If not, why not?

131. Do you concur that a properly designed and installed solar water heating system in West Hawaii can operate at 90% efficiency? If not, why not?

132. Do you concur that a large family will realize not only a higher dollar reduction on their electric bill than a smaller family but also a higher percentage reduction of the same bill? For instance, a small family may save $25-$30 or about 30% of their entire bill whereas a larger family may save $55-$70 a month or 40%-50% of their bill.

133. If not, why not?

134. If solar water heaters were to be installed would it make sense to target large households utilizing 120 gallon solar water heting systems?

135. If not, why not?

136. Would the large storage capacity of a 120 gallon system be beneficial to HELCO in reducing evening electrical storage demand?

137. Is it true that voltage loss incurred in transmitting electricity across the island to W.Hawaii is about 10%?

138. Is it true that 50% of the electric demand is from W.Hawaii?

139. Since the levels of solar insolation are higher in W.Hawaii than most other areas of the island, could a solar water heating installation program centered in W.Hawaii save more energy and more money than an island-wide program since savings would be realized both in decreased consumption and also in power otherwise lost in transmission?

140. What percentage of electricity used in W.Hawaii goes to residential customers?

141. What percentage of that power could be saved by solar water heating?

142. What would the annual value of those savings be?

143. What would the value of those savings be over the anticipated lifespan of those systems in comparison to the cost of building and operating an oil-fired generator?

144. HELCO's inadequate response to question No.5 in my Jan.22 letter regarding energy conservation through the use of compact flourescent or low energy light bulb provided by HELCO was detected by Mr. Kelly Moorehead who will be responding via a separate EIS input letter.

LETTERS FROM SEN. ANDY LEVIN AND GOVERNOR WAIHEE

145. In his July 6, 1993 letter to Governor Waihee, Senator Andy Levin characterizes an expanded power plant at Keahole as an "eyesore...which will be detrimental to tourism, the University campus, and the people of W.Hawaii." Your comments on Sen. Levin's statement please.

146. Sen.Levin also states in his letter to the governor "... if you agree with me that Keahole is not the best location, that you step in and get the administration to move as rapidly as possible in approving the Kawaihea project ..."

Attached is Governor Waihee's Aug.18 reply to Sen. Andy Levin regarding power generating facilities on Hawaii. In it the governor says "the state has been moving ahead with its plans to provide for the development of a power plant in the Kawaihae area. The Hawaiian Home Commission, at its regular monthly meeting of July27, 1993 approved the negotiated lease terms and provisions between the Dept. of Hawaiian Home Lands and Waimana Enterprises Inc. (WEI). The terms of the general lease are for 65 years and wil encumber approximately 40 acres of HHL and Kawaihae, Hawaii. WEI will build a 58-megawatt power plant, to be in servicew by the end of 1996, and a desalination plant capable of producing 2.6 million gallons per day of potable water," and that "the State and WEI are already working on the permits and other approvals that are necessary for the project. We are hopeful that this will result in the prompt filing and processing of the various permit applications."

In light of the states support, encouragement, assistance, and preference of a power plant at Kawaihae, wouldn't it be prudent for you to immediately negotiate a purchase agreement with Waimana, withdraw your expansion plan at Keahole, and support, assist, and encourage Waimana in costructing the cogenerating power plant at Kawaihae?

147. If not, why not?

148. What is the subject matter and status of the two pending dockets at the Public Utilities Commission which are referred to in the governor's Aug.18 letter?

149. The governor states "I am told that, even with generating facilities in Kawaihae and at Puuanahulu, HELCO projects a need for additional plants in W.Hawaii to meet the ever-increasing demand for electricity and to ensure that HELCO will be able to service its customers without instituting rolling blackouts." If this be so, please provide the documentation indicating that a 56 mw plant at Kawaihea OR Keahole, AND a power plant at Puuanahulu as proposed, is insufficient.

150. The governor's letter indicates that "this lease represents an affirmative and important step by the State to assist HELCO in meeting W.Hawaii's growing energy needs." Since Gov.Waihee and the state are offering to help HELCO meet W.Hawaii's energy needs by facilitating the development of a cogenerating power plant at Kawaihae, why do you spurn such help?

VIEWPLANE

151. The first question in my Jan.22 letter related to views of the plant from the surrounding area. I specifically asked "what will it look like from 1/4 mile down the airport road and from the intersection of the airport road and Queen Kaahumanu Hwy?" A photosimulation is provided for the former but not the latter. Why didn't you respond?

152. Will you please provide photographic simulations from the perspective of the airport/Queen K. intersection facing eastward?

153. You state in your June 21 reply to my Jan.22 letter that "we now conclude that while there may be some visual impact from a lower stack, the impact will not be significant." Yet on page vii of the revised draft, in a chart titled "Summary of Impacts" you indicate that "Visual Resources" is an adverse impact which "may not be significant". "May not be significant" equally means that it "may be signficant" as "may" is equivalent to "may not". Obviously your reply is subjective, biased and self-serving as most other people, whether they are local residents or island visitors, believe that a 104′ chimney at along the highway is a very adverse visual impact. Please comment.

154. What other single object, if any, will have a more significant visual impact than a 104′ high chimney just off the highway?

155. What color will the chimney be painted?

156. Will it have a flashing light on it to warn aircraft pilots of the impending danger?

157. What is the color plan for painting the entire power plant including the buildings, the diesel generators, storage tanks etc.

DANGEROUS NEW TELEPOHONE POLES

158. Enclosed is a letter to the editor of the West Hawaii Today newspaper of Oct 6 from Jack Lippencott of Kallua-Kona about the 40 unmarked utility poles recently erected on Hualalai Rd. from Kuakini to Queen Kaahumanu Hwy. Please comment.

159. Are all the facts in the letter true?

160. If not, which facts are not true?

161. Who is responsible for failure to place reflective materials on the pole?

162. When did HELCO begin installing those poles and when was the installation completed?

163. Do you agree that failure to illuminate those poles with reflective material constitutes negligence on the part of HELCO or its agents?

164. This is to put HELCO on notice that failure to IMMEDIATELY place reflective markers on the poles will make HELCO officials PERSONALLY LIABLE for gross negligence.

165. If HELCO officials are sued for personal negligence and lose, will they have to pay out of their own pocket, does insurance cover it, or will ratepayers end up footing the bill?

166. How many accidents have occurred in the past under similar conditions i.e a driver crashing into a telephone pole that had no reflective marker on it?

167. What was the total cost of the pole installation job?

168. How much would it have cost if the wires that are strung to the poles were placed underground instead?

169. If HELCO's buearacracy is too cumbersome to provide immediate relief to this life thereatening situation caused by HELCO, will you please fax me written permission (329-7651) so I may personally place reflective tape on each pole within 24 hours of receipt of such permission? I will do it as a public service without charging HELCO for labor or material.

KEAAU SITE AS AN ALTERNATIVE

170. Your response to Question 6 of my Jan.22 EIS input is a weak and inadequate attempt to suggest, without substantiation, that the Keaau site is unacceptable to fulfill your anticipated near-term reserve needs.

171. Please provide evidence that HELCO has made a recent serious assessment of the feasibility of CT-4 at Keaau.

172. Did HELCO state in '88 (or '89) that "The Puna power plant is the only existing site which does not have significant constraints associated with the installation of a new generating unit"?

173. Was that statement true then?
174. Is it still true?
175. If not, why not?

176. Since the space required by CT-4 in Keaau is quite small and the future plans of HELCO call for dual train combustion turbines with heat recovery steam generators, you can combine CT-4 with CT-3 and a steam generator to provide near term, high efficiency electric generation, can't you?

177. Since the Keaau CT-4 is similar to the existing CT-3, couldn't prior air permit calculations for CT-3 be used to shorten the "18 months to prepare an air permit application for Keaau..."?

178. Couldn't any doubt about air quality in the "area impacted by CT-3" be readily resolved by retiring some of the small, old, high polluting generators such as Shipman 1,3, & 4, Kanoelehua 11, and CT-1?

179. Did HELCO say that "CT-1's fuel efficiency is about three times worse than any other unit in the HELCO system" making CT-1 an extremely high polluting unit?

180. Wouldn't the removal of CT-1 compensate for emissions from CT-4?

181. What would the net peak power addition be under this scenario?

182. Since CT-1 is a peaking unit and the new 36mw is baseload generation which the HELCO system needs, wouldn't it be a superior alternative?

183. Your concern about wastewater disposal is trivial since CT-3 is already handling it. Please comment.

184. Wouldn't additional line capacity be provided if the 69 KV line was energized to 138 KV for which it was originally designed?

185. Your assertion that a new cross-island transmission line would be needed is highly dubious. Please provide supporting evidence.

186. You have claimed that the main reason for locating generating plants in W.Hawaii is to locate them near the users to reduce "line losses". It is our understanding that line losses are minimal especially if the lines are proPerly engineered and maintained. On the mainland transmission distances extend thousands of miles. Do you have a study which compares the cost of line loss against the cost of long term chemical treatment of brackish water and its associated waste water disposal? If so what does it show.

187. If not, please do one.

REQUESTS FOR MORE DRAFT REVISED EIS'

188. Also, please include in the final EIS as requested, my letter of Sept. 13 requesting that additional draft revised EIS's be printed to meet the increased demand for this information, and your reply.

189. How many revised draft EIS's did you print and distribute?

190. What is your cost for printing and for mailing the draft revised EIS?

191. How much money did HELCO save by not printing another 100 sets of draft revised EIS' in order to meet the demand for such documents during the last three weeks of the draft revised EIS input period.

192. How much are you charging ratepayers for doing the entire EIS process including paying consultants, printing etc?

193. Was everyone who requested the original draft EIS also automatically sent a copy of the revised draft or was the draft revised EIS made available only when requested?

194. Were people who requested the revised draft who hadn't obtained the original 3 book EIS sent only the revised draft book or were they sent the entire 3 book set?

195. I think it is indicative of HELCO's contempt for the public in not providing sufficient draft revised EIS's to meet the demand. After spending hundreds of thousands if not millions of dollars of ratepayers money to do the EIS, they withhold a few thousand dollars to provide sufficient copies to the public. Please comment.

196. Also please answer the two questions in my Sept.13 letter which you failed to answer in your Sept.15 reply: (1) How many EIS sets were originally printed (of the pre-revised draft)

197. (2) What is the cost per EIS set that you will be charging ratepayers.

GENERATING CAPACITY AND RESERVE

198. In the West Hawaii Today article of October 1, Bill Stormont said that "aging equipment suffering from overuse during delays in PGV beginning production is adding to the chance that power shortages may once again become a reality if the Keahole plant is not built. We'll be back in the same boat we were in when when we had rolling blackouts if we are not able to retire those units soon."

Now that PGV is on line and an adequate backup reserve is available, has all of HELCO's "aging equipment" been overhauled and properly maintained so that it is less likely to break down in the future as it did in the past?

199. Some of HELCO's generating equipment is 40 years old (D-8,9,&10 in Waimea totalling 2.70 mw) and still operating. It is scheduled to be retired in 1995 as is Kanoelehu D-11, Kanoelehua CT-1, Shipman 1, and Waimea D-12 totalling 19.85 mw). D-12 is 23 years old.

200. How old is Kanoelehua D-11, Kanoelehua CT-1, and Shipman 1?

201. If D8,9,&10 are 40 years old and still running, can't D-12 which is only 23 years old and Kanoelehua D-11, Kanoelehua CT-1, & Shipman 1 also run another year or two instead of retiring them as planned in 1995 to assure even more backup reserve if needed during 1996 when Waimana would finish its Kawaiahea power plant?

202. Based solely on your "Resource Plan:Power Facility Addition & Retirements" (Table 1-1 on page 1-5 in vol.1 of the revised draft EIS) provided that you do NOT retire the 7 units comprising 20 mw in 1995 as scheduled or in 1996, there is only 5 less mw reserve through 1996 WITHOUT ADDING ANY ADDITIONAL ELECTRIC GENERATION than there is in 1999 even with the retiring of Hamakua Sugar in 1994. (33.2 - 10mw increase in annual forecasted peak with DSM = 23.2, as compared to 28.5 in 1999.) This doesn't take into consideration hydropower energy added to the system or wind energy that may be added to the system. Nor does it take into consideration any forecast overestimations based on a declining economy. Is this analysis correct?
203. Blank

204. If not, whereso is it wrong?

205. If it is correct does it not indicate that if Waimana came on line by Dec.31 1996 Hawaii would not be in dire threat of rolling blackouts as you want us to believe and that the emergency situation you describe that requires HELCO to expand its Keahole plant by 1995 instead of waiting for Waimana to come on line in 1996 is not based on fact or reality?

206. What is the present status of Hilo Coast Processing Co's permitting application for using coal to fuel its turbines once begasse is no longer available?

207. Is HELCO working with HCPC to facilitate the permitting process so that HCPC's generation will be ready to switch from bagasse to coal when its sugar cane production ceases?

208. When does HELCO anticipate is the earliest HCPC can be approved to burn coal?

209. What if any is the contingency visual mitigation plan if the road is not realigned?

MISCELLANEOUS:

210. Volume 2 Section 9 (Public Involvement Program) has approximately 300 pages and is NOT NUMBERED, making it extremely difficult to use. Why did you do it this way? and will you please rectify the condition by numbering every single page of the revised final EIS sequentially from beginning to end in the final EIS?

211. HELCO failed to list 1.5.1, 2.3.1,.2,.3,.4,.5,.6,.7, 2.4.1,.2,.3,.4, etc. in the index. Will you please do so in the final.

212. What is the name, address & phone number of the owner of Muheenui Cone who you say wants to mine it making it inelgible as a site for the proposed future 200 mw plant.

213. Enclosed are recent letters to the editor and advertisements about your proposed expansion at Keahole. Please print them with your comments in the event you disagree with anything that has been written.

214. Do you want people to use more electricity or less electricity?

215. Due to the delay caused by an inadequate EIS and the need to do a revised draft and final EIS, and due to the pending contested case hearing, please publish an updated schedule of the 22 steps leading up to commercial operation of the proposed Keahole Generating Station expansion that would replace the obsolete Nov.'92 schedule of permits & approvals etc. Please base your estimations on a realistic assessment of when you believe the contested case hearing will be underway and when you think the final decision will be rendered.

216. What is the present status of each of the listed components of the schedule?

217. What is the status of negotiations to turn the Lalamilo wind farm over to HELCO?

218. What is the result of your study, if any, to develop the power plant at the existing substation on Mamalahoa at Waikoloa.

219. Attached is a draft flier by the Keahole Defense Coalition. Please review and comment.

220. What is the total sum of money HELCO will be collecting from rate payers for its Integrated Resource Planning?

221. In the Sept.18 Hon Adv. article Stormont said that HELCO had not been invited to attend any of the community meetings. The public was repeatedly invited to all KDC meetings via newspaper and radio.

222. Doesn't HELCO, a "public utility", consider itself part of "the public?"

223. Isn't HELCO interested enough in this matter to attend a public meeting on its proposed Keahole expansion plan to attend without a special, personal invitation?

224. Your representative Albert Lono Lyman of C2HM Hill was specifically called and invited to our public informational meeting. Did he or his or HELCO's representative show up?

225. Why hasn't HELCO applied to the Land Use Commission to reclassify the property?

226. What is HELCO's plan in the event it is challenged in its apparent circumvention of the LUC since all the surrounding lands are currently being reclassified?

227. Why do you plan an oil burning plant rather than state of the art equipment?

228. If the state doesn't sell or lease you abutting land for a buffer zone, and you are able to expand the Keahole plant as planned, what adverse impact would that have on abutting property owners?

229. Will you expand the plant before you close the purchase or lease of abutting land from the state for a buffer?

230. If the state won't sell you its land for a buffer, will you expand the Keahole plant anyway?

231. Item 2e of the "Real Property Disclosure Statement for Home Sellers" would require notification of the proposed power plant expansion in regard to known toxic substances in the soil, air, or water. Won't such notification of such potential adverse impacts from the operation of your proposed expanded plant decrease property values?

232. Please summarize the results of your study on this matter.

233. Does HELCO believe that a municipal or community owned electric utility on Hawaii could produce better service at lower rates then HELCO, considering that HELCO's primary interest appears to be stockholders not its customers? Please discuss the pros and cons of turning the electric utility into a municipal utility or consumer owned utility.

Yours for a better way,

Jerry Rothstein

Jerry Rothstein, CDCW
76-123 Royal Poinciana Dr.
Kailua-Kona Hawaiiisland 96740
329-1568 // FAX 329-7651

Enclosures:
- Gov.Waihee's Aug.18 letter to Sen.Levin about the Kawaihae site
- Keahole Defense Coalition flier
- Kehole Defense Coalition ad in West Hawaii Today
- J. Lippincott's Letter to editor
- Alice Goo's letter to the editor
- Keichi Ikeda's letter to the editor
- Peggy Ratliff's letter to the editor
- Jojo Tanimoto's letter to the editor
- Albert Hee's letter to the editor
- Sept.22 WHT article "Group prepares to battle power plant expansion"
- Oct.1 WHT article "Two-front battle planned..."

EXECUTIVE CHAMBERS

HONOLULU

JOHN WAIHEE
GOVERNOR

AUG 25 1993

August 18, 1993

The Honorable Andrew Levin
The Senate
Seventeenth State Legislature
State Capitol
Honolulu, Hawaii 96813

Dear Senator Levin:

Thank you for your recent letter concerning the proposed development of power generation facilities on the Big Island.

I am cognizant of your concerns and support the siting of future power plants in West Hawaii at the most suitable locations, consistent with our goal of providing a timely, reliable, and cost-effective power system for the island. However, I am told that, even with generation facilities at Kawaihae and at Puuanahulu, Hawaii Electric Light Company, Inc. (HELCO) projects a need for additional plants in West Hawaii to meet the ever-increasing demand for electricity and to ensure that HELCO will be able to service its customers without instituting rolling blackouts.

Nonetheless, the State has been moving ahead with its plan to provide for the development of a power plant in the Kawaihae area. The Hawaiian Homes Commission, at its regular monthly meting of July 27, 1993, approved the negotiated lease terms and provisions between the Department of Hawaiian Home Lands and Waimana Enterprises, Inc. (WEI). The terms of the general lease are for 65 years and will encumber approximately 40 acres of Hawaiian Home Lands at Kawaihae, Hawaii. WEI will build a 58-megawatt power plant, to be in service by the end of 1996, and a desalination plant capable of producing 2.6 million gallons per day of potable water.

I am informed that the State and WEI are already working on the permits and other approvals that are necessary for the project. We are hopeful that this will result in the prompt filing and processing of the various permit applications.

I am advised that it would be inappropriate for me to comment on HELCO's plans to expand its facilities at Keahole because these proposals are the subject of two pending dockets at the Public Utilities Commission (PUC). The PUC must make its decisions solely on the basis of the record in each of these proceedings, without my input or that of anyone else who is not a party to these dockets.

As you note in your letter, while there is an agreement on the need for additional power generation in West Hawaii, there is a lack of consensus on where the electric plants would be located. By agreeing to lease Hawaiian Home Lands property in Kawaihae to WEI, the State has identified one West Hawaii site for development of a generation facility. In the midst of a continuing debate on the siting of other generation facilities, this lease represents an affirmative and important step taken by the State to assist HELCO in meeting West Hawaii's growing energy needs.

Your interest and concern in the matter are appreciated.

With kindest regards,

Sincerely,

JOHN WAIHEE

Say "NO!" to HELCO

KEAHOLE DEFENSE COALITION
325-7073 329-1568 329-7289 329-6770
P.O. BOX 1510, KAILUA-KONA, HI 96745

SAY "NO" TO :

NO MORE POLLUTION - NO WATER SHORTAGES
NO DECREASED PROPERTY VALUES
NO NEW (104 FT.) SMOKESTACK - NO INCREASED TRAFFIC/ACCIDENT/OIL SPILLS
NO 2.1 MILLION GALLON DIESEL FUEL STORAGE TANKS

"SMOKESTACKS IN KONA?"

HELCO IS ACTIVELY TRYING TO TRIPLE THE SIZE OF THE POWER PLANT LOCATED ACROSS THE HIGHWAY FROM THE KEAHOLE AIRPORT. WHAT MESSAGE DOES THIS SEND TO "HAWAII VISITORS"? DO WE WANT TWO SMOKESTACKS (70 FT. AND 104 FT) SPEWING SMOKE AT THE GATEWAY TO WEST HAWAII. AT LEAST 12 LARGE TANKER TRUCKS WILL TRAVEL DAILY FROM HILO TO KONA ON OUR HIGHWAYS DELIVERING DIESEL FUEL TO THE MOST DANGEROUS, ACCIDENT-PRONE INTERSECTION ON THE ISLAND. UP TO 75 VEHICLES PER DAY WILL BE ENTERING AND EXITING THIS BUSY SITE. THE EXPANSION WILL ALSO ADD THREE NEW 42-FT. FUEL STORAGE TANKS , IN ADDITION TO THE PRESENT SIX 40-FT. DIESEL STACKS. THESE STORAGE TANKS WILL HOLD APPROX. 2.1 MILLION GALLONS OF DIESEL FUE AT THE SITE.

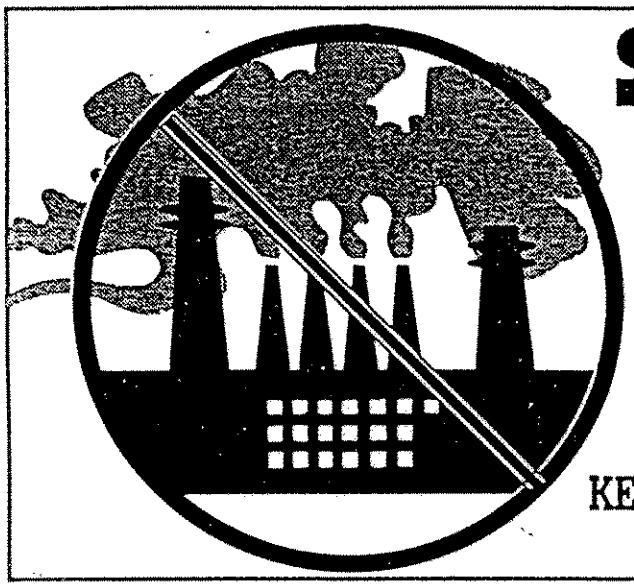
IN SPITE OF WATER SHORTAGES, THE COUNTY HAS COMMITTED 129,600 GALLONS OF POTABLE WATER PER DAY FOR THE FIRST PHASE ONLY.

IF THE KEAHOLE POWER PLANT IS ALLOWED TO EXPAND, NITROGEN OXIDE, SULFER DIOXIDE AND CARBON MONOXIDE WILL INCREASE AND MIX WITH THE EVER PRESENT V-O-G AFFECTING PLANTS, ANIMALS AND HUMANS. THIS POLLUTION WILL DEGRADE THE AREA AND PROPERTY VALUES WILL BE ADVERSELY AFFECTED BY THE KNOWN TOXIC SUBSTANCES IN THE SOIL, WATER SUPPLY AND ATMOSPHERE.

NO THREAT OF ROLLING BLACKOUTS!

TWO YEARS AGO WHEN KONA WAS BOOMING, IT LOOKED LIKE THE DEMAND FOR POWER WAS GOING TO KEEP INCREASING. HOWEVER, IN MORE RECENT TIMES:

1) 20 MEGAWATT COMBUSTION TURBINE GENERATOR INSTALLED AT KEAAU.
2) 25 MEGAWATT GENERATOR AT PUNA GEOTHERMAL HAS COME ON LINE AND HAS BEEN ACCEPTED AS A FIRM POWER SOURCE.
3) A SMALLER HYDROELECTRIC PLANT HAS BEEN COMPLETED AND PUT INTO SERVICE IN HILO.
4) HAMAKUA SUGAR IS ON LINE WITH 10 MEGAWATTS
5) WAIMANA ENTERPRISES HAS SIGNED A LEASE WITH HAWAIIAN HOMELANDS TO BUILD A POWER PLANT AT KAWAIHAE.



Say "NO!" to HELCO

No Pollution · No Water Shortages · No Decreased Property Values · No New (104 ft.) Smokestack · No Increased Traffic/Accident/Oil Spills · No 2.1 Million Gallon Diesel Fuel Storage Tanks

Stop Keahole Power Plant Expansion

Public Informational Meeting

Wed., Sept. 22, 7pm · Kona Palisades Rec. Center · Crosson Pavilion

KEAHOLE DEFENSE COALITION · 325-7073 · 329-1568 · 329-7289 · 329-6770

Please Send Donations to: P.O. Box 1510, Kailua-Kona, HI 96745

Warn drivers

dltor:

Since it appears to be currently fashionable to thrash HELCO in his column, I may as well get in my two-cents worth before the fad becomes obsolete.

Among its numerous inadequacies from poor management to the lame excuses issued as explanation for the blackout problems, there looms another threat.

Approximately 40 utility poles have been erected on Hualalai Road extending from the Kuakini Highway intersection and winding upwards to the Queen's Highway intersection. I presume the use of these poles is shared by other utility companies, so this letter should be direct to all of the guilty parties who may be subletting the space.

Every one of these poles has been placed within three to five feet of the roadside boundaries. There is a total absence of street lighting along this stretch of avenue and absolutely no illumination of any kind on or near these poles to warn a driver that, should he become distracted, his vehicle may quickly become a wrap-around ornament for these structures. These poles loom out of the darkness quickly and surely pose an obvious danger to any average motorist.

Before someone gets killed ramming themselves into one of these dangerous eyesores, I implore of HELCO to take a portion of the profits they reap from my electric bill and invest in some type of reflector in order to alert drivers that there is a 40-foot piece of solid wood very near to their vehicle. Any hardware store or bicycle shop will be happy to supply them with simple reflectors for about $1 apiece. Then all it takes is one responsible employee with a hammer and nail to tack them up to the poles to warn drivers of this very real danger.

Jack Lippincott
Kailua-Kona

Consider it now before it's too late

Editor:

The time has come for old and new residents of paradise to realize we are under siege. We are under attack by developers like Ron Brown and his Tombstone city, a garbage dump within spitting distance of our major industry tourism, a non-working sewage plant located in a prime area adjacent to a public park and now HELCO planning to expand a small facility into a major power plant at the entrance to our airport and on a major thoroughfare.

This community is not aware of some of these fiascos until after the fact, when it become next to impossible to do anything about it. Now is the time to consider the consequence of HELCO's proposed expansion. Consider at least 12 more tanker trucks on the highway from Hilo daily to store fuel in two over two million gallons tanks, additional air pollution that already exceeds state standards of air quality acceptability, the threat of a serious water shortage the next big drought season because HELCO receives thousands of gallons of our potable water daily and the bottom line being our electric bills will go up markedly.

All this because we believe we need an additional source of power now to prevent rolling black-outs. In reality, according to HELCO's facts, due to no increased needs for power because of our stalled economy, and additional power sources coming on line, like Puna Geothermal, there is no imminent danger of rolling blackouts. There are numerous alternative power conservation ideas and power sources like Waimana (Kawaihae) for our future needs.

Wake up Kona, we must take control of what is happening in our community. This must be done before it happens and not after it happens. Keahole Defense Coalition is a newly founded group trying to arouse interest and involve the community in HELCO's proposed expansion. Act now, write to Box 1510, Kailua-Kona 96745. For more information or call 325-7073, 329-7289 or 325-5146.

Alice Goo
Kona Acres

Letters

Say no to HELCO

Editor:

HELCO is very actively trying to get approval to expand its Keahole generating station. The proposal is to nearly triple the size of the plant located right across the highway from the entrance to the airport. This plant will have a smokestack 104 feet high, and storage tanks to hold two million gallons of fuel.

According to people who work for HELCO, this expansion has to be in Keahole because there is a very urgent need to start producing 20 megawatts more of electricity by the end of 1994. They say the plant cannot be put anywhere else if they are to meet this deadline.

Is there really a need to meet this deadline? Two years ago we were really short of power. The economy was booming. It looked like the demand for power was going to keep increasing. Puna Geothermal Venture was unable to complete its plant as scheduled. The need for additional generating capacity was urgent.

But look at what has happened since then:

—A 20-megawatt combustion turbine generator was installed at Keaau.

—Puna Geothermal Venture's 25-megawatt generator has come on line and has been accepted as a firm power source.

—A somewhat smaller hydroelectric plant has been completed and put into service in Hilo.

—The economy has slowed; new buildings are not being put up as fast as they used to be; the number of tourists coming to this island has declined; this means hotels have fewer rooms that need to be air conditioned and lighted; some businesses have closed down, decreasing their demand for electricity.

—Plans are progressing for an independent 58-megawatt power plant and desalination facility in Kawaihae. A native Hawaiian-controlled corporation called the Waimana Enterprises Inc. has entered into a lease agreement with the Hawaiian Homes Commission for land on which to build this plant. Waimana plans to be on line with this power plant in late 1996.

Because of these developments, the need to expand the Keahole power plant by the end of 1994 has greatly diminished. Waiting two years or so longer for the Waimana plant will be worth the wait because the Waimana proposal has several important advantages over the Keahole plant expansion.

It will not degrade the landscape at the gateway to West Hawaii. It will be located close to where the fuel is unloaded. It will be producing potable water, while the Keahole plant will be consuming 129,600 gallons a day of potable water.

By the way, has anyone noticed the 3.8 percent surcharge that has been added to everyone's HELCO bill? I am told this increase is needed to raise $2,190,000 per year to pay Puna Geothermal Venture for its geothermal plant.

The proposed Keahole plant expansion is going to cost around $95 million. If HELCO were allowed a return of 10 percent on the money spent for this plant expansion, then it will cost the rate-payers another $9,500,000 per year. If it took a 3.8 percent rate increase to raise $2,190,000 a year, then it will take a 16.48 percent increase to raise $9,500,000 a year.

So, the question becomes this: Do we need a plant that will degrade the landscape, add to the air pollution, damage crops of nearby farmers, consume a lot of water, and increase everyone's electric bill, especially when the plant may not really be needed?

I do not want and we do not need the Keahole plant expansion. And I urge all those who agree to join a group being formed to oppose this plant expansion and pursue a contested hearing case against this project.

This group is the Keahole Defense Coalition and it plans to meet at the Kona Palisades Recreation Building at 7 p.m. Sept. 22 and 29.

Remember that this is not a temporary plant that HELCO is proposing to build. Once this plant is built, it will be here for a long, long time. And we will be paying for it a long, long time.

Keichi Ikeda
Kailua-Kona

HELCO plans are at odds with agriculture

By PEGGY RATLIFF
Kailua-Kona

What do you do when you can no longer "live and let live?"

What do you do when you're just regular farmers trying to eke out a living, and along comes HELCO and threatens your very livelihood?

You fight, that's what you do.

HELCO is trying to expand the Keahole Generating Station at the expense of the Keahole Agricultural Park, along with affecting surrounding areas including Kona Acres and Kona Palisades.

According to HELCO's draft environmental impact statement, it says that the proposed project has no significant adverse effects on air quality, plants, property values, noise, etc.

Keahole Ag Park is directly adjacent to the proposed project.

HELCO's EIS makes statements such as that the nearest residences are approximately one-mile away rather than directly adjacent to the project, when in fact, the nearest residence is approximately 50 yards from the project.

HELCO has drawn the conclusion that because the Ag Park is state lease land, and our rules are different, no significant impact to property values have been identified and no mitigation measures are proposed.

Then they turn right around and say that future development of land within half mile of the station should be discouraged. Also adequate disclosure of the expected noise levels from Keahole Generating Station should be provided in all real estate transactions, and rental or lease agreements, involving lands within half mile of the station.

Currently the state is in the process of rezoning 2,600 acres from conservation to urban. This land will come right up to HELCO's boundary. Also the West Hawaii University Campus is proposed in the area.

Before the EIS, HELCO did not even bother to run tests to see if the emissions from the stack would damage the plant life in the ag park.

It just so happens that the emissions from the generators in Hilo are causing the paint to pit on new cars at dealerships adjacent to the HELCO plant. It is such a problem that the cars have to have a plastic coating put on them for protection. Doesn't it seem logical that if the emissions can cause pitting of car paint, that they will certainly destroy flowers and other plant life?

HELCO has lowered the stack from an original 210 feet to 104 feet for visual reasons. Why do they give a stack tall height to begin with? Lowering it could have a more detrimental effect on the immediate area.

HELCO also has not addressed electromagnet field radiation at all.

Unfortunately, because the ag park has been conspicuously absent in the EIS, in order to protect our agribusiness and our residents, we had no choice but to ask for a contested case hearing.

It seems something is definitely wrong with our system when agriculture has to fight for survival in this manner. Why couldn't someone in the early planning stages study this and realize that this is adjacent to a 179-acre ag park and address the problem?

It seems a shame that HELCO does not have the capacity to realize at this point that the site is wrong and voluntarily move it to another location.

HELCO plans to spend $100 million on this expansion (which, don't forget, is passed on to the consumer).

If you have been to any of the HELCO meetings, you know that we have some brilliant experts right here in Kona who have offered some terrific ideas to HELCO.

With people like these and $100 million, can't you just imagine how efficient and safe our power source could be?

HELCO has documented that their inefficiency rate increases rather than decreases, to the tune of 3 percent per year.

We have government by the people in this country, not government by HELCO or do we?

Viewpoint articles represent the views of individuals in our community and do not necessarily reflect the opinion of the newspaper.

HELCO plant belongs in Kona

Editor:

Recently, articles have been written in your column regarding HELCO's Keahole Energy Plant. Mr. Bill Kawahara and Eichi Nakamura conveniently refer to Kawaihae as a location to build this kind of facility. Perish the thought. The Hawaiian Homes beneficiaries see this effort as a scam.

Quit dumping the general public conveniences on Hawaiian Homes Lands. These lands are for homesteading. Presently, DHHL has general leases, licenses, rights of ways, etc., for HELCO in Panaewa, GTE Phone Co., Department of Transportation, public schools, public works, DLNR and on and on.

One of the reasons it is convenient to build these facilities on Hawaiian Homes Land is the land is cheap (for the beneficiaries). The other reason is encumberance of homesteading land for the mighty dollar. But, how much does Hawaiian Homes need? Much more than they are dealing for. How much is that? Well, Hawaiian Homes is not sure. In other words, this concept could go on forever. The waiting list could continue to grow. In the end, where is the land for homesteading? Everybody else has it besides the homesteader.

HELCO needs to build in Kona because the development is in Kona. When the development goes to North Kohala, HELCO will need to find somewhere closer to North Kohala. HELCO wants to build in Kona because HELCO owns the land at Keahole.

Now, if the opposers feel desperate to use Kawaihae, how much is it worth to pass the pollution and strong concerns to beneficiaries of Hawaiian Homes Lands? One percent of the state taxes? One percent of the state taxes and one percent of the county taxes? These monies will certainly benefit the DHHL plan to provide revenues, for infra-structure, housing, administrative costs, etc. These revenues could also alleviate costs for pollution and enforcement control.

Perhaps this way, the electrical services demanded by HELCO islandwide consumers can be met and the goal of DHHL can also be met and then the general public (which includes beneficiaries) will all be happy at one time.

Jojo Tanimoto
Kealakekua

Project responds

Editor:

As the local developer/owner-partner for the proposed Kawaihae Cogeneration Partners (KCP) Plant, I would like to clarify some points raised in Jojo Tanimoto's letter (WHT Sept. 2) regarding the use of Hawaiian Home Lands at Kawaihae Harbor for a power plant facility.

The KCP project is not "dumping" on Hawaiian Home Lands. To the contrary, it will be contributing an additional 25 percent to the Department of Hawaiian Home Lands (DHHL) annual revenues, assisting DHHL beneficiary training programs and providing a needed source of water and electricity for Kawaihae's homestead development. The goal of the Hawaiian Homestead Act is to rehabilitate beneficiaries. This includes assisting beneficiaries into the business mainstream of society as well providing homesites.

DHHL lands at Kawaihae constitute one of the largest single parcels in the state (10,000 acres) but it is without roads, water, and power. The department has prepared a 10-year master plan for this area, which includes a power plant within the industrial harbor to help service the surrounding residential development for beneficiaries.

Jojo is right to be concerned about pollution and needing monies to "...benefit the DHHL plan to provide revenues for infrastructure, housing, administrative costs, etc." As far as pollution, I assure her that the strictest standards for pollution control will apply under the federal Clean Air Act and Clean Water Act. These laws also carry stiff penalties for violations and have monitoring requirements (enforcement) as standard conditions.

KCP will be paying $1.2 million in annual lease rent to DHHL which comes to 25 percent more for DHHL's annual cash flow that could help pay for infrastructure, housing, etc. DHHL presently gets about $4 million a year in total statewide lease revenues.

Most of all, the project could bring a needed source of fresh water for the surrounding area's homestead development. Federal laws require an independent power producer like KCP to be more efficient by making use of excess heat and steam. Subject to DHHL's needs, KCP intends to have a supplemental facility onsite to remove salt from sea water using waste heat (desalination).

Jojo and I are in total agreement on the need to meet the goals of HELCO islandwide consumers and the goals of DHHL and the general public. I, as well as KCP's assistant project manager, are beneficiaries on the DHHL waiting list and so we are even in stronger agreement in not wanting this waiting list to continue to grow.

Albert S.N. Hee
Kawaihae Cogeneration Partners (KCP)
an affiliate of Waimana Enterprises Inc.

Group prepares to battle power plant expansion

By BOBBY COMMAND
West Hawaii Today

A West Hawaii group will meet tonight to plan strategy to fight the proposed $100 million expansion of the Keahole power plant.

The Keahole Defense Coalition also met last week to discuss its opposition to Hawaii Electric Light Co.'s application to the State Department of Land and Natural Resources for a conservation district use permit to allow the $100 million expansion.

The coalition is raising funds to participate in a contested-case hearing with HELCO, which says the expansion is necessary to avoid recurrences of power shortages and rolling blackouts that plagued the Big Island a few years ago.

A coalition spokesman says the reason for the power outages,

See KEAHOLE Page 4A

...Keahole expansion opponents organize

From Page 1A

mainly delays in opening the Puna Geothermal Venture plant, no longer exists. Therefore the Keahole expansion, which the coalition says will damage the environment and create a visual blight, is no longer needed.

A number of community groups, businesses and political leaders have also questioned the location of the proposed expansion, which would include a 104-foot smokestack and three 42-foot high oil storage tanks, one of which would hold 1.5 million gallons of fuel oil.

Groups including the Kona-Kohala Chamber of Commerce and the Outdoor Circle have said they are concerned the plant may affect tourism because it will be visible to visitors who are driving to and from Keahole Airport.

A revised draft environmental impact statement for the proposed expansion is being reviewed by the DLNR and is still within the 60-day comment period.

The original EIS was rejected because HELCO did not address alternative sources of energy, mainly the 25 megawatts promised from Puna Geothermal and 58 megawatts proposed from Kawaihae Cogeneration Partners.

"Puna Geothermal was not on line when we submitted the original draft EIS," said Warren Lee, president of HELCO. "Hawaiian Homes was still dealing with Kawaihae at that time."

Based on Puna Geothermal beginning operations and successful land negotiations between the Department of Hawaiian Home Lands and Kawaihae Cogeneration, Lee said the draft EIS was pulled to make necessary changes that would satisfy the DLNR.

Coalition members say instead of expanding the Keahole plant, HELCO should wait until Kawaihae Cogeneration completes its plant in 1996 and then buy the needed power from the private generator.

Opponents also say that Hawaiian Electric Industries, Inc., HELCO's parent company, stated in its 1992 annual report that rolling blackouts would not be necessary if Hamakua Sugar Co. is supplying electricity. Both Hamakua and PGV are providing power to HELCO.

But a HELCO official said demand is continuing to rise while its sources of electricity are diminishing.

Two-front battle planned for Keahole power plant

By BOBBY COMMAND
West Hawaii Today

Opponents of a proposed power-plant expansion at Keahole said they will fight the project on two fronts.

At its final scheduled meeting, the members of the Keahole Defense Coalition said they would try to halt approval of the revised Environmental Impact Statement through comments to the Department of Land and Natural Resources.

A pair of its members are also parties to a contested-case hearing against Hawaii Electric Light Co., Ltd.'s 58-megawatt expansion of its Keahole Power Plant.

Keichi Ikeda, a spokesman for the coalition, said there are many reasons for opposing the plant expansion. "It's no longer needed," Ikeda said. "The urgent conditions no longer exist."

According to a coalition representative, Hawaiian Electric Industries, Inc., HELCO's parent company, stated in its 1992 annual report that rolling blackouts would no longer be necessary if Hamakua Sugar Co. is supplying electricity. Both Hamakua and PGV are currently providing power to HELCO.

Ikeda also said the coalition has concerns about water use and quality because of the wells HELCO is digging, what effect it will have on the adjacent agricultural lots and the what consumers will pay to finance the project. Ikeda said these items will be covered in comment to the EIS before the input deadline Thursday.

"All of these factors combined with our forecasts for the next five years tells us we need Keahole." — Bill Stormont

Coalition members have also expressed concern about the visual impact of the proposed 104-foot smokestack and three 42-foot-high storage tanks which would hold a million gallons of fuel oil.

Instead of expanding the Keahole plant, coalition members have said HELCO should wait until Waimana Enterprises, Inc. completes its proposed oil-fired power plant and water desalinization plant in 1996. They said HELCO could then buy needed electricity from the private generator, which would be located in Kawaihae.

But a HELCO official said demand is continuing to rise while its sources of electricity are diminishing. "Our reserve margin is continuing to shrink," said Bill Stormont, HELCO's manager of administration.

Stormont said Hamakua Sugar will cease electric generation after its last harvest in 1994. He also said Hilo Coast Processing Co., which is also halting sugar production, wishes to continue producing electricity, but must switch from bagasse, or sugar cane byproducts, to coal to fuel its turbines, and that will entail a whole new set of permitting applications.

Stormont added that aging equipment suffering from overuse during delays in PGV beginning production is adding to the chance that power shortages may once again become a reality if the Keahole plant is not built.

"We'll be back in the same boat we were in when we had rolling blackouts if we are not able to retire those units soon," Stormont said.

Should Hilo remain the source of electricity for West Hawaii, Stormont said, more transmission lines would also mean more cost to consumers. He said the average loss of transmitting electricity from Hilo to Kona is 10 percent.

As for the visual aspect of the Keahole plant, Stormont said the state has informed them that the entrance to the airport will eventually be moved to a different site and that the current access will become a service road.

HELCO has also said in the past that the Waimana plant could no not be completed until 1996. Delays in the EIS have already pushed back the completion date of the Keahole plant to late 1995.

"All of these factors combined with our forecasts for the next five years tells us we need Keahole," Stormont said.

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Jerry Rothstein, CDCW
76-123 Royal Poinciana Dr.
Kailua-Kona, Hawaii 96740

Dear Mr. Rothstein:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

WAIMANA: AN INDEPENDENT POWER PRODUCER

1. Generally, there should be no difference to the ratepayer's monthly bill if Waimana, or any other independent power producer (IPP) that may negotiate a contract with HELCO, is a qualifying facility. HELCO could only enter into a contract with a qualifying facility which provided that HELCO would be paying no more than 100 percent of its avoided cost. If Waimana is not a qualifying facility, HELCO would not be obligated under Hawaii law to pay 100 percent of its avoided cost and could, presumably, pay less, if a lesser amount could be negotiated. In this instance, lower monthly bills for ratepayers could be realized. A possible power purchase agreement between HELCO and Waimana (as well as other IPPs) is currently under negotiation; however, no exact numbers are available.

2. It would be speculative to estimate what the impact on HELCO's profits would be associated with purchasing power from an IPP. If HELCO were to build a plant at Keahole, additional stockholder investment would be required to pay for a portion of the plant. This additional investment would require additional return on the investment; however, the rate of return on the investment would not change. Currently, HELCO does not earn anything on power purchased from IPPs such as Waimana. HELCO passes the purchased power cost through to ratepayers without a mark-up. However, if an IPP were to be paid HELCO's avoided cost, then ratepayers would pay the same amount they would have if HELCO had built the plant itself. The ratepayers would be paying the IPP's stockholders instead of HELCO's stockholders.

3. HELCO's stock is not traded and therefore does not have a market price. We cannot predict whether expansion at Keahole instead of buying power from Waimana would change the value of HELCO's stock.

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4. We disagree with the characterizations made in your comment. HELCO is not pursuing the expansion at Keahole because of "greater dividends." Waimana has only recently reached an agreement on key lease terms with the Department of Hawaiian Home Lands (DHHL). Even so, Waimana is still waiting for the lease document to be finalized and executed. In the meantime, negotiations are continuing with Waimana for a purchase power agreement. Although Waimana's schedule shows a late-1996 completion date, any developer's schedule is subject to delays, and the uncertainty that IPPs have had in the past in meeting supply deadlines (Puna Geothermal Venture [PGV] was 3 years behind) has led to unacceptable power supply situations on the Island of Hawaii. Currently, HELCO has projected a need for additional power generation by early 1995, more than a full year before Waimana is scheduled to be operational. Because HELCO will not place itself in the position of requiring rolling blackouts, it is pursuing the parallel path planning process described in the Revised Draft EIS. Furthermore, your assertions that the Waimana facility would result in lower rates to the consumer, and a cleaner and safer environment, are speculative. The expansion at Keahole still remains the most reliable alternative for meeting the 1995 demand at the least cost to the customer.

5. If Waimana's project is a qualifying facility under the criteria established by the Public Utility Regulatory Policies Act of 1978 (PURPA) and the Hawaii Public Utilities Commission (PUC) Rules, HELCO is required to purchase power made available in accordance with Hawaii PUC Rules. Please note, however, that other IPPs that may develop qualifying facilities in the same time frame are also engaged in negotiations with HELCO.

6. HELCO is unaware of the statement in the "10-K" report to which you are referring. HELCO remains willing to discuss with independent power producers any reasonable purchase agreement.

7. The building permit for the first phase of the Keahole expansion is currently planned to be obtained in July 1994. Building permits for subsequent phases would be obtained after mid-1994.

8. HELCO will defer expansion at the Keahole site in favor of the Kawaihae site only if a purchase power agreement is reached with a non-utility generator (NUG) located at Kawaihae, the agreement is approved by the PUC, and the NUG has achieved certain contracted milestones in its project that would guarantee that the project will be completed on schedule. Until then, HELCO must proceed with the Keahole expansion project or risk being unable to meet customers' power needs.

9. The existing Keamuku switching station site is not large enough to accommodate a generating station. This general area was considered in the 1988 *West Hawaii Site Study* but was eliminated as a viable site. Several factors, such as the site being located above the underground injection control (UIC) line, possible impacts to underground water resources, and fuel transportation issues, contributed to its elimination.

10. PGV came on-line in mid-1993, although by contract it should have been on-line in 1990. PGV's 25 megawatts (MW) of power have helped to increase the reserve generation margin. Hamakua Sugar will end its electrical production in 1994, with a loss of 10 MW of firm capacity to the

HELCO system. The Wailuku Hydro project is "run-of-the-river" and does not provide firm capacity to HELCO. Its output is based on the amount of water flow in the river, which is directly related to the amount of rainfall on the slopes above the hydro plant intakes. There have been many periods in which the hydro project produced well below its 10-MW capability.

HELCO still needs to retire its older units, which were scheduled to be retired years ago but have been kept on-line largely because of the PGV delays. Retirement has been delayed again because of the pending closing of Hamakua Sugar Company. The resource plan shown in the Revised Draft EIS indicates that HELCO's planned unit additions will be in 1995, which is based on the earliest date HELCO can place a unit on-line. Waimana's projected schedule is late 1996.

11. Until such time as the conditions described in the response to your question 8 have been achieved, HELCO must proceed with the proposed Keahole expansion. Waimana's schedule is no more assured than HELCO's or any other IPP's. Assurance of project financing would be one critical milestone for any IPP project, but HELCO has no assurance to date that "they've [Waimana] got the financing." As to the lease, HELCO's understanding is that, while the key lease terms have been agreed to in principle, the lease document still needs to be finalized and executed. Furthermore, the viability of the desalination feature is contingent on many factors, including obtaining contracts from water purchasers, and remains uncertain at this time. Aside from differences on contract issues (such as pricing), HELCO has no fundamental objections to Waimana's planned power plant at Kawaihae or to the similar plants proposed by other IPPs.

Because HELCO is in discussions with several IPPs, a detailed description of the outstanding issues in the HELCO/Waimana negotiations cannot be provided without violating the confidentiality of Waimana's proposal.

12. Mr. Stormont's comments were in reference to such sites as Kawaihae and Puu Anahulu, where it was uncertain whether HELCO would be able to acquire any of the sites, when they could possibly be secured, at what cost, and subject to what conditions.

13. First, HELCO has not been "stonewalling" Waimana. During the time that HELCO has been in discussions with Waimana, a number of legitimate business issues and other considerations have prevented an agreement from being reached. From HELCO's perspective, the issues that have been raised with Waimana, and with other IPPs as well, are all critical to meeting the needs and protecting the interests of its customers. Second, the Hawaii Administrative Rules do not require that an agreement be negotiated in 75 days, but only that, if no agreement can be reached within 75 days of an "offer" (which term is not defined in the rules or otherwise by the PUC), a petition shall be submitted by the utility to the PUC. A difference of opinion exists between HELCO and Waimana as to whether a complete offer under the rules has been made, with HELCO believing that a complete offer must cost HELCO no more than its avoided cost. However, HELCO was prepared to submit such a petition but suspended that action after Waimana filed a complaint with the PUC. The PUC has since dismissed the complaint and opened a separate docket for the purpose of reviewing Kawaihae Cogeneration Partners' offer to sell energy and capacity to HELCO.

13a. It is a race against time in order to maintain an adequate margin of generating reserve.

13b. In addition to other issues, HELCO and Waimana disagree on the cost of capacity and energy to be paid by HELCO to Waimana.

14. Mr. Stormont was referring to the growth in energy usage on the Island of Hawaii. It is more than 2 percent over last year, and HELCO continues to receive requests for service. For example, the Prince Hotel is scheduled to open in 1994. COSTCO and K-Mart plan for service dates in the 1994-95 time frame. These are just some of the developments referred to as increasing demand. Mr. Stormont's reference to "sources of electricity are diminishing" is based on the pending closure of Hamakua Sugar Company in 1994.

TRAFFIC HAZARD AT KEAHOLE

15. HELCO acknowledges that accidents do occur at the Keahole Airport Access Road intersection with Queen Kaahumanu Highway (see traffic accident study included in the Revised Draft EIS) but is not in a position to subjectively conclude that the intersection is considered to be "the most dangerous intersection in the County of Hawaii." According to the State Department of Transportation (DOT), several improvements to the intersection have occurred in the last 3 years that have significantly reduced the number of accidents, from approximately eight per year to only three within the last year. HELCO will coordinate its planning efforts with the DOT Highways Division to ensure that roadway improvements will accommodate fuel tanker trucks.

16. With the addition of the full combined-cycle unit in 1997, the Keahole Generating Station is expected to require an average of seven to eight trucks per day. The addition of the combustion turbines CT-4 and CT-5 in 1995 allows the existing six diesel units (D18-D23) to go to standby operation beginning in 1995. These units are planned to continue in standby status until their retirement in 1999 and 2000.

Previous trucking estimates made by HELCO indicated a maximum of 12 trucks would be required to support the Keahole Generating Station after addition of the combined-cycle unit. However, recent production simulation runs provided by HECO's Generation Planning Department, which now include the 25 MW from PGV, have reduced the expected operating hours and associated fuel consumption of the Keahole diesel units. Traffic studies prepared for the EIS showed that an average of 12 trucks per day would result in no impacts. The revised estimate of 7-8 trucks per day, therefore, would also result in no impacts.

17. As indicated by the traffic accident study prepared for the Revised Draft EIS and in the Transportation section of the Revised Draft EIS (Section 3.3.6), the proposed Keahole unit addition would not adversely affect projected peak-hour traffic conditions. The trips generated by the proposed expansion would not change the operating Level-of-Service at intersections in the project vicinity. On the basis of the 1990 accident rate and projected traffic entering the intersection of Queen Kaahumanu Highway and the Keahole Airport Access Road, the proposed project could increase the number of accidents at that intersection by only 0.034 per year. As

stated in response to your comment 15, improvements installed by DOT have lessened the traffic safety problems currently associated with the Keahole Airport intersection. HELCO will coordinate its planning efforts with the DOT Highways Division to ensure that roadway improvements will accommodate fuel tanker trucks.

18. Should there be an accident on the highway involving a fuel truck, notification would likely be made to the proper authorities (police, fire, rescue) through a source other than HELCO. HELCO maintains no radio or other direct contact with the individual trucks, which are the responsibility of Kuwaye Bros., an independent contractor. Once notified, however, HELCO would respond as directed by the appropriate agency with any personnel and/or equipment required.

19. During the scoping process for the EIS, the Hawaii County Civil Defense received information about the project and a request to become a consulted party. The County Civil Defense did not respond. However, the State Civil Defense organization did send a late comment letter regarding the Revised Draft EIS.

20. The precise date for completion of the DOT improvements to Queen Kaahumanu Highway and the Keahole Airport Access Road intersection is not known. However, DOT has indicated that it is likely that the improvements will be completed prior to full build-out of the proposed unit addition at Keahole Generating Station.

21. The widening of the Queen Kaahumanu Highway is included in the State DOT budget. At this time, DOT is trying to secure federal funds in addition to the State funds.

22. HELCO does not have a specific procedure for dealing with events such as an airplane crash into a fuel storage tank; such events are catastrophic in nature and do not occur frequently enough to warrant specific procedures. In the unlikely event that such an accident would occur, HELCO would respond as directed by the appropriate agency (police, fire, Federal Aviation Administration [FAA], etc.) with any personnel and/or equipment required. It is important to note that the Keahole facility is not located within either the clear zone or the accident prevention zone for Keahole Airport.

AIR POLLUTION AND WIND PATTERN STUDIES AT KEAHOLE AND KAWAIHAE

23. According to the 1990 census, there were 22,284 people (7,898 households) in North Kona in 1990. The Keahole site is located within census tract 215.01. The area within tract 215.01 represents approximately a 5-mile radius mauka of the Keahole facility. The census indicates that there were 6,486 people (2,166 households) within census tract 215.01 in 1990. Population data for the area within 2, 3, and 5 miles are not available.

For the area within 5 miles of the Keahole facility, the most significant amount of future growth is expected in the urban expansion area on State lands. Depending on which growth scenario is implemented, between the years 2010 and 2025, approximately 16,000 to 21,500 new residents

are projected to be added within the 2- and 3-mile radius area (based on the 1993 Final EIS for Urban Expansion State Lands).

This future development has been accounted for in planning the expansion of the Keahole facility. It represents a significant future demand for power and would be served by the proposed expansion. These future residents have been considered in terms of project impacts; no significant adverse impacts are expected to occur to these existing or future residents.

24. HELCO did not "require" Waimana to abandon consideration of a coal plant. The 50-MW coal plant being proposed was too large to meet HELCO's criterion that no unit exceed the largest unit currently on the HELCO system, which is 25 MW. Also, the technology of coal-fired units does not easily allow the units to cycle their power to follow the load demand on the Island; the ability to cycle is required of any new units. Under these conditions, Waimana itself elected to proceed with an oil-fired alternative rather than revise its coal proposal.

25. Yes. Background meteorological data were collected for the Keahole site from February 1984 through January 1985 (12 months) at an air quality monitoring site located in Kona Palisades, 0.8 mile southeast of the Keahole Generating Station. A wind rose of these data is presented in Figure 1-3, Revised Draft EIS, Volume I, Section 3. In addition, onsite meteorological data are now being collected for a period of one year.

26. Not applicable.

27. HELCO gathered meteorological data in the Kawaihae area (at a site different from the site that Waimana may lease from DHHL) from December 1990 through August 1992. These data have no bearing on the proposed expansion at Keahole. As indicated in HELCO's testimony before the PUC for CT-4, HELCO considers this information proprietary. Therefore, the data are not published in the Revised Final EIS.

28. The Prevention of Significant Deterioration (PSD) application submitted to the State Department of Health (DOH) on January 13, 1993, identified both emissions and predicted air quality impacts of criteria and non-criteria pollutants from existing and proposed sources. The constituents of vog, to the degree that these are criteria pollutants, would have been measured in the ambient air quality data gathered from February 1984 through January 1985. As required by U.S. Environmental Protection Agency (EPA) procedures, additive impacts were considered. In summary, the application shows emissions from all sources, including criteria pollutants from vog, to be in compliance with air quality standards. Additional studies have been conducted regarding sulfur and nitrogen oxides, ethylene, and acid aerosols. The results of these studies are summarized in the Revised Final EIS.

29. The worst-case scenario for interaction of vog and power plant emissions would most likely be a 24-hour period in which the plant was operating at full capacity and the vog level was at a maximum. In the case of the plant alone, such a scenario has been modeled as part of the PSD application and/or EIS. As for the maximum vog level, one could review existing data, take the

maximum 24-hour sulfate (SO_4) level (14.7 micrograms per cubic meter [$\mu g/m^3$]), add two standard deviations (2 x 2.8 = 5.6) to get an estimated "worst-case" value (20.3 $\mu g/m^3$), and then assume it was all sulfuric acid. The resulting air quality would then be a mix of gases and particulates originating from the two sources under consideration.

Emissions from the plant are not the same as the constituents of vog; thus, the plant would emit sulfur dioxide (SO_2) while the vog contains primarily SO_4. Under this scenario any effects occurring would be due most likely to the high acid level, not to the gaseous SO_2 level that would be within standards. While the SO_2 will eventually convert to SO_4 in the atmosphere, this does not occur instantaneously but slowly over time and at some distance from the plant.

Worst-case modeling of manmade sources identifies the point of highest concentration. That maximum concentration number by no means represents an areawide concentration. Furthermore, the highest concentration is for a particular time period with specific meteorological conditions. This means that for essentially all other time periods and locations, concentrations would be lower—in most cases, substantially lower.

30. The current volcanic eruption is a rift zone eruption that has lasted more than 10 years. HELCO cannot predict how long the current volcanic activity may last.

31. According to the Hawaiian Volcano Observatory, the longest recorded eruption lasted more than 100 years, approximately 1823-1924. That eruption was a summit eruption.

32. Because of the great uncertainty about continuing volcanic activity, the air quality analysis has not hypothesized future higher levels of vog any more than it has considered the equally likely possibility of cessation of activity and reduced levels of vog. HELCO is unaware of any meaningful method to quantify the potential for volcanic emissions to affect the area surrounding Keahole in a manner that is not reflected in the measured background data included in the PSD application. In the absence of such quantification, the conservatism in the EPA/DOH approved modeling methodology ensures identification of worst-case concentrations under present vog conditions. The worst-case concentration is higher than the expected concentration. Therefore, to invalidate the conclusions made in the PSD application, any increase in vog impact must be greater than the difference between the expected and worst-case concentrations.

33. If future vog conditions were to result in measured pollutant concentrations inconsistent with air quality standards, DOH would have to modify its State Implementation Plan (SIP) to reflect nonattainment in the impacted area, and establish a compliance plan by which attainment would be reestablished. In that case, DOH could impose limitations on all manmade sources in order to reduce their contribution to the episode. "No Burn" days are already declared periodically on the Island of Hawaii because of air stagnation conditions and vog-induced haze.

34. There is no evidence to date indicating that such dire circumstances would occur. The plant's emissions are chemically different from those of the vog and thus would not be significantly

additive within the impact area of the plant. It is the vog constituents themselves that would be most responsible for any observed health effects.

35. While we object to the characterization contained in the first four sentences of your comment, the remainder of the statement is essentially correct. Given what is already known about the composition of vog, it is equally likely that health effects are occurring as a result of continuing exposure.

36. Future reports on the adverse health effects associated with vog exposure will have no immediate effect on HELCO's siting decisions. As noted, the vog composition is chemically different from power plant emissions; as long as the new unit is well within allowable ambient standards, it could be permitted at Keahole.

37. As was stated in the previous answer, vog composition is different from fuel oil emissions and would not be significantly additive within the impact area of the plant. The American Lung Association's report will have no foreseeable impact on the Keahole expansion.

38. The costs of the meteorological and air quality data collected by HELCO at Kawaihae have not been passed on to the ratepayers. If appropriate, HELCO may seek recovery of these costs at a later time. Whether or not information, studies, equipment, etc., are eventually paid for by ratepayers, the documents and material continue to belong to HELCO. As a public utility, HELCO is regulated by the PUC in terms of the level and method of determining rates and the utility's authorized return on equity, among other things. HELCO is not "public," however, in the sense of being a State-owned entity free of competitive business pressures. PURPA opened up the utility market to non-utility generation and severely restricted utility participation in non-regulated generation. As a result, IPPs compete directly for market share with HELCO to a certain degree. For this reason, HELCO considers the air data proprietary.

39. Please see response to question 38.

40. HELCO has always been open to discussions with Waimana and other IPPs and has met with Waimana to negotiate such a contract on numerous occasions since August 1992 (in addition to preliminary meetings before that time). Even after all those meetings, there are still many business and cost issues involved in the negotiations. Some of the issues require that the IPP substantiate that it would be able to place the proposed unit on-line as represented, both before and after negotiations, and that its projected in-service date would be late 1996 at the earliest. To date, Waimana has not indicated (by changing its schedule accordingly) that the length of negotiations with HELCO has had any impact on its schedule, which was and continues to be in a time frame too late to meet the HELCO system need projected to occur in early 1995. Likewise, any discussions regarding HELCO's Kawaihae wind data have apparently not affected Waimana's projected schedule, since that schedule has not changed.

41. At the time the Draft EIS was prepared, the FAA required that the stack not exceed 190 feet in height.

42. By reconfiguring the layout (in effect, moving higher structures away from the proposed stack), the stack height could be lowered to 104 feet, still following good engineering practice (GEP) without compromising air quality standards. Visual impacts have also been reduced by lowering the stack height.

43. HELCO assumes you are referring to the existing exhaust stack with a height of 70 feet. The proposed unit addition will require a taller stack because of the lower thermal buoyancy of the plume, resulting from the use of the heat recovery steam generators.

44. A stack height of 70 feet for a 56-MW, combined-cycle combustion turbine, as configured for the Keahole expansion, would result in adverse impacts to the air quality.

45. Modeling data indicate that high ground-level concentrations would result with a lower stack, because the plume would not be adequately dispersed.

46. Assuming a year of air quality and meteorological data would capture "the more frequently occurring times when the vog is so thick that one can't see the top of Mt. Hualalai," the air quality modeling would have taken these conditions into consideration.

47. Please see response to question 32.

48/49. Not applicable.

50. Air Quality Management Districts (AQMDs) are California-based agencies and do not exist in Hawaii. All air quality monitoring is performed in accordance with DOH and EPA requirements.

51. HELCO, with DOH concurrence, continues with a testing program to determine an appropriate particulate limit for CT-2. The alleged "violation" will be corrected at such time as an appropriate limit is established and the permit modified to reflect that revised limit.

52. Not applicable.

53/54. Testing is anticipated to be complete by the end of 1993, with application for revision to the particulate emissions limit submitted in the spring of 1994.

55. Even when CT-2 is operated for best emissions performance, it is not possible to meet the existing particulate emissions limit, which EPA (by its letter dated April 13, 1992) considers inappropriately low.

56. In order to remedy the violation, the regulators must be satisfied that the unit is being properly operated and maintained. In conjunction with proper operation and maintenance, and on the basis

of the results of testing now under way, a modified limit for particulate emissions will be established.

57. With respect to the alleged $8,100 CT-2 fine, HELCO has not sought cost recovery from its customers.

58. All data presented in the PSD application are estimates and must be verified before the operating permit is issued. As explained in the transcripts from the evidentiary hearings on CT-4, when the permit application for CT-2 was in preparation in early 1988, the manufacturer, the utility, and the regulators had no experience on that fuel/technology combination. At that time, HELCO did not have the knowledge regarding what emissions might occur. The source of information that formed the basis for the permit was an EPA reference called AP-42, which provides average emissions for fuel and technology types. When the source testing was first done on the unit following construction, it became apparent in the area of particulate emissions only that the unit did not appear able to comply with the particulate limit. HELCO did subsequent testing, keeping DOH apprised of the situation. In November 1991, on the basis of information gathered from consultants, the performance of the units, and the efforts of HELCO to make sure that it was operating in compliance with manufacturer's directions, HELCO submitted a request for modification of the permit limit for particulate matter.

By letter dated April 13, 1992, EPA agreed that the limit in the present CT-2 permit for particulates is inappropriate and that it should be increased. There are plans to conduct testing, beginning in early March 1994, to determine what an appropriate particulate emission limit should be for CT-2, and HELCO will modify the PSD permit for CT-2 in accordance with those findings. It should be noted that CT-2 is the only CT of its type within the HELCO system.

59. Normal operations of the Keahole facility do not result in the emission of "black smoke pouring out of the chimney." The infrequent occurrence of such a condition is not an indication of a "violation." Concerned citizens can call the HELCO Trouble Desk at 935-1171 in Hilo. The call will be routed to the appropriate HELCO official for response. The number for the DOH Clean Air Office in Hilo is 933-4552 and in Kealakekua is 322-7011.

60. According to DOH, the air quality impact analysis is adequate and in compliance with applicable regulations. The analysis determined the maximum pollutant concentrations within the EPA-defined significant impact area, based on monitored background air quality data and modeled incremental impacts of the proposed addition. Determination of the background air quality levels takes into account all existing sources of criteria pollutants, including vog, existing facilities, and mobile sources. The proposed project's area of potential air quality impact extends approximately 4 kilometers from the Keahole Generating Station, as shown in the attached Figure 4-1 of the Keahole PSD application.

61. No. Although additional emissions will be generated when the plant is expanded, the PSD air quality impact analysis demonstrates that all ambient air quality standards will be maintained.

62. No. Please see response to question 61.

63. We have addressed the worst-case scenario with regard to the power plant and vog in response to your question 29. Increased mobile source activity (cars, aircraft) adds different pollutants than those found in vog (Appendix B of the PSD application discussed mobile emissions sources in the Keahole area; pages 2-8 and 2-11 from Appendix B are attached). Although CT-2 has not met the current particulate emission limit, particulates are not the limiting pollutant for the proposed generation addition.

64. The entire State of Hawaii is an attainment area, which means it is in compliance with federal and State air quality standards. The combined sources in Campbell Industrial Park significantly exceed Keahole in emissions. If more detail on other air pollution problems in Hawaii is desired, you should contact DOH for a quantitative list of emissions from all permitted sources in the State.

65. EPA and DOH require compliance with air quality standards at all offsite locations, including the 500-acre proposed University of Hawaii (UH) West Hawaii campus. The PSD application demonstrates compliance with all air quality standards. Therefore, even under worst-case conditions, the air quality at the proposed UH West Hawaii campus development will be in compliance with all State and federal standards.

66-69. Air quality monitoring was not done "farther up the hill" because it was not required by the PSD permit. If an inversion condition, similar to that experienced in the Los Angeles basin, were the case, the resulting pollutant concentrations would be higher throughout the area, not just at the base of the inversion layer. Ambient air quality data in the PSD application did not reflect that condition.

70. Because the models are designed for decision-making before the facility is constructed, they intentionally over-predict pollutant concentrations. EPA has addressed model uncertainty and concluded that use of the "best estimate" is acceptable. The modeling results presented in the PSD application are considered a best estimate and represent higher than expected concentrations. It is difficult, if not impossible, to determine the exact magnitude of this over-prediction.

71. No response required.

HIGHEST RATES TO CONSUMER

72. HELCO's rates are not the highest in the country. A recent survey of utilities nationwide for the Edison Electric Institute found that the Long Island Lighting Company of New York ranked first in amount charged residential customers per 750 kilowatt-hours (kWh) and above per month. Maui Electric's Molokai operations ranked second for the 500-kWh rate normally used as an average comparison by HELCO. HELCO was ranked fifth for the same rate of consumption. The following table shows the national rankings of these three utilities with regard to kWh charges.

Utility Rate Rankings* per Kilowatt-Hour Charges										
	Kilowatt-Hours									
Utility	100	250	500	750	1,000	1,500	2,000	3,000	5,000	7,500
Long Island	4	3	2	1	1	1	1	1	1	1
MECO, Molokai	1	1	1	2	3	3	3	4	4	4
HELCO	2	4	5	5	5	6	6	8	8	8
*Ranking numbers represent a utility's place among all utilities reported in the Edison Electric Institute survey.										

In addition, HELCO's rates are the third lowest in the State of Hawaii. As of July 1, 1993, the following are average bills for Hawaii residential customers using 750 kWh per month:

Molokai	$123.27
Lanai	$122.24
Kauai	$115.78
Hawaii Island	$113.27
Maui	$ 98.98
Oahu	$ 88.02

73. HELCO's rates are the result of the isolation of its network from an underlying power grid system, the relatively large land area served by HELCO, and the low density of development on the Island of Hawaii. This geographic isolation requires capital expenditures for an entirely self-contained system of power generation and transmission facilities that must be spread over a small ratepayer base. An underlying power grid system, such as those developed on the mainland, allows for the purchase of cheaply produced economy energy from other regions (e.g., hydroelectricity produced in Washington and transferred to California). HELCO also uses oil and pays comparable oil-related rates for purchased power, because other fuel sources (such as natural gas) are not as readily available in Hawaii as they are on much of the mainland.

74. Given Island of Hawaii circumstances, HELCO's rates are reasonable.

75. There is no truth to the statement.

76. HELCO does not have a "guaranteed return on its invested capital." In its most recent rate case, PUC Docket No. 6999, the PUC set new rates based on a 1992 test year that included an opportunity to earn, not a guarantee to earn, a return on rate base of 10.4 percent.

77. HELCO's greatest responsibility is in meeting the mandate established for it through its PUC charter: to provide high-quality, reliable energy at the least cost to the customer.

FUEL TRANSPORTATION, STORAGE, CONSUMPTION, ETC.

78. HELCO's diesel fuel supplier is Chevron USA. The fuel currently arrives at Hilo Harbor. HELCO expects to be trucking fuel from Kawaihae Harbor by 1995, with the expansion at Keahole.

79. Fuel is currently trucked to the Keahole Generating Station from Hilo Harbor via Route 19, through Waimea to Queen Kaahumanu Highway. This route would also be used for the additional trucks associated with the project. With the expansion of Keahole, HELCO expects to be trucking fuel from Kawaihae Harbor to Keahole along the Queen Kaahumanu Highway as early as 1995.

80. The Keahole Generating Station currently consumes about 33,600 gallons of fuel per day (used by the diesels and CT-2) in a peaking mode. The projected maximum fuel consumption of two 20-MW CTs operating as baseload is 54,890 gallons per day; the total combined fuel requirement for the station at build-out, therefore, would be 111,600 gallons per day.

These numbers represent maximum fuel consumption for the station for a 4-year period (1995-99), until the retirement of diesels in 1999. Projected actual fuel consumption is likely to be less. For example, CT-4 will be operated in Phase 1 as a peaking unit and will typically consume 10,000 to 20,000 gallons per day. As Phases 2 and 3 are brought on-line, the operation of diesels will be reduced by 63 percent in comparison with scheduled operating hours for the diesels in 1994. Similarly, the operation of CT-2 will also be reduced. The reduced operation of the diesels and CT-2 will result in a slight reduction in fuel consumption. The above discussion is supported by the data shown in the following table.

Calculation of Number of Fuel Trucks Serving Keahole Generating Station		
Year	**Barrels of Diesel per year**	**Avg. No. of Trucks/Day**
1993	172,897	3
1994	161,180	3
1995	231,756	4
1996	283,033	4
1997	379,909	6
1998	477,026	8
1999	408,703	7
2000	433,463	7
2001	390,541	6
2002	419,656	7
2003	437,337	7
2004	464,140	7
2005	473,503	8

Notes:
1. Each truck based on 180 barrels, 365 days/year
2. Number of trucks has been rounded off to next whole number
3. One barrel contains 42 gallons of fuel

Assumptions:
CT-4 added in 1995
CT-5 added in 1995
ST-7 added in 1997 (convert CT-4 and CT-5 to combined cycle)
Diesel 18 and 19 retired in 1999
Diesel 20, 21, 22, 23 retired in 2000

81. Please see response to question 80.

82. A maximum of seven to eight fuel tanker trucks per day will be required to provide fuel to the generating station at full build-out. The number of trucks could decrease as diesel units are retired.

83. According to HELCO's present contractor, the average tanker truck will consume about 37 to 40 gallons of diesel fuel per round trip from the Chevron terminal in Hilo to Keahole and back.

84. Using a maximum of seven to eight tanker trucks per day at 37 to 40 gallons of fuel per round trip from Hilo to Keahole, a range of 259 to 320 gallons per day of fuel would be consumed.

HELCO'S CREDIBILITY

85. We disagree with the characterizations made in your statement concerning the Keahole power plant site. With regard to the second portion of your statement, HELCO did state during the 1988 Conservation District Use Application (CDUA) process that, at that time, it did not envision a need for further expansion at the site. This statement was based on the expectation that geothermal development would proceed at a faster rate than has occurred, and on the expectation that HELCO would acquire and develop a West Hawaii power facility site at an earlier date than has proven feasible.

86. HELCO does not consider the statements made in 1988 to the Department of Land and Natural Resources (DLNR) as "commitments not to expand" further at Keahole. At that time, the West Hawaii and PGV baseload power facilities were expected to be on-line by now. HELCO believed in 1988 that it would be able to acquire a lease from DHHL for the site in Kawaihae identified in the 1988 *West Hawaii Site Study*. With the additional power to the network from those units, forecasted demand would have been met. PGV has only recently come on-line, and the West Hawaii power facility has not been built. HELCO needs to retire older generating units and demand has continued to increase, which has caused HELCO to reexamine its options for meeting the short-term need.

87. Please see response to question 86.

88. The length of time required for PGV to come on-line has forced HELCO to operate older units beyond their recommended and effective operating age. In addition, the West Hawaii baseload power facility has not been built. Given increasing demand in the West Hawaii area, the need to retire older generating units, the need for immediate power generation to meet short-term needs, and unsuccessful efforts to acquire alternative sites, the expansion of Keahole is the most efficient alternative for HELCO to meet its requirement to provide high-quality, reliable electric service when needed and at the least cost to the customer.

89. No. HELCO must constantly adjust to address changing circumstances and to provide reliable energy at the least cost to the customer. Remaining dogmatically locked to prior statements in light of the changing times would not be a prudent approach to best serving HELCO's customers.

90. Documentation of the difference in the level of intensity of operations and impacts between the existing conditions and the proposed conditions is the purpose of the environmental impact statement process. The EIS addressed this difference.

91. Comparisons of the level of intensity and impacts between past expansions and the current expansion cannot be made. The current EIS process is much more detailed in the level of analysis. However, the current EIS process also details existing conditions and would document any major adverse impacts associated with the current plant.

92. We are not aware of any inconsistencies in information presented to the two groups in question. The windrose contained in the Revised Draft EIS reflects information collected over a one-year period, from February 1984 to January 1985, and would supersede prior presentation materials. The fact that prevailing winds are predominantly from one direction does not mean the winds are only from one direction. The windrose describes the frequency with which winds come from each direction.

It is true that the results of the modeling, which are provided in the PSD application, show that a stack height of 104 feet will not contribute in any significant way to existing pollution levels in the Agricultural Park. The modeling was based on data collected at a height of 33 feet, to allow modeling of existing sources at the generating station as well as the proposed unit addition. The model, developed by EPA, contains a formula that extrapolates meteorological data to the height of the proposed source. The model was developed for use in support of permit application reviews and, like most regulatory support models, is expected to be conservative (i.e., it will overestimate rather than underestimate impacts).

It is also true that new meteorological data are currently being collected. The new monitoring data, collected at a height of 104 feet, are being collected to confirm that there are no significant differences between the two sets of data that would affect predicted ground-level pollutant concentrations.

93. We do not agree with the characterizations contained in the statement.

WATER

94. An average of 20 gallons per minute (gpm) is used when CT-2 is in use.

95. No brackish water is currently used because there are no supply wells onsite.

96. The County will provide an average of 70 gpm of additional potable water at the end of Phase 1. Phase 2 will require the addition of a brackish well to provide at least an additional 120 gpm. Phase 3 will require an average of 90 gpm of potable water, and an average of 160 gpm of brackish water.

97. An average of 90 gpm of potable water and 160 gpm of brackish water will be used at full build-out.

98. The water will be supplied by the County and by a brackish supply well to be developed onsite.

99. Yes. See the Revised Draft EIS, Volume II, Section 9, and the December 18, 1992, letter to Don Horiuchi from the County of Hawaii, Department of Water Supply.

100. No response required.

101. The County Department of Water Supply has evaluated the proposed project in terms of its water budget and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

102. HELCO will be required to comply with applicable regulations related to water conservation.

103. HELCO will continue to evaluate its system and procedures in order to identify additional water conservation measures.

104. Hydrogeologists have analyzed this issue and reviewed the results with the Natural Energy Laboratory of Hawaii Authority (NELHA). These results are included in the Revised Draft EIS, Volume I, Section 3.1.4., page 3-26 and Volume II, Appendices C and D. There is no basis to believe that our conclusions are wrong. On the basis of the aforementioned analysis, the operation of similar facilities, pretreatment, and the stringent federal and State regulations that apply to the use of an injection well, no impacts are anticipated.

105. In the unlikely event that damages occurred and were proven to be attributable to HELCO, any damages that were not covered by insurance would be borne by HELCO's stockholders.

106. HELCO does not have sufficient information to demonstrate the feasibility, economic or otherwise, of a desalination plant at Kawaihae. It is prudent for HELCO to move forward with expanding its power generating capacity to ensure that the County of Hawaii does not again experience rolling blackouts similar to those experienced in 1991-92. Power from the Keahole expansion will aid the County in developing additional potable water sources for the area.

KEAHOLE AG PARK PLANT DAMAGE

107. No. The PSD air quality impact analysis shows that the proposed project will not have a significant impact on the Agricultural Park.

108. Not applicable.

109. Modeling studies conducted in accordance with federal and State regulations indicate that the Agricultural Park will not be impacted. Even at the predicted site of maximum ground-level concentration, which would be located approximately 0.4 mile northeast of the Keahole facility, no exceedances of applicable federal and State standards or allowable pollutant levels are projected to occur. Additional studies and literature reviews have been conducted to focus on potential impacts to vegetation. These studies indicate that the risk of such impacts is low. The studies are summarized in the Revised Final EIS.

110. As stated in the Revised Draft EIS, the Kanoelehua facility is in compliance with all applicable federal and State emissions and air quality requirements. The source of the car pitting has not been established.

111. Ethylene emissions are a component of hydrocarbon emissions, which result from incomplete fuel combustion. The combustion of fuel in a modern combustion turbine, as proposed for Keahole, is more complete in comparison with a diesel engine. A study of ethylene emissions was conducted to examine potential risks to vegetation at the Agricultural Park; the study indicated that the risk of ethylene impacts is very low. The study is summarized in the Revised Final EIS.

112. CT-2 has experienced periodic episodes of high particulate emissions, beyond the permitted level of 7.76 pounds per hour. As explained in the response to question 58, HELCO (with EPA concurrence) believes this particulate emission limit is inappropriately low for the type of fuel/technology used.

While not historically showing exceedances of permitted nitrogen oxide (NO_x) levels, recent tests of CT-2 have shown short-term occurrences where NO_x is slightly higher than the currently permitted level of 42 parts per million (ppm), most likely due to adverse ambient conditions. HELCO is working with DOH to determine appropriate action regarding CT-2's NO_x. The existing permit provides for revision of the permit level to as high as 60 ppm, if HELCO can conclusively show that an injected water-to-fuel mass ratio above 1.0 to 1.0 is needed to achieve the NO_x emission limit, and that excessive turbine wear or unacceptable operating characteristics are taking place because of the high levels of water injection required. The tests performed to date suggest that these conditions are the case for CT-2. It is expected that a revised permit limit of 50 ppm will ensure compliance, except in rare instances of high load and hot, dry weather. Alternatively, a revised permit limit of 55 ppm is expected to ensure continuous compliance for all ambient conditions.

113. Ethylene emissions are not associated with the episodes of high particulate emissions, as described in the responses to your questions 111 and 112.

114. There is no basis to conclude that the proposed expansion will exceed anticipated ethylene emissions. The combustion conditions responsible for exceedance of NO_x and particulate emissions decrease ethylene emissions rather than increase them. The proposed General Electric (GE) LM-2500 turbine is not expected to have NO_x and particulate problems similar to those of CT-2 because it is different in design and from a different manufacturer. MECO and HELCO have had good operating experience with the LM-2500 at the Maalaea and Puna power plants. CT-2 is the only unit of its type within the HECO system.

NEGAWATTS (CONSERVATION)

115. HELCO has not defined Demand-Side Management (DSM); rather, it uses the PUC's definition, as documented in the *Framework for Integrated Resource Planning*, revised May 22, 1992, page 1, which states: "Demand side management programs means programs designed to influence utility customer uses of energy to produce desired changes in demand. It includes conservation, load management, and efficiency resource programs."

116. HELCO works with its customers to assist them in reducing their electricity bills. As energy costs have risen during the past several years, HELCO's efforts have similarly expanded to promote energy efficiency and load management. HELCO's most recent activities are described in *HELCO's 1993 Energy Conservation Report*, recently submitted to the PUC. Through integrated resource planning, HELCO believes there will be much greater and more cost-effective opportunities to promote DSM and, once its recently filed Integrated Resource Plan (IRP) is approved, HELCO will pursue those opportunities. HELCO proposes to spend $19 million over the next 5 years on programs designed to encourage customers to use electric energy more efficiently.

117. Yes. HELCO generally believes that manufacturing companies that locate on the Island of Hawaii will benefit the local economy by creating jobs, paying taxes, and increasing the degree of economic diversification. In particular, companies that would manufacture high quality products at an attractive price that would enhance HELCO's customers' prospects to participate more fully in the proposed DSM programs would benefit both HELCO and the local economy. At this time, HELCO is in discussions with a company that proposes to develop a diversified solar products industry, including a solar assembly facility, on the Island of Hawaii.

118. We could not verify that Pacific Gas & Electric (PG&E) did not construct power plants solely on the basis of conservation and DSM. In the IRP that HELCO filed with the PUC on October 15, 1993, HELCO has proposed an aggressive program of cost-effective DSM programs that would build "negawatt" savings to 44 MW during the next 20 years. A comparison was made with a hypothetical 20-year plan having no DSM programs (*HELCO Integration Report*, page 8-13). The comparison shows that, with cost-effective DSM, two fewer generating units would be needed over the next 20 years than if no DSM were to be implemented. However, the effect of "negawatt" savings will have no impact on the short-term need for additional generation.

119. It is difficult to predict at this time exactly how well DSM will work in Hawaii. The assumption that because it works in one place, it will work in another, may not hold true because of the distinct differences between these areas. Specifically, there are a number of differences between the California and Hawaii electricity end-use markets and regulatory environments that may result in different rates of market penetration of DSM programs in the two separate service areas. For example, the end-use markets may be substantially different in terms of achievable DSM potential, which is related to local economic conditions, type of electrical equipment in use, climate conditions, public awareness, and general acceptance of energy-efficiency products and incentives.

In addition, the regulatory environment is substantially different in these two service territories. California has been pursuing DSM for a number of years, and the Commission there has developed special regulatory incentives to make the pursuit of DSM attractive to utilities. One of the mechanisms developed in California in the early 1980s, which removed the utilities' disincentive to pursue aggressive DSM, is called ERAM, or Electric Revenue Adjustment Mechanism. This is a process whereby base revenues are decoupled from the level of sales. With ERAM in place, a utility does not lose authorized base revenue when it increases its DSM efforts and is therefore not punished for DSM.

A separate mechanism that is employed in California to encourage utilities to aggressively pursue DSM is program-related financial incentives. Several forms of these incentives are employed, with the basic intent to reward utilities financially for the pursuit of DSM. At this time in Hawaii, there are still a number of issues to be resolved by the PUC with regard to proposed utility net lost revenue and shareholder incentives.

Other factors that contributed to substantial DSM involvement by utilities in California include a statewide collaborative DSM planning process that developed incentives as well as DSM program designs, regulator interest in DSM, environmental concerns, and customer service concerns.

HELCO intends to initiate DSM efforts here, and hopes to be able to effect a large DSM impact in Hawaii. HELCO is working toward this goal at the same time that it is addressing its immediate need to secure an adequate margin of reserve generating capacity through expansion at Keahole. It remains to be seen how well DSM programs are accepted and supported by the Hawaii market and the regulatory system.

120. Residential energy use declined in 1992 to 6,622 kWh per customer, from 6,684 kWh in 1991. Although economic factors are important, continued energy awareness and more active energy conservation on the part of consumers contributed to the decline. HELCO has had an active part in encouraging conservation among consumers. Its recent consumer conservation efforts are described in *HELCO's 1993 Energy Conservation Report*. Among the many ongoing programs are education services such as the "In Concert with the Environment" environmental awareness program, the ENERGY LINES bulletin for teachers, and the What's Watt energy lecture program. HELCO has been developing, and soon will launch, a pilot program to offer compact fluorescent lamps at steep discounts to customers. This follows its highly successful Pilot Commercial Lighting Program, which offered rebates to commercial customers for retrofitting existing lighting systems with efficient lighting.

HELCO has also filed with the PUC for an Interim Commercial Lighting Program (Docket No. 7574, filed December 29, 1992), and a Pilot Residential Retrofit Program (Docket No. 7692, filed April 30, 1993). HELCO is currently awaiting PUC approval of these programs before it can proceed. If approved, these programs will precede the full-scale DSM programs, which are projected to result in connected load reductions of 2,780 and 335 kW, respectively.

121. To date, HELCO has not implemented full-scale DSM programs. In its IRP, HELCO proposes to implement such DSM programs. The detailed schedule for DSM Plan Implementation is included with the current DSM Action Plan in the HELCO IRP *Summary Report* (see Appendix C of same). This schedule is subject to PUC approval. HELCO has also submitted to the PUC for its consideration proposals for cost recovery, lost margin, and utility incentives for DSM programs, as provided for in the IRP Framework.

122. In the peak demand forecast, HELCO's proposed DSM programs are assumed to be approved by the PUC in the first quarter of 1994, with launching of the programs during the second half of that year. Also accounted for in the forecast is HELCO's estimate of 700 kW of savings credited to the Pilot Commercial Lighting Program, which was completed in 1992. Estimated peak capacity savings from future DSM programs are 510 kW in 1994, and 860 kW in 1995 (*HELCO Integration Report*, page 3-20). Rounding 860 kW to "1 MW," the resource plan shows the forecast peak to be reduced in 1995 by 1 MW (from 171 to 170 MW) with DSM.

123. HELCO does not have any state-by-state data on load savings for DSM programs. HELCO does have a summary of a report by Eric Hirst of ORNL, which gives statistics for 890 utilities with DSM programs in the period 1989-91 (based on data from federal EIA Form 861). The data show that the average peak load savings for all utilities with DSM programs was 4.8 percent in 1991. This average is projected to increase to 8.8 percent by the year 2000, according to Hirst. Of the top 25 utilities in DSM peak load savings in 1990, the average savings was 10.1 percent. HELCO's program, which is projected to reduce peak demand by 13 percent by year 2013, compares favorably with most other utilities.

Differences in percentage savings vary considerably from utility to utility, depending on several factors, including: cost-effectiveness of various measures, characteristics of utility sales profile, market size, degree of customer acceptance, percentage of free riders, and degree of snap-back. When comparing HELCO with mainland utilities' DSM programs, it is important to keep in mind that much of the mainland utilities' DSM efforts to date have been in weatherization programs to reduce heating and cooling costs. These opportunities are much smaller in Hawaii with our mild climate. Also, it should be pointed out that HELCO's estimated savings are a <u>projection</u> out to 20 years, which was made without the benefit of prior experience in DSM. Meaningful comparison with actual savings of other utilities that have ongoing programs is not straightforward. HELCO's program is designed to be aggressive and cost effective, and the estimated penetration represents a realistic target for the Island of Hawaii market.

A complete discussion of the DSM measures considered by HELCO is included in its IRP filing as the *Demand-Side Management Assessment Report*. To summarize, HELCO first identified a list of 270 candidate DSM measures applicable to the Island of Hawaii. This list was screened using various criteria (described in the report) to identify the 30 technologies most likely to provide significant cost-effective energy and capacity reductions to HELCO. This also compares favorably with other utilities, many of which used a subjective screening process to identify only 20 (or fewer) DSM options to consider in developing programs. However, please also note that HELCO has included as one of the selected DSM programs a "Custom Rebate" program that

allows commercial/industrial customers to propose their own conservation actions. Thus, although DSM programs have been developed on the basis of a select number of the most cost-effective measures, no measure has really been "omitted." Under the Custom Rebate program, which HELCO expects will be particularly attractive to the resorts, HELCO would consider any DSM measure proposed by a commercial/industrial customer if it can be shown to be cost effective.

HELCO does not consider its work in the development of cost-effective DSM programs to be finished. The recent filing with the PUC was only the first. HELCO plans to continue DSM program development with its customers by convening "focus groups" in various DSM areas. HELCO recently had a series of focus group meetings in Hilo to discuss DSM with industry representatives in lighting, water heating, air conditioning and refrigeration, and new construction design. Such meetings will help HELCO find even more effective ways to implement DSM programs for greater penetration in the Island of Hawaii's energy market.

124. HELCO has been working with a consultant in West Hawaii, Mr. James Russell, on this subject. Mr. Russell has indicated that, on the basis of his surveys, there are considerable energy and load savings to be had at the resorts. Specific measures still have to be formally identified and subjected to engineering and economic analysis before anyone can say how much potential there is. HELCO is working with the engineering departments of the resorts, not only to encourage them to participate in our upcoming DSM programs, but also on a possible technology demonstration project in cool storage for air conditioning. HELCO expects the resorts will participate in proposed DSM programs over the next 2 years, and contribute to an island-wide savings of 3.1 MW projected for 1996.

125. Heat recovery is a DSM option included in HELCO's Commercial Water Heating DSM program which, in the near term (to 1998), is projected to save 210 kW. Load shifting is already promoted by HELCO through its Schedule U (Time-of-Use) rate, and special Riders "M" (Off-Peak and Curtailable Power) and "T" (Time-of-Day Power). HELCO is working with the Department of Water Supply, and other customers with water pumping loads, to seek arrangements for more off-peak pumping. HELCO is also pursuing a technology demonstration project in cool storage for air conditioning. If cool storage proves feasible in Hawaii, it has the potential to shift compressor loads to off-peak hours. As for cost avoidance, HELCO submits to the PUC for approval all capital projects in excess of $500,000, which include generating unit additions. In submitting its projects for approval, HELCO has the burden to prove that its proposed expenditures are both prudent and reasonable.

126. No response required.

127. Depending on the cost of electricity, this estimation of savings is possible given a number of assumptions, including: the hot water unit previously used was an electric resistance water heater, and the term efficiency refers to the savings potential of solar over electric resistance water heating units; the solar system is properly designed and installed in an appropriately sunny location; and there is a typical amount of hot water usage for this five-member family.

128. Not applicable.

129. Please refer to response to question 127.

130. Not applicable.

131. Depending on the cost of electricity, your suggested scenario is possible assuming that the solar unit is replacing a standard electric resistance water heating unit, and the term "efficiency" refers to the savings potential of solar over electric resistance water heating units.

132. Depending on the cost of electricity, this may be possible. HELCO expects, however, that the percentage of an individual residential bill attributable to hot water heating will vary depending on a number of factors, including: the amount of hot water used by the family, and the number of other electricity-consuming items used by the family and the related kWh usage of these items.

133. Please refer to response to question 132.

134. If the objective were to realize the largest potential savings through the lowest numbers of installations, then targeting large households using 120-gallon solar water heating systems would make sense. However, there are other objectives to consider in conducting a utility DSM program, such as aiming for the total achievable and cost-effective potential for each DSM measure, and equity considerations regarding DSM program cost distribution in relation to targeted customer classes.

135. Please refer to response to question 134.

136. Depending on the cost of electricity, the use of 120-gallon storage tanks with solar water heating units can potentially reduce the evening electrical demand; however, this may not necessarily be true under certain weather conditions. This type of information has not been researched sufficiently in the service territory to give HELCO a firm answer to this question. This is one of the reasons that HELCO has developed and intends to implement (based on PUC approval) a pilot DSM program designed to collect this type of information. The program is called the Energy Efficient Home Pilot Program and involves residential installations and extensive data collection of solar water heaters, heat pump water heaters, and high-efficiency electrical resistance water heaters.

137. The voltage loss depends on the mix of units operating at Keahole. With all units operating, the average voltage loss is about 9 percent. With only three diesels operating, the average voltage drop is about 20 percent. If none of the units were operating at Keahole, the voltage loss would be greater.

138. The information being collected is not the energy demand by area but the energy consumption (gigawatt-hours [gWh]) by area. According to 1992 data, approximately 50 percent of the energy demand is in West Hawaii.

139. Under certain assumptions, it may be possible that a solar water heating installation program centered in West Hawaii, particularly in the South Kohala to South Kona area, could save more energy than an island-wide program. However, other DSM program objectives must be considered. These include aiming for the total achievable and cost-effective potential for each DSM measure, and social and economic equity considerations related to the distribution of DSM program costs relative to the distribution of targeted classes of HELCO customers.

140. On the basis of 1992 year-end figures, approximately 35 percent of the energy sales (gWh) in the Kona and Waimea service areas is attributable to residential customers. Specifically in the Kona service area, 95.9 gWh out of a total of 245.2 gWh were for residential use. In the Waimea service area, 56.8 gWh out of a total of 186.7 gWh were for residential use.

141. It is not possible to accurately estimate this percentage at present because of a lack of information regarding the numbers and size (kWh reduction potential) of the available and willing residential end-use market for solar water heating in West Hawaii. As mentioned in response to question 136, HELCO has developed and intends to implement (based on PUC approval) a pilot DSM program designed to collect this type of information. The program is called the Energy Efficient Home Pilot Program and involves residential installations and extensive data collection of solar water heaters, heat pump water heaters, and high-efficiency electrical resistance water heaters.

142. Please refer to response to question 141.

143. Please refer to response to question 141.

144. We do not agree with your characterization.

LETTERS FROM SEN. ANDY LEVIN AND GOVERNOR WAIHEE

145. HELCO does not agree with the statements made by the Honorable Senator Levin. As documented in the Revised Draft EIS, no impact to tourism or to the West Hawaii campus of the University can be expected from the Keahole plant. In addition, HELCO has prepared a landscaping plan to mitigate, to the fullest extent possible, visual impacts associated with the proposed addition at Keahole.

146. The Keahole expansion would provide power needed in 1995. Waimana's project would be completed in late 1996 at the earliest. Waimana has only recently reached an agreement on key lease terms with DHHL and is still waiting for the lease document to be finalized and executed.

As explained in the Revised Draft EIS, in the section entitled Parallel Path Planning (page 1-8), it is HELCO's policy to purchase electric power from IPPs when that power is available. However, as a contingency against IPP project delays, HELCO pursues parallel path planning for the installation of its own capacity. This contingency planning is terminated only when the IPP has met agreed-upon milestones and will meet the commercial operation date. The validity of this

approach was confirmed by the recent difficulties encountered by PGV. HELCO cannot rely on an IPP to produce power at Kawaihae or elsewhere until these agreed-upon milestones are met.

147. Please see our response to your question 146.

148. At the time of the Governor's letter, HELCO Dockets 7048 (CT-4), 7623 (CT-5/ST-7), and 7655 (Keahole Switching Station) were before the PUC, and they are still pending.

149. The requirements for power generation to meet the growing demand in the West Hawaii area are shown in Table 1-1 of the Revised Draft EIS.

150. Discussions are continuing between HELCO and Waimana and other IPPs regarding purchase power arrangements. These discussions are complex and multi-faceted and will take time to mature into final agreements. Furthermore, if HELCO were to satisfy its generation needs through an IPP, there is no assurance that Waimana would be considered the most appropriate developer.

VIEWPLANE

151. The Revised Final EIS includes a conceptual drawing of the proposed facility from a viewpoint near those you suggested.

152. Please see our response to your question 151.

153. The perceived inconsistencies in statements about the nature of visual resource impacts in the Revised Draft EIS have been corrected in the Revised Final EIS. Visual impacts are expected to be adverse, but not significant. This is because the unit addition would not alter the dominance of the Keahole facility within the viewsheds analyzed. As discussed in Section 3.3.4 in the Revised Draft EIS, the existing facility is characterized as being codominant from two viewpoints, subordinate from one viewpoint, and dominant from two viewpoints. Dominant, codominant, and subordinate are defined as follows:

- Dominant — The viewer's attention will be focused on the facility.
- Codominant — The viewer's attention will be divided among other features in the landscape of equal interest to the viewer.
- Subordinate — The facility will constitute a minor component of the landscape. The viewer will not be aware of the presence of the facility unless specifically looking for the facility.

The analysis of visual impacts concluded that the dominance of the facility with the proposed unit addition would not change significantly over existing conditions. If the proposed facility's dominance were expected to increase from subordinate to codominant or dominant, or from

codominant to dominant, a determination that the impact would be significant would have been made.

154. There are many objects that could have a significant visual impact from the highway. It is not the responsibility of this EIS, however, to assess the potential impact of other objects. A visual analysis of the potential impacts of the proposed unit addition was undertaken as part of this project. The results of this analysis are documented in the Revised Draft EIS.

155. There are a number of colors available for painting of the stack. HELCO will use a neutral color, such as an earth-tone color.

156. The FAA has informed HELCO that a flashing white light will not be required during the daytime. However, a steady red light will be required at night.

157. HELCO currently has no plans to change the color scheme of its existing equipment and facilities. The new combustion turbines, CT-4 and CT-5, will be similar in color to the existing CT-2 unit. Specific paint colors for the other equipment and structures have not been selected, but they will be chosen with the assistance of consultants to minimize any impacts to view planes.

DANGEROUS NEW TELEPHONE POLES

158. The pole line was designed and constructed to meet the General Order standards of the PUC. The original pole line started from the intersection of Kuakini and Hualalai and extended upward to what is now Queen Kaahumanu Highway. The pole line was installed in several increments as line extensions, with the first installation in 1957. The poles are jointly owned by Hawaiian Telephone and HELCO, and several may be jointly owned with the County of Hawaii. Some of the original poles are still in place.

159. The statements made in the letter generally express the opinions of the writer. There are some factual statements, such as "the utility poles have been erected on Hualalai Road extending from the Kuakini Highway intersection and winding upwards to the Queen's Highway intersection." The poles are shared by utilities.

160. The letter contains the opinions of the writer and some incorrect information. For example, there are 30 rather than 40 poles. The poles have been installed within the road right-of-way, usually adjacent to the road boundary. As road improvements have been made over the years, the roadway pavement has gotten closer to the poles. There are at least two street lights on Hualalai Road, not "a total absence of street lighting," as alleged in the letter. The pole placement was designed so as not to be a danger to motorists driving in that location. The statement that the "poles loom out of the darkness quickly and surely pose an obvious danger to any average motorist" is the opinion of the writer. HELCO installs approved traffic reflectors.

161. Reflective markings are placed on poles only when required by the applicable government agency, or by HELCO's determination. The fact that some poles do not have reflectors should not be construed as a "failure." No government agency has determined that reflectors are required on the poles in question. However, HELCO has reviewed the situation and has installed reflectors on some of the poles.

162. As stated in our response to question 158, the original pole line was installed in 1957. Some of the original poles have been replaced because of age, and the line has been extended over the years.

163. No. The poles were placed so as to give motorists adequate opportunity to negotiate that stretch of road safely. HELCO has reviewed the situation and has installed reflectors on some of the poles.

164. No response required.

165. HELCO would not anticipate successful lawsuits in that event. The pole design and placement have been reviewed by appropriate government agencies for compliance. In the unlikely event HELCO was judged to be negligent, the matter would be paid by insurance.

166. The number of accidents that have occurred under circumstances that you have described cannot be ascertained.

167. The total cost of the pole line is difficult to establish because it was constructed many years ago, and was added to in several increments over time.

168. The estimated cost to convert the overhead pole line to an underground circuit is estimated at approximately $1,100,000. This estimate does not include the cost for Hawaiian Telephone to place its facilities underground, which would have to occur if HELCO were to place its line underground.

169. As stated earlier, HELCO has reviewed the situation and has placed reflectors on some of the poles.

KEAAU SITE AS AN ALTERNATIVE

170. We do not agree with your characterization of the response to your question regarding the December 1992 Final EIS.

171. As evidenced in PUC Docket 7049, filed in August 1992, HELCO evaluated the alternative of installing additional generation at the Puna Power Plant in Keaau. This alternative was determined not to be feasible for the following reasons:

- Limitations of existing transmission lines to export the power from the Puna plant to West Hawaii
- Wastewater disposal limitations because the Puna plant is located above the UIC line
- Air permitting concerns because of the requirement to include generating sources in Hilo in the modeling

The air quality modeling conducted for the Puna CT-3 unit installation indicated that it was likely that additional generating units could be installed in Puna only if existing East Hawaii generating units were concurrently retired.

172. Yes, HELCO did make that statement because, on the basis of the alternatives available at that time, the Puna Power Plant site in Keaau was the best site for adding additional generation.

173. Yes, that statement was true at that time.

174. Now, after the addition of CT-3, that statement is no longer true for the following reasons:

- The air quality modeling performed in support of the CT-3 application indicated that the emission limits for that part of the Island are very near the maximum that would be allowed under federal regulations.
- The Puna Power Plant site is above the UIC line, making disposal of any additional wastewater at the site prohibitive.
- With the addition of CT-3 and PGV on-line, the existing transmission lines are close to the transmission capacity. Adding more generation to this site would require the construction of additional transmission lines to bring the power from Keaau to West Hawaii.

175. Please see response to your question 174.

176. It is technically possible to engineer the installation of CT-4 next to CT-3 and convert both to a dual-train combined-cycle system. However, it would be difficult, if at all possible, to obtain the air permits and the underground injection permits. The time required to permit the new installation would not meet the 1995 service dates in the resource plan. In addition, a new cross-Island transmission line would be required to transfer the power from East to West Hawaii.

177. No. There have been significant changes in the DOH modeling guidance since the submittal of the CT-3 application. The CT-3 application is based on Hilo airport meteorological data. These data no longer meet the DOH requirements. DOH now requires the use of site-specific meteorological data for a one-year period. These data are not available at Puna, and would require one year plus the time to install the tower. An additional 6-month period is required to prepare a PSD application once the meteorological data are collected. Therefore, an 18-month

period would be the minimum time needed to collect the meteorological data and prepare the PSD application. Another 18-month period is typically required by DOH to process the PSD application.

178. The removal of any source will result in improved air quality. If other conditions do not change, the retirement of some of the units at Shipman and Kanoelehua will result in an air quality improvement in the vicinity of those plants. At this time, however, HELCO cannot retire any units before it brings replacement units on-line, because of the lack of reserve generating margin on the Island of Hawaii.

179. No. CT-1 is not "extremely high polluting," although it is inefficient when compared with other HELCO units. CT-1 is not "three times worse" but approximately one-half as efficient as either a typical electro-motive diesel (EMD) unit or a CT unit, such as the GE LM-2500 model proposed for Keahole.

180. The removal of CT-1 would result in some improvement in air quality in the Hilo area. However, it is unknown whether this increment of improvement would compensate for installation of CT-4 at the Kanoelehua Power Plant. The question is somewhat moot because, as stated in the response to question 178, HELCO cannot retire any units before it brings replacements on-line because of the lack of reserve generating capacity. Additionally, HELCO would not be able to obtain air permits and construct a unit addition in Hilo in time to meet the projected increase in energy demand, since no onsite meteorological or air quality data are available for the Kanoelehua Plant and, thus, PSD air permitting would take approximately 3 years to complete.

181. The reserve rating for CT-1 is currently listed as 9 MW. The reserve rating of the CT-4 unit is 20.8 MW. Therefore, the net peak power addition is 11.8 MW.

182. No, since CT-1 would be retired no matter where CT-4 is placed. As shown in HELCO's IRP, the CT-1 unit is scheduled for retirement in 1995, shortly after the addition of CT-4 and CT-5 at Keahole. As stated by HELCO, installing the new generating units in West Hawaii near the load is the preferred alternative because it avoids the construction of additional cross-Island transmission lines and the resulting inefficient line losses. Also, please see response to your question 174.

183. We do not agree with your comment. Because CT-3 is located above the UIC line, wastewater must be disposed of off site. This procedure is costly and inefficient, and it is not a "trivial" matter.

184. Yes. The maximum power transmitting capability of a transmission line will increase if the operating voltage is increased from 69 to 138 kV. There currently exists only one cross-Island transmission line that has been designed for and is capable of 138 kV operation: Saddle Road Line No. 2. However, Saddle Road Line No. 2 cannot be operated at 138 kV until the infrastructure required to operate this circuit at 138 kV is developed. The required infrastructure, which does not now exist, would include at least one additional 138 kV cross-Island transmission line and

138 kV substations. Until this infrastructure is developed, all transmission lines will continue to be operated at 69 kV.

There are no plans being developed at this time for the routing and construction of a new 138 kV cross-Island transmission line, which would be needed for system reliability. There are also no plans being developed for the siting, design, and construction of new 138 kV substations, which are required for 138 kV operation.

HELCO's experience has been that the environmental studies required for each of these projects would take about 2 years to complete. Surveying and design would then take about 1-1/2 years, and construction of the transmission line and substations would take another 2 years to complete, assuming that work on the transmission line and substations proceeded simultaneously.

185. An additional cross-Island transmission line is needed for system reliability. There are four major cross-Island transmission lines that connect the east side of Hawaii to the west side. Two lines run down the saddle, one cross-Island line runs along the northern coastline, and one cross-Island line runs along the southern coastline.

Although upgrading Saddle Road Line No. 2 to 138 kV could alleviate the low-voltage situations projected for West Hawaii by providing power generated in East Hawaii, the upgrading would not solve the problem of system reliability. The two Saddle Road transmission lines are separated by only 75 to 87.5 feet for much of the route; a catastrophe on one Saddle Road transmission line could catastrophically affect the other saddle line.

If any two cross-Island transmission lines were simultaneously out of service, either because of damage to a combination of maintenance on one line and unexpected damage on another line, the remaining two cross-Island lines would not have sufficient voltage capacity to sustain reliable service. Consequently, the need for system reliability requires the building of an additional cross-Island transmission line.

186. HELCO does not have a study, nor does it believe there is justification for a study, that compares the cost of line loss with the cost of long-term chemical treatment of brackish water and its associated wastewater disposal. As explained in response to your question 185, transmission line installation would be an additional cost that would be required for power generation facility construction in East Hawaii.

HELCO's reasons for putting a unit addition at Keahole are primarily related to the time frame within which additional generating capacity is needed, the need to place generating capacity near the load, and the fact that no alternative sites can be developed within the necessary time frame. Without additional capacity in 1995, HELCO may be unable to meet peak demands for electricity. None of the other alternatives evaluated (see Section 2 of the Revised Draft EIS), including other sites and IPPs, will be able to address these needs in 1995.

187. Please see response to your question 186.

REQUESTS FOR MORE DRAFT REVISED EISs

188. Per your request, we have included your September 13, 1993, letter in the Revised Final EIS. However, since it is not a comment letter on the Revised Draft EIS, we have not prepared a response to it.

189. Our records indicate that 170 two-volume sets of the Revised Draft EIS were printed. One hundred and fourteen copies of the Revised Draft EIS were distributed at the time the project summary and request for comments were published in the Office of Environmental Quality Control (OEQC) Bulletin. An additional 40 copies were distributed to interested parties upon request. The remainder were used internally.

190. The cost for printing one two-volume set of the Revised Draft EIS was approximately $36.00. The cost for mailing one two-volume set to the Island of Hawaii was approximately $5.45.

191. We did not receive requests for an additional 100 sets of the Revised Draft EIS, although we did receive requests from 40 individuals for sets. You requested an additional 20. We mailed you one set and informed you that additional volumes were available through the local public libraries. By not printing and mailing the additional 55 sets, approximately $2,280 was saved and the paper that would have been required for copying was conserved.

192. The amount of any rate increase for the entire Keahole expansion project has yet to be determined. Currently, costs incurred for the project are accounted for in a holding account, consistent with Federal Energy Regulatory Commission (FERC) accounting requirements. The PUC will decide later what rate increase, if any, would be incurred as a result of the project.

193. Yes, all consulted parties received copies of the Revised Draft EIS.

194. People who requested the Revised Draft EIS and had not previously received the Draft EIS and Technical Appendices were sent Volumes I and II of the Revised Draft and the Technical Appendices.

195. We do not agree with the characterization in your statement. The Revised Draft EIS was distributed in accordance with direction from OEQC, and it was fully available and accessible to the general public through the public library system. At least one copy was sent to all those who, during the scoping process, requested that they be included as a consulted party. Copies were also sent to those who requested a copy after the scoping process.

196. Our records indicate that 168 sets of the Draft EIS were printed at a cost of $33 per set.

197. This has been answered in the response to your question 192.

GENERATING CAPACITY AND RESERVE

198. The delay in PGV coming on-line resulted in the postponement of much-needed turbine and boiler overhauls to various steam units, and also accelerated wear of the EMD and CT units as they were used as baseload units rather than as peakers. This maintenance was postponed because of the need to use the units to maintain adequate reserve capacity. Since PGV has come on-line, several of these steam units have had major overhauls. EMD unit overhauls have been performed as well, although several units are still in need of major work. The HELCO generation availability has improved accordingly. However, with the lack of additional generation to accommodate the expected load growth by 1995, HELCO would be back in the same situation it was in 1990 and 1991, when it had inadequate reserve margin, maintenance deferrals, over-worked equipment, and equipment failures.

199. No response necessary.

200. Kanoelehua D-11 and CT-1 were installed in 1962 and are 31 years old. Shipman 1 was installed in 1943 and is 50 years old.

201. The postponement of retirement of older generating units will increase the costs of maintenance and the likelihood of equipment failure. Additional postponement would further increase maintenance costs and the risk of equipment failure. This is not an action that HELCO can allow to occur in light of its legal responsibility to provide reliable service at the lowest practical cost to customers. HELCO is obligated by the PUC to have adequate and dependable generation reserve to cover the loss of the two largest units in the system. In 1991 and 1992, without PGV, HELCO had to rely on these older units and was forced to curtail power to customers when one of these older units failed. Finally, there is no certainty that the Waimana or any other IPP facility will be developed by late 1996. Therefore, HELCO must plan to meet the generating needs by 1995.

202. Your analysis is not correct. Hydropower and wind energy do not represent firm capacity that can be relied upon to meet the system peak requirements; they are not and should not be counted on for capacity planning purposes.

If no capacity is added in 1995 and the retirements scheduled for that year are deferred, then the capacity in 1996 would be 197.6 MW (the same as at the end of 1994), and the reserve margin would be 23.6 MW. However, retirements are shown at the end of the year, so that the reserve margin in 1999 at the time of the system peak (which normally occurs in November or December) is 34 MW (28.5 + 5.5 = 34 MW). The difference in the margins between 1999 and 1996 is 10.4 MW.

Table 1-1 in the Revised Draft EIS is only a summary of planned unit additions and does not present the application of the HELCO capacity planning criteria and process. To determine the need for new units, HELCO considers forecasted peaks and maintenance of units on a monthly

basis. HELCO must also consider the condition and reliability of existing units. The retirements in question have again been deferred from 1994. CT-1 was originally scheduled to be retired in 1991, and Waimea 8, 9, and 10 were originally scheduled to be retired in 1993. Under the depressed economic scenario developed for the HELCO IRP, the 1995 peak would be 3.6 MW lower. With the need to retire the units indicated, CT-4 is still required in 1995.

203. No response required.

204. Please see response to your question 202.

205. Please see response to your question 202.

206. To HELCO's knowledge, Hilo Coast Processing Company (HCPC) has not submitted any application. However, since HELCO is not directly involved in HCPC's permit process, such information is best obtained directly from HCPC.

207. HELCO is not participating in HCPC's permitting process. However, HELCO is encouraging HCPC to continue generating power in order to fulfill its contractual commitment after sugar cane production ceases.

208. HELCO does not have any information on this subject.

209. A conceptual landscape plan, shown in Figures 3-23a and 3-23b of the Revised Draft EIS, will be implemented regardless of whether the airport access road improvements are made. A rendering showing the view of the power plant from the proximity of the existing access road with landscaping in place is also included in the Revised Final EIS. HELCO is preparing a detailed landscaping plan. If the access road improvements are made, the landscaping at the Keahole facility will be supplemented by landscaping provided by DOT with the roadway improvements. If the access improvements are not made, HELCO will still proceed with its landscape mitigation plans.

MISCELLANEOUS

210. Section 9 was not paginated because many of the letters and attachments had preexisting page numbers. Covering the original numbering of an attachment, for example, would make it difficult to locate the information in its source document, while a dual numbering system would be confusing. For this reason, we have not paginated this section in the Revised Final EIS.

211. The Table of Contents has been revised to reflect the changes you have requested.

212. It would be inappropriate to publish the name, address, and phone number of the private landowner without his or her permission. Mining of the Muheenui Cone has already commenced.

213. We have included the letters as attachments to your comment letter. However, because they are not addressed to us, nor do they contain specific comments related to the content of the Revised Draft EIS, we have not commented on them. We note that several of the individuals did submit comment letters on the Revised Draft EIS, which we have answered and included in the Revised Final EIS.

214. HELCO's legal responsibility is to provide high-quality, reliable electric service at the least cost to the customer. No matter how much electricity is used by the customers, HELCO is required to use its best efforts to meet the demand.

215. Following are the estimated completion dates for the major components of the Keahole expansion project.

SCHEDULE FOR KEAHOLE GENERATING STATION

Item	Estimated Completion
Acceptance of Final EIS	January 1994
CDUA	Ongoing through July 1994
Air Quality Permitting	July 1994
PUC Approval Permit	August/September 1994
Underground Injection Control	June 1994
Manufacturing/Delivery	
CT-4	May 1994
CT-5	May 1994
ST-7	March 1994
Installation	
CT-4	August 1994 to April 1995
CT-5	August 1994 to July 1995
ST-7	December 1996 to June 1997
Startup and Testing	
CT-4	May to June 1995
CT-5	July to August 1995
ST-7	July to September 1996
Commercial Operation	
CT-4	July 1, 1995
CT-5	September 1, 1995
ST-7	October 1, 1997

216. Applications for the various environmental permits and for PUC approval of CT-4, CT-5, and ST-7 have been submitted. These applications are currently being reviewed by the appropriate agencies. CT-4, CT-5, and ST-7 have been ordered and are now being manufactured.

217. Corporate approvals to turn the Lalamilo wind farm over to HELCO were obtained earlier in 1993, but certain conditions must still be satisfied before the transaction takes place.

218. The Mamalahoa site at Waikoloa is above the underground injection control line; it was excluded from further consideration because of the environmental and regulatory issues pertaining to wastewater disposal. The substation site is also too small for a power facility.

219. The flyers are included as attachments to your comment letter in the Revised Final EIS. We do not agree with the characterizations made in them. Specifically, we disagree with the statement that plant emissions will affect plants, animals, and humans. The basis for our conclusion was provided in the Revised Draft EIS and is documented more fully in the Revised Final EIS. Also, property values will not be affected, as explained in the Revised Draft EIS. The statement that "Waimana has signed a lease" is not true (as of late October Waimana had agreed to key terms and conditions of the lease, but no document has yet been signed); furthermore, even a signed lease is not a guarantee of successful project completion, nor is it a commitment to construct within a schedule.

220. This amount is not known at this time. Cost recovery will be sought from HELCO customers in accordance with the PUC directive that:

> "The utility is entitled to recover its integrated resource planning and implementation costs that are reasonably incurred, including the costs of planning and implementing pilot and full-scale demand-side management programs."

221. No response required.

222. HELCO is a subsidiary of Hawaiian Electric Industries, a private corporation chartered through the State of Hawaii. As an electric utility, HELCO is regulated by the State Public Utilities Commission. Thus, technically HELCO is a publicly regulated private company that provides a public service. Inasmuch as HELCO plays an important role in providing electricity, and its employees live within the Island of Hawaii community, HELCO considers itself a part of the public.

223. HELCO strives to attend all meetings open to the general public in which the Keahole Generating Station expansion is a part of the agenda, and in which HELCO may provide its perspective on the project. Given the scheduling and number of these meetings and the availability of HELCO staff, it is not always possible to attend every one.

224. Mr. Lyman did not attend the public informational meeting. A representative from HELCO did attend.

225. The response to this question is contained in the response to DLNR's comment letter.

226. HELCO does not agree with your characterization that it is circumventing the Land Use Commission. HELCO does not anticipate any challenges based on the reclassification of the surrounding conservation lands to urban lands. If such a challenge were to occur, HELCO does not anticipate that the challenge would be successful.

227. The equipment proposed at Keahole is a state-of-the-art combustion turbine and heat recovery system. The combustion turbine technology proposed for this project was selected based on its overall efficiency and economy. As part of HELCO's Integrated Resource Planning process, the capital, operating, and external costs (i.e., pollution impacts) of a wide variety of power generation options and fuel types were evaluated. The combustion turbine technology at Keahole was the most cost-effective option that could provide the amount of generation capacity needed within the required time frame.

228. The project will not have an adverse impact on abutting property owners. Buffers are typically required to reduce noise levels and visual impacts at the property boundary. The noise analysis for the unit addition has shown that there will be no increase in noise levels at the property boundary. Perimeter landscaping will be installed to reduce visual impacts.

229. HELCO is not considering purchasing abutting land for a buffer. HELCO will expand the plant without purchasing abutting land.

230. Please see response to your question 229.

231. Yes. The project is not anticipated to contribute toxic substances to soil, air, or water such that potential adverse impacts would occur. Any notification to the contrary would not be based on existing evidence.

232. A study of potential impacts to property values was included in Section 10 of the Revised Draft EIS. The study was summarized in Section 3.3.5 of the Revised Draft EIS.

233. No. A municipal- or community-owned electric utility could not produce better service at lower rates than HELCO without taxpayer subsidization. While the pros and cons are extensive, a primary con that would likely preclude further discussion is the fact that the County and/or a community-owned entity would have to buy HELCO's facilities from its current stockholders. Current federal tax laws forbid the issuance of tax exempt bonds to fund the purchase of investor-owned electric utilities. Therefore, many of the historical advantages of municipal utility acquisitions that occurred in other parts of the country in the 1950s and 1960s are no longer available.

The question erroneously assumes that HELCO's "primary interest" is its stockholders, not its customers. This is not true.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

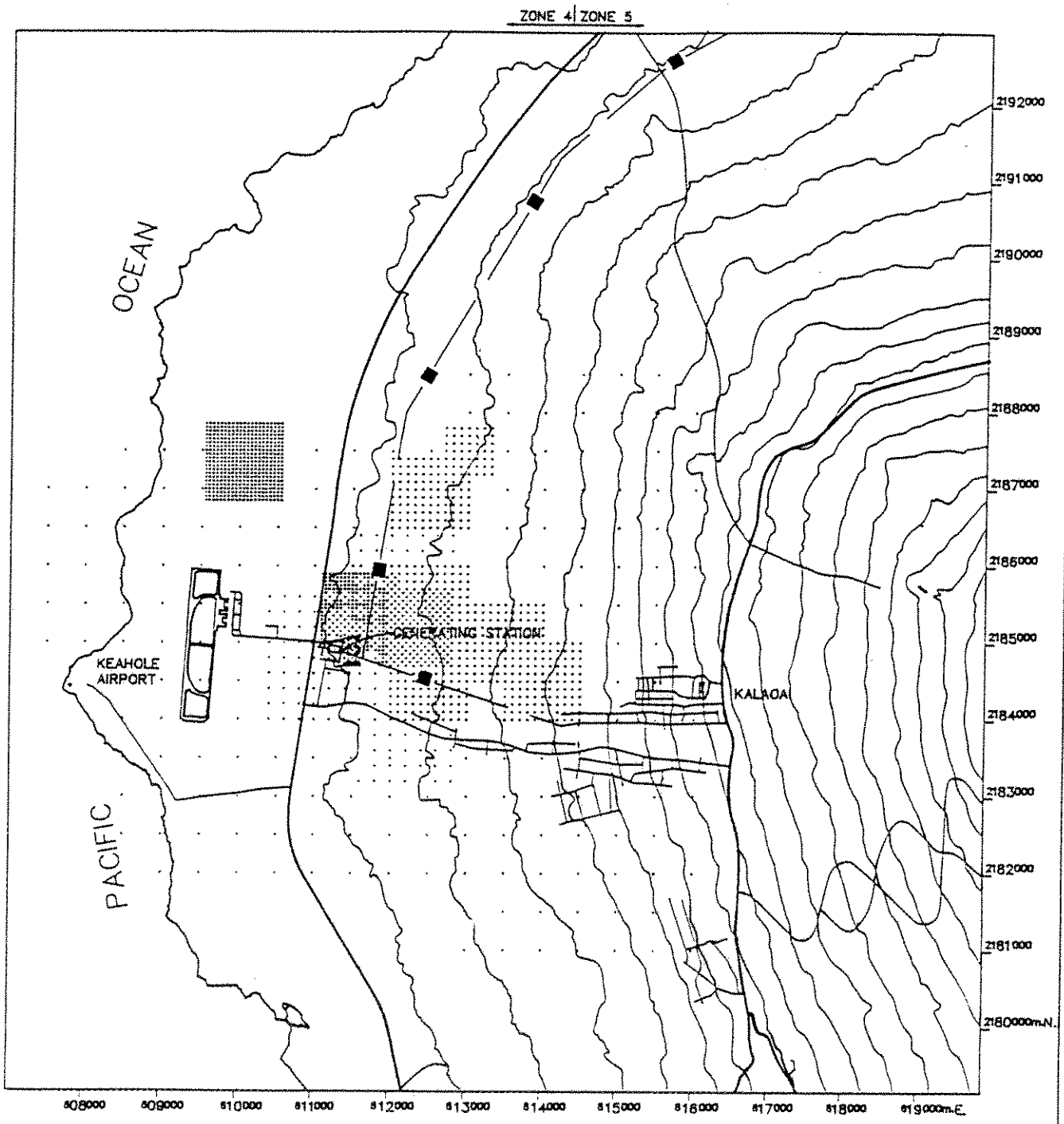
Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

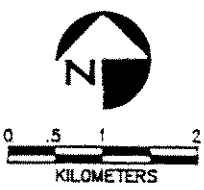
HNL89\070.51

FILE RECEPTI 12/15/92



SOURCES: USGS 7.5 MINUTE TOPOGRAPHIC MAPS
KEAHOLE POINT (OLD HAWAII DATUM 1000 METER UTM, ZONE 4)
MAKALAWENA " " " " " " " "
KAILUA (OLD HAWAII DATUM 1000 METER UTM, ZONE 5)
KIHOLO " " " " " " " "
DATED 1982
ISLAND OF HAWAII, HAWAII

NOTES: THIS MAP IS ADJUSTED TO REPRESENT GRID ZONE 4 OVER BOTH ZONES 4 AND 5.
TOPOGRAPHIC CONTOURS ARE 200' INTERVALS



DATE	REV.	DRWN.	INIT.
12/15/92		MEA	

OGDEN

Receptor Grid 1
Keahole Generating Station
Island of Hawaii

FIGURE
4-1

are described fully in Section 1.4.2 of this Appendix. Table 2.3-1 shows the maximum modeled increment consumption values. In all cases, the tabulated concentrations are well below the allowable increment thresholds. The maximum computed 3-hour SO_2 value is 82.1% of the corresponding Class II increment. The percentage increment consumptions for all other pollutant/averaging time combinations are all substantially lower. Figures 2.3-1 through 2.3-18 show concentration isopleths of maximum increment consumption for the applicable pollutants and averaging time.

For each pollutant, a series of concentration isopleth maps are generated. The first concentration isopleth map in each series is a large scale map depicting local physical features using data from Receptor Grids 1 and 2. This is followed by a closer view of the facility without physical features (Receptor Grids 1 and 2). For the short-term averaging periods, two more concentration isopleth plots using refined Grids 3 and 5 are provided to demonstrate that the maximum concentration along the property boundary was identified. Each grid indicates with an "M" the maximum predicted concentration for that area.

The location coordinates of the maximum values are provided in Table 2.3-1 and shown graphically in the individual isopleth plots. Contributions of the various Keahole Generating Sources to the maximum predicted increment consumption values are presented in Table 2.3-2.

According to DOH, HELCO must consider the contribution of mobile and area sources, as well as point sources, in the NO_2 Class II increment analysis. This means considering the contribution of automobile traffic along Queen Kaahumanu Highway and the airport operations at Keahole Airport. The Draft "Technical Guidance on Emission Inventory and Modeling for the NO_2 PSD Increments" published by the EPA indicates that a mobile and area source inventory is generally not required, if 1) the impact area is rural, and if 2) NO_x emissions are dominated by point sources, or little or no growth has taken place. The data collected by HELCO indicate that Keahole satisfies both of these conditions, as described below.

Because there are no other major stationary sources, nor large industrial complexes within approximately 50 km of the Keahole Generating Station, Keahole satisfies the rural condition (see Section 1.7). In addition, HELCO has considered the growth rate of both airport and automotive traffic. According to data presented in the 1988 Keahole Airport Master Plan Environmental Impact Statement and the most recent airport traffic data

obtained from Department of Transportation (DOT) Airport Division, aircraft operations at Keahole have remained relatively constant since 1988 (see Table 2.3-3). Total aircraft operations at Keahole in 1987 and 1988 were 67,497 and 56,584, respectively, for air carrier, air taxi, general aviation, and military operations. For these same aircraft types in 1990 and 1991 the total aircraft operations were 60,086 and 56,140, respectively. Therefore, airport traffic meets the no growth criteria for NO_2 increment analysis.

While the automobile traffic along Queen Kaahumanu Highway and the airport access road has increased since 1988, this increase is at least partially offset by increased use of more fuel-efficient automobiles. The EPA model MOBILE 4.1 was run for the baseline year 1988, and the present. The predicted NO_x emission rate for vehicles traveling 55 mph, based on default composite vehicle mixes for 1988 and 1992, are 4.11 and 3.00 gr/mile, respectively. Therefore, if traffic counts remained the same, there would be a 27% reduction in NO_x emissions. Traffic count data provided by the DOT (see Table 2.3-4) indicate an overall increase of 48% for afternoon peak hour traffic. Subtracting the offset due to more fuel efficient automobiles lowers this increase to 21%. It should also be noted that the overall traffic volume is low.

According to DOH, Hawaii's average vehicle miles traveled per gallon of gas is higher than the national average. This is most likely due to the number of newer rental cars on the road. However, this means that Keahole will most likely see a greater reduction in NOx emissions than the predicted 27%.

In conclusion, the proposed project satisfies the EPA guideline criteria for exemption from area source NO_2 modeling.

2.4 NAAQS AND SAAQS ANALYSIS

Maximum pollutant concentrations due to all proposed and existing Keahole Generating Station sources and the proposed Grace Pacific temporary asphalt batch plant sources were modeled to determine whether compliance with applicable NAAQS and SAAQS would continue at Keahole after addition of the CT-4, CT-5 and the emergency fire pump. Isopleths of total concentrations for each pollutant/averaging time combination governed by Federal and State ambient air quality standards are provided in Figures 2.4-1 through 2.4-26.

September 13, 1993

Albert Lono Lyman, CH2M Hill
1585 Kapiolani Blvd. Ste. 1420
Honolulu Hawaii 96814-4530
FAX /-941-8225, Voice /-943-1133

Re: requesting twenty (20) EIS's for HELCO's proposed power plant expansion by Keahole Airport

Dear Mr. Lyman,

After being refused by your office, the Keahole Defense Coalition (KDC) requested help in obtaining additional EIS' for its growing list of members This letter is to respectfully requests twenty (20) sets of the EIS for HELCO's proposed expansion at Keahole.

The Keahole Defense Coalition, whose purpose it is to say "NO" to HELCO at Keahole, needs this amount to provide a set to each KDC member organization which includes subdivisions in Kalaoa, Keelakehe, and Kailua, airport and highway safety interests, Sierra Club, UHWest, and Negawatt (conservation) interests, and such other organizations and individuals as have expressed an interest or will be invited to participate. If necessary we will send you the names of those who receive the EIS in order that you may account for those documents.

We appreciate having the 20 sets in our hands by Wednesday September 15 when we have our organizational meeting and will pay the air freight bill to do so. Please call to advise.

If you are running low of sets, KDC requests that you immediately print another edition. KDC expects to create a public demand for HELCO's Keahole EIS. KDC also will hold an EIS public input meeting on Wed.Sept.29 in preparation for the Oct.6 EIS input deadline.

We urge that if any other organization (eg Kona Outdoor Circle, Kona Board of Realtors, UH West interests, High School senior classes, League of Women Voters, etc.) wants multiple copies of the Keahole EIS to distribute to their interested members, you provide them as well. PLEASE, NO ROLLING BLACKOUTS ON EIS'. EIS distribution is the LAST PLACE HELCO should seek to save its customers money. HELCO should have as many EIS' AS ARE REQUESTED.

HELCO's plan to triple the size of its Keahole Electric Generating Station presents a critical issue not only as it effects public health & safety and the wallet of every electricity purchaser, but also because it deals with the question of Hawaiiisland's energy future.

Is our 21st century energy to be based on MEGAWATTS or NEGAWATTS, on supply side management or on demand side management (DSM), on HELCO's fiduciary responsibility to increase shareholder dividends by building more electric power plant and selling more electricty or the public's interest in buying less electricity from HELCO? A negawatt of electricity is a megawatt HELCO DOESN'T HAVE TO MAKE. Do we really need more megawatts in 1995 as claimed by HELCO, or can we generate negawatts into the 21st century? California negawatted 5 power plants off the drawing board saving consumers billions of dollars. We need to evaluate the "IF" as well as the "WHERE".

As the energy issue is one of utmost concern, unfulfilled requests for an EIS will be raised as grounds for rejecting the revised EIS.

Should there be any EIS' left over, HELCO can contribute them to high schools & colleges throughout the state to study the state's

If requested, will you provide 10 or more sets of EIS' to each of the Kailua, Kealakekua & Holualoa Libraries, and the Bookmobile, so they may be borrowed (or given) as well as referenced? If not 10, how many?

KDC understands that anyone calling your Honolulu office at 1-943-1133 or FAX'ng you at 1-941-8225 requesting the HELCO/Keahole EIS, will be sent one by return mail. Thank you for your continued promptness in this regard.

The Keahole Defense Coalition invites you to attend its PUBLIC INFORMATION MEETING on Wednesday Sept.22 at 7pm at the Waikoloa Recreational Center (Crosson Pavilion) on Kaimi Nani Rd. in Palisades.

Here are 10 questions pertaining to EIS availability. Please reply without delay. Also, please publish this letter and your response, in the final EIS.

1. Will you fulfill KDC's request for 20 copies by Wed. Sept. 15?

2. Will you fill requests for multiple EIS' from other organizations?

3. What plans do you have to meet the demand of other multiple EIS requesters by the October 6 deadline?

4. How many sets were originally printed?

5. How many EIS sets are left as of this date?

6. Do you intend to print more?

7. If so, how many?

8. If requested, will you place multiple sets in nearby libraries?

9. If requested, will you dispose of surplus EIS's, if any, to schools?

10. What is the cost per EIS set that you will be charging ratepayers?

continued

Thank you for your prompt reply.

Yours for a better way,

Jerry Rothstein

Jerry Rothstein, CDCH
76-123 Royal Poinciana Dr.
Kailua-Kona Hawaiiisland 96740
329-1568 / FAX 329-7651

cc:
S.Spaulding,SierraClub Legal Def.Fund
Dan Cromwell, Kona Board of Realtors
Keahole Airport car rental agencies,
Susan Dursin, League of Women Voters
Barbara Kassow, Kona Outdoor Circle
Roy Mushrush, Palisades Comm. Assoc
Keichi Ikeda, Kona Acres Comm.Assoc
Kalani Schutte, chr. County Council
Albert Hee, Waimana Enterprises Inc
Francoise L'Orange, Green Party
Kona Kohala Chamber of Commerce
Chris Yuen, BLNR Hawaii member
Jojo Tanimoto, Kawaihae Hstd
Peggy Ratliff, party to cch
Jim Rath, CntyCncl.8th Dist
Bart Kane, State Librarian
Mahi Cooper, party to cch
Kona public libraries (3)
Keith Ahue, Chrprsn, BLNR
Kohala Coast Resort Assoc
Yukio Naito chrpsn. PUC
Walter Kunitake, UHWest
Nelson Ho, Sierra Club
Waikoloa Village Assoc
Wm. I. Zimmerman, Esq
Rep. Virginia Isbell
Robt. Fox, Bd of Ed
Rep. Larry Tanimoto
Lionel Kutner, COED
June Johnson, AAUH
Don Horiuchi, DLNR
Linda Bradley, KDC
Sen. Andy Levin
OEQC Bulletin
HELCO
Media
bcc

Oct. 5, 1993

Dept. of Land & Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl Street, Room 131
Honolulu, HI 96813

Mr Don Horiuchi,

I would like to express the following concerns and questions regarding the proposed Keahole Generating Station Expansion, I have reviewed the revised Draft of the Environmental Impact Statement.

① If the proposed project has a 104 foot high stack visable from Keahole airport, doesnt this have a detremental effect on tourism (our bread and butter) as the first thing that visitors will see ~~looks~~ is an ugly smoking stack? Why not have the project in a less impacted area (Kawaihae?)

② How can the county supply 90 gpm of water to the project, when there are still homes in existing subdivisions (Kona Highlands) that do not have water?

③ I believe that adding 12 fuel taker trucks per day is asking for a major catastrophe. Wouldnt it be better to use the proposed private Kawaihae facility so that fuel would not have to be transported long distance in multiple vehicles?

④ Isnt it dangerous to have all that fuel stored in an area of frequent seismic activity?

There must be a more sensible way to provide energy, if it must be done quickly lets use the Kawaihae facility if not, why not think of the bigger picture and create energy in a different way - Garbage to energy? (These facilities are not unappealing to the eye)

Thank You for your time
Donna Giebler

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Donna Siebler
73-4179 Alaha Place
Kailua-Kona, HI 96740

Dear Ms. Siebler:

Thank you for your October 5, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

If the stack is visible from the airport, won't this have a detrimental effect on tourism?

As stated in the Revised Draft EIS (Section 3.3.4), the project is not expected to have an impact on tourism or the tourism industry. Land uses surrounding an airport are not likely to affect vacation destination planning. The Keahole site is not a vacation destination site. In general, it is not uncommon to encounter industrial land uses adjacent to airports.

Why not have the project in a less [visually] impacted area (Kawaihae)?

Kawaihae is not necessarily less visually impacted. Further, at this juncture, construction at Kawaihae is not an option available to HELCO. An independent power producer's proposal to develop power generating facilities at Kawaihae would not meet the 1995 time frame for the next increment of generating capacity on the Island of Hawaii.

How can the County supply 90 gpm of water to the project when there are still homes in existing subdivisions that do not have water?

The Department of Water Supply is developing new supply wells and will allocate water to the HELCO project. HELCO is not qualified to answer why some areas may not have an adequate water supply as you allege; power from the Keahole expansion would aid the County in future water source development.

HNL89\051.51

Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530
808 943-1133
Fax No. 808 941-8225

Adding 12 fuel tanker trucks per day is asking for a major catastrophe. Wouldn't it be better to use the proposed Kawaihae facility so the fuel would not have to be transported long distances in multiple vehicles?

Construction of a generating station in Kawaihae is not an option for HELCO because of the need to meet short-term energy needs by 1995.

Previous trucking estimates by HELCO indicated that a maximum of 12 trucks per day would be required to support the Keahole Generating Station after addition of the combined-cycle unit. Recent production simulations prepared by HECO's Generation Planning Department now include 25 MW from Puna Geothermal Venture. This has reduced the expected operating hours and associated fuel consumption of the Keahole diesel units. Previous traffic studies showed that an average of 12 trucks per day resulted in no impact to the roadway system. The current estimate of 7 to 8 trucks per day, therefore, would also have no impacts. The Revised Final EIS includes the revised trucking estimates.

Fuel is currently trucked to the Keahole Generating Station from Hilo Harbor via Route 19, through Waimea to the Queen Kaahumanu Highway. The additional trucks would also follow this route until such time as facilities are available at Kawaihae Harbor. HELCO may be trucking fuel from Kawaihae Harbor by the time Phase 1 is finished in 1995.

The total project-related traffic represents less than a one percent increase in peak-hour traffic on Queen Kaahumanu Highway, north of the generating station. This increase is not considered significant and would not result in a significant increase in the potential number of traffic accidents.

It should also be noted that, as Phases 1 and 2 of the project are brought on-line, the operation of the diesels and CT-2 will be significantly reduced. For example, in 1995 the operation of diesels will be reduced by 63 percent in comparison with the scheduled operating hours for the diesels in 1994. Similarly, the operation of CT-2 will also be reduced. The reduced operation of the diesels and CT-2 will result in a slight reduction of fuel delivery to the Keahole facility.

Isn't it dangerous to have all that fuel stored in an area of frequent seismic activity?

Construction of any fuel storage structures and facilities must conform to stringent regulatory requirements and engineering design standards that protect employees, the general public, and the environment. Construction of facilities within an area of seismic activity necessitates that special provisions be taken to negate or minimize the potential impact of earthquakes.

The American Petroleum Institute (API) is one of the many organizations that is concerned about the safe storage and handling of fuels. This organization mandates stringent provisions to protect the public and the environment from the dangers associated with the use of fuels. These industrial codes mandate adherence to rigorous design provisions that include conservative safety factors to ensure that the storage vessels will withstand prevailing environmental conditions. These codes also require that secondary containment be provided to isolate the entire contents of a storage tank. If for any reason the storage vessel should rupture, secondary containment is provided to isolate and prevent the release of any fuel to the environment.

The Island of Hawaii falls within seismic zones 3 and 4, with 4 representing the most active area. The Keahole project falls within seismic zone 4. As such, the storage tanks will be constructed to adhere to API 650, Appendix E, for seismic design within this zone. These provisions for the design of the tank, and related ones for the secondary containment, take into account the forces and activities that occur during a seismic event and ensure that the tank will be constructed to provide reliable service. The design of these vessels will ensure that the tank can withstand stress, the sloshing of fluid, and associated pressures, as well as all other forces to which the tank may be subjected during a seismic event. Tanks are also required to be adequately anchored to prevent overturning. The secondary containment will be designed and constructed to provide a failsafe backup as an additional level of assurance. Tanks are placed on a bermed, impermeable surface capable of containing the contents of the tank.

To ensure that the tank and secondary containment meet or exceed the provisions of API 650, Appendix E, and other related building codes, all design calculations of these structures will be reviewed and approved by a professional engineer of the State of Hawaii prior to construction, and the actual construction of the tanks will be supervised to verify adherence to all design details.

There must be a more sensible way to provide energy. If it must be done quickly, let's use Kawaihae. If not, why not think of the bigger picture and create energy in a different way—garbage to energy (such facilities are not unappealing to the eye)?

Additional generating capacity is needed by 1995, and the Keahole Generating Station offers the only opportunity that HELCO has to meet this need.

Garbage-to-energy plants take longer to permit and have become problematic for the following reasons:

- A relatively low volume of energy is available in garbage.
- The amount of energy generated from burning garbage is decreasing because of increased recycling efforts.

- The ash resulting from the burning of garbage may soon be classified as hazardous waste, requiring more costly disposal.

HELCO has evaluated a variety of alternatives to the Keahole project, as documented in Section 2 of the Revised Draft EIS. Power is needed in 1995; however, development of a power plant in Kawaihae is not anticipated until late 1996 or 1997, at the earliest.

HELCO will continue to rely on alternative solutions such as Demand-Side Management (DSM) and renewable energy to the fullest extent feasible. At present, however, the low margin of reserve generating capacity and the need to retire older generating units dictate that additional capacity be added in 1995. No other options meet the time frame.

For its longer term planning, HELCO has identified several alternatives that involve geothermal, renewable, and pumped storage hydropower resources.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

HNL89\051.51

RECEIVED

Oct. 6, 1993

'93 OCT 12 PM 12:16

Hawaii State Dept. of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl St., Rm. 131
Honolulu

DLNR
OCEA

I am writing to express my concern about several issues inadequately addressed by the Revised Draft of the Environmental Impact Statement prepared for the proposed HELCO expansion of the Keahole Generating Station.

In addition to major concerns about effects this proposed expansion will have on area water reserves, already marginal during periods of drought, and on its visual impact to tourists and other visitors arriving at Keahole Airport, I am actually most worried about the consequences of the "approximately 12 fuel tanker trucks per day" (Page 3-78 Of the Revised Draft) that "are expected to be needed to provide fuel to the generating station, delivering fuel from Kawaihae Harbor." My question: Has anyone considered what would happen if even one of these trucks becomes involved in an accident that causes it to either spill its load or explode? In addition to the potential for loss of life and environmental pollution that such an accident could cause, at the very least it will result in the closure of this essential thoroughfare for the many hours required for clean-up. When this happens close to the airport road, or at the Kawaihae Rd.-Queen Ka'ahumanu Highway junction, the consequences to road travelers becomes mind-numbing and nerve-jangling.

My husband and I have just returned home to Hawaii after two long, stressful years in Los Angeles, where freeway closures and accidents of this sort are a regular occurrence. One of the main reasons we live in Hawaii is because people here don't want to have to contend with these disasters, and plan their prevention accordingly - or so we thought. Twelve huge fuel trucks per day over 30 miles of two-lane highway where people already drive much too fast and one hardly ever sees a police patrol car sounds like an accident waiting to happen to me. If it does insist on this build-out, why can't HELCO at least wait until the Queen's highway is widened between Keahole and Kawaihae, and police traffic patrol is increased, two factors which would increase the safety of those 12 fuel trucks per day and all the cars traveling with them, including my husband, who commutes to and from work daily on that thoroughfare.

My other major question concerns air quality around the proposed buildout. I read the entire section (3.1.1, pp. 3-1 - 3-12) several times, and nowhere did I see addressed the problem of increased electrical plant emissions plus vog. Doesn't anyone realize how unpleasant the vog already is on "bad" days? Doesn't anyone care how much more poisonous the air around the generating station will become with all the additional sulfur dioxide and nitogen dioxide (p. 3-10)? I live just mauka of the plant, and I care alot.

Thank you for your consideration of my questions. I hope you condemn this proposed

expansion, or present evidence to nullify my fears.

Sincerely yours,

Bobbette Strauss

Bobbette Strauss, M.S.W.
73-1104 Mahilani Dr.
Kailua-Kona, HI 96740

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Bobbette Strauss, M.S.W.
73-1104 Mahilani Dr.
Kailua-Kona, HI 96740

Dear Ms. Strauss:

Thank you for your October 6, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

What would happen if one of the fuel trucks has an accident causing it to spill its load or explode? Why not at least wait until the highway is widened between Keahole and Kawaihae and police traffic patrol is increased?

Should there be an accident on the highway involving a fuel truck and another vehicle, notification would likely be made to the proper authorities (police, fire, rescue) through a source other than HELCO. HELCO maintains no radio or other direct contact with the individual trucks. Once notified, however, HELCO would respond as directed by the appropriate agency with any personnel and/or equipment required.

With regard to the widening of Queen Kaahumanu Highway, this facility is currently being master planned by the State Department of Transportation (DOT). The two-lane highway is proposed to be widened to a four-lane divided freeway between Kailua and Kawaihae. The four-lane widening of Queen Kaahumanu Highway between Kailua and Keahole may be completed within the time frame of the proposed unit addition at the generating station. However, the State has not secured all the necessary funding for the project. Given the need to provide additional power in early 1995, HELCO cannot wait for the DOT Queen Kaahumanu project to be completed before proceeding with its expansion. DOT does, however, intend to install a flashing amber light at the intersection of Keahole Airport Access Road and Queen Kaahumanu Highway before the end of 1993. This improvement will help to improve traffic safety at the intersection.

The air section does not address the problem of increased emissions plus vog. Doesn't anyone care about how much more poisonous the air around the station will become with all the additional sulfur dioxide and nitrogen dioxide?

Vog is primarily an acid aerosol composed of fine particles made up of sulfuric acid and its neutralization products. In addition, when lava flows into the ocean, its interaction with

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seawater results in the generation of hydrogen chloride at rather high concentrations in the immediate vicinity.

These emissions differ from those of automobiles, geothermal production, and the power plant. Emissions from cars consist primarily of carbon monoxide, nitrogen oxides, and hydrocarbons with lesser amounts of particulate matter and very small amounts of sulfur oxides. The principal pollutant associated with geothermal emissions is hydrogen sulfide. Emissions from the power plant include particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and hydrocarbons, all of which (except hydrocarbons) must meet health-based ambient air quality standards.

Concerning the interaction of these various pollutants, we would offer the following comments. The seawater-generated hydrogen chloride ("laze") and the geothermal hydrogen sulfide are essentially minimal in Kona because of the distance from the sources. Increasing automotive pollutants will contribute, in the long run, to a change in Kona's air quality, but at present are limited to discrete "hot spot" intersections. Limited automotive-related air quality data for the Kona area indicate that levels are currently well below health-based ambient standards. No special or unique interaction is expected with power plant emissions or vog.

Initially, power plant emissions will simply be another contributor to ambient pollution levels within the impact area and must comply with health-based ambient standards. They will be chemically different from vog constituents. As these emissions move downwind, some of them will undergo chemical transformation to sulfates and nitrates. Because of dispersion, however, the addition is not likely to be noticeable within the normal variation in vog concentrations.

In summary, "laze" and geothermal emissions do not factor into the air quality of Kona. Automotive emissions will contribute to the overall pollution burden in Kona but have no unique interaction with vog or power plant emissions. Power plant emissions are initially distinct from vog and within health standards, and they will eventually contribute insignificantly to aerosol acidity on a downwind area basis. In terms of potential adverse health effects, vog will continue to be the primary contributor for years to come.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al ~~Lono Lyman~~
Senior Project Manager

HNL89\065.51

October 7, 1993

Mr. Don Horiuchi
Department of Conservation and
Environmental Affairs
Post Office Box 621
Honolulu, Hawaii 96809

SUBJECT: Comments on Revised Draft Environmental Impact Statement for Keahole Generating Expansion by HELCO

After reviewing the Revised Draft EIS, I have the follpwomg comments to make:

Let me first inquire about the most obvious part of the planned expansion itself...the proposed humungus smoke stack. Helco has declared the additional new smoke stack will be 104 feet tall. That is equal to a 10-story building. Question: If there is a "need" to limit the height of a building in this State, should there not be a "need" to limit everything else to conform.... including smoke stacks? If not, why not?

The diameter at the bottom of this stack is designated as being 48 feet. That is larger than the floor plan of an average-size home! Helco has also given the diameter at the top of this 10-story stack to be 32 feet. Get out your tape measure, it is much wider than the usual "turn-around-space" in front of your house. Question: Why should this monstrosity be allowed to be built in front of our Keahole Airport where it will loom super-ugly to our Tourist Industry? They come for the express purpose of experiencing Paradise!!

There presently are six 40-foot stacks (equals a 4-story house) and one 70-foot stacks (equal to a 7-story house) plus the proposed 10-story stack. CH2M Hill quoted a "load" was 190 barrels (10,400 gallons), times the 12 "loads" would equal 125,400 gallons being burned every single day. Once the 3 storage tanks of 2.7 million gallons are filled there will still be the 12 "loads" per day...representing 125,400 gallons to be burned every day. Question: What do YOU envision as to the amount of particulate and smoke belching out of the those smoke stacks (worse yet, if it is only the humungus 10-story stack) if all of this is allowed to become a reality?

This will effect many things in our Coastal community: trees, flowers, animals, birds, all vegetation, and people's respiratory health on this whole hillside...especially those near their plant such as the University.

Helco stated there will be "no significant damage" to the flora and fauna of the Ag Park and Palisades. For every flower the particulate is presently spotting, it means the Ag Park residents (who depend upon their very existence from their farms) lose that portion of their income. Helco denies any effect, but it is visible. To Helco "no significant damage" or their "no adverse effect" appears to mean their ability to realize massive amounts of revenue for their company is much more important than these "little people" who will soon "go down the tubes" if Helco's proposed actions become reality. Question: Are the Ag Park residents to be sacrificed so Helco can make their big bucks? The State of Hawaii created the development of the Ag Park. Question: Why are the State Agencies vascillating over Helco's planned expansion which will eventually destroy the Ag Park's ability to be productive? As a point, even the present landscaping at the Helco Plant has died and it is constantly exposed to the down-draft particulate. Question: What effect will it have on human lungs if it has already done that to palm trees? An added Question: Why has Helco addressed only the Ag Park and Palisades from the standpoint of their being affected? There are at least 10 other subdivisions in this immediate area of which are aware of the wind currents carrying Helco's "smell" upland (when they are burning only 4 truckloads of fuel per day)...obviously it will be much worse when the truck-loads of fuel are tripled to 12 per day.

POLLUTION: GROUND AND OCEAN

Question: What happens if or when a fuel storage tank ruptures for any reason and thousands of gallons of diesel fuel goes into the "soil"? Berms control what spreads but there is no possible way to control what sinks into the porous lava bed. Question: How will Helco handle such an occurance? Question: What facilities does Helco have immediately available in the event of a FIRE? Yes, I know about the stated 240,000 gallons of brackish-water storage tank which drains at 2000 gallons per minute, giving a 2 hour supply to fight an oil fire! I am also aware it takes 8 hours to refill that tank again.

ANY oil would be contamination in it's worst form, as once it sinks below

the surface it would seek the lowest level via the lava tubes directly into the ocean. The oil-slicks on the waters surface would then drastically effect all the ecology under water plus vitally damage fish life and the extensive fishing industry of our entire Kona Coast. In the EIS, HELCO "assumes" many things. Question: How is Helco actually prepared to handle the disastrous effects of any oil leakage that reaches the fish farms at NELHA? Question: How will Helco prevent their brackish-water with all it's treatment chemicals from reaching the fish farms when perform the "reinjection" routines? Question: What will that same brackish-water/treatment chemicals do to fish-life when it reaches the ocean? Question: How is Helco going to handle whatever oil surfaces in our beautiful pristine ocean? No assumptions, please. Question: Can seepage under a runway at the airport eventually create depressionswhich would result in a plane crash with massive injuries and loss of life? Would Helco be prepared for that responsibility?

FUEL STORAGE TANKS:

Helco has stated there will be 3 fuel storage tanks in their tank farm. Those tanks will be 42 feet high, equal to a 4-story house. . One berm will hold the larger tank, 80 feet in diameter & 4-stories high. The other berm will hold 2 tanks, each 50 feet in diameter & 4-stories high. Their holding capacity was stated to be 2.7million gallons. There will be one rectangular berm encircling the compound with a division separating the larger tank from the 2 smaller ones. The berm will be high enough to contain the total contents should they rupture, leak or explode. Question: What will Helco have as immediately available in the event of an explosion? Question" What will the procedure be in the event of bodily injury to their own employees? Question: What actual safety measures will be in place? Question: What will Helco's procedure be in the event of a larger disaster and it involves cars and people on the highway? Facts please.

7 smoke stacks, a 4-story tank farm plus the 10-story monster is a most devasting eye-sore for this community, even more disappointing for the expected tourists. Helco has stated they will paint the stacks a neutral color. Question: What neutral color would Helco choose? Black is considered a neutral color. Nothing is going to diminish the appearance of the monstrosity!

Helco has also stated they will be landscaping their Plant. Question: How can Helco "landscape", so as to be unnoticeable, a 10-story stack? Nothing grows that high. Question: Where will Helco find foliage tall enough to render the 4-story tank farm and it's divided berms unnoticeable? Their present palm trees give the appearance of a wart on your nose...and have died in the process! With the new international airport a reality, it will surely produce an abundant influx of travelers. Weary from a long flight, they certainly will be deterred from thinking about a return visit when they view that super-ugly site as they leave our airport...the very gateway to West Hawaii!

FUEL SUPPLY AND TRAFFIC:

Helco has stated there will be at least 12 truck tankers PER DAY to supply diesel fuel for the expanded Plant. That is 365 days per year from Hilo to Keahole and back to Hilo. It represents 12 trucks, some of those a Tractor-trailer and some a Tuck and Trailer. CH2M Hill did supply the information that there were 190 barrels at a time...55 gallons to the barrel which represents 10,450 gallons per trip...125,400 gallons per day. With 12 truck tankers from Hilo and 12 truck tankers going back to Hilo, it means a total of 24 "trips". Those 12 truck tankers will vitally affect the traffic flow from the Hilo point of origin to Keahole...approximately 100 miles. Truck traffic is nesessarily slow from Hilo to Waimea because of the Hilly terrain...so we cannot plan on that changing. We can however expect long lines of backed-up trafic behind those slow-moving loaded Helco tankers. Cars will be unable to pass those truck for many miles. That in turn affects workers going to their jobs, tourists trying to see this island, and the "supply-line" truckers to outlying area...all the small towns and villages along that route... we can then also expect some seripus accidents including deaths. Picture the traffic flow slowed down and backed up every half hour in each direction. Question: Should all the communities, which are along this 100-mile route and are dependent primarily on the small-truck industry as a "supply-line provider" for all of our necessities, be subjected to and/or penaliZed by these traffic tie-ups/slow-downs caused by Helco's tanker-traffic every 30 minutes? (12 hours & 24 "trips")

Our Big Island Police Chief has gone on record that the intersection at Keahole Airport/Helco Service Road is now the record holder for the most numerous and serious accidents on the Big Island. It has involved Automobiles, Trucks, and Cyclists...included deaths. Question: With that statistic in mind, do we need Helco's stated increase of "up to 75 vehicular traffic daily into and out of their plant" at what is presently designated as the worst intersection on our Island? Question: Is this the most expedient way, fuel-wise, to provide electricity to this Island? Question: Is all this trucking of fuel the cheapest way to produce electricity? Statistics, please. We must remember that Helco's first choice of locations was Kawaihae. Other alternative still exist.

WATER:

Each summer the whole hillside above Helco's monstrous planned expansion is cautioned about water consumption and most every year we are curtailed with no lawn watering; no watering of flower gardens; no water for fruit trees; no car washing; and less toilet flushing. It was stated that our County had committed 129,600 gallons of water per day (year round) of our drinking water (potable) in addition to what Helco plans to produce from brackish water. For the County to commit to that is unbelievable. They don't even have an additional well at this time, and have no idea of what any well they will end up with can produce.

My big Question is: WHO GETS THE WATER AVAILABLE? The people in this community should come first. Question: Is Helco going to get all the water they want...run day and night for big profits at our expense and we suffer while they do it? We, living in the hundreds of homes on this broad hillside, will be shortchanged even more than we have been by the blackouts...we'll be restricted to the degree our trees, flowers, and foliage start dying out. It only takes one (1) hot summer of no water to kill trees and shrubs. Question: Should we have to endure this destruction and devaluation of our home and property? There is no equality in Helco's planned water consumption...it is dowright "piggish" and the price we have to pay is too much to even consider.

In addition to our hillside communities, there will be a 2640 acre sub-division in an H form, butting up against Helco, lying adjacent to the mauka side

of the Ag Park, extending toward the Kaloko Industrial Park and upward to Kona Acres. This is in the planning stage. They too will have to be supplied with water. There should be approximately 2000 homes. Question: Will they be denied building permits because of the water shortage? (Of course!)

QuestionWhat about the water supply that will be required for the State University's 500 acres whose boundary closest to Helco is less than half a mile? Question: What happens to the water needed to supply the University's planned residential area?

Obviously there are not enough wells to sufficiently supply water to all those living and going to be living in our immediate area. Helco already has the assurance of 129,600 gallons of water every day for each day of the year. Question: What happens to OUR water supply when Helco cries wolf that they need MORE water after Phase 3 (they will), and the County agrees to give it to them (they will), and we are left surrounded by our devastated plant life, devalued property and our ocean is polluted?

The evasiveness along with the brushed-over and "pat" answers found in the various EIS will no longer suffice for this community. This now requires FACTS and FIGURES from Helco on EVERY SINGLE ITEM!

Thank you for allowing me to express my opinions and comments along with the questions.

Most Sincerely,

Dr. Nathalie D. Tucker, D.C.

Dr Nathalie D Tucker
Box 1510
Kailua Kona HI 96745

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Dr. Nathalie D. Tucker, D.C.
Box 1510
Kailua-Kona, HI 96745

Dear Dr. Tucker:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

If there is a "need" to limit the height of a building in this State, should there not be a "need" to limit everything else to conform . . . including smoke stacks? If not, why not?

The minimum height of the stack is determined by the U.S. Environmental Protection Agency (EPA). The federal guidelines for good engineering practice (GEP) stack height were used to determine the appropriate stack height for the Keahole plant. A minimum height of 104 feet is needed to minimize the influence of nearby structures on normal plume dispersion. EPA controls would not permit a lower stack height.

Why should this monstrosity be allowed to be built in front of our Keahole Airport, where it will loom super-ugly to our Tourist Industry?

We do not agree with your characterization of the project. HELCO undertook a detailed siting study to identify the best site with the fewest potential impacts. This siting process is described in Section 2 of the Revised Draft EIS. No other site is available that could provide the required power in 1995.

As stated in Section 3.3.4 of the Revised Draft EIS, the project is not expected to have an impact on tourism or the tourism industry. Land uses surrounding an airport are not likely to affect vacation destination planning. The Keahole site is not a vacation destination. In general, it is not uncommon to encounter industrial land uses adjacent to airports.

What do you envision as to the amount of particulate and smoke belching out of the smoke stacks (worse yet, if it is only the humongous 10-story stack) if all of this is allowed to become a reality?

Under normal operations, there would be no smoke "belching" out of the stack. The projected potential emissions from the proposed unit addition are presented in Table 3-3 of the Revised Draft EIS.

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Are the Agricultural Park residents to be sacrificed so HELCO can make their big bucks?

No, no one is being "sacrificed." The proposed unit addition is designed to prevent the type of rolling blackouts experienced by the Island of Hawaii in 1991-92. Air modeling studies indicate that the Agricultural Park will not be impacted by emissions from the proposed unit addition.

Why are the State Agencies vacillating over HELCO's planned expansion which will eventually destroy the Agricultural Park's ability to be productive?

State agencies are not "vacillating" over HELCO's planned expansion. The Department of Land and Natural Resources requested additional information to make an acceptance decision for the Draft EIS. Emissions are not predicted to affect the vegetation or productivity of the Keahole Agricultural Park.

Even the present landscaping has died and it is constantly exposed to the down-draft particulate. What effect will it have on human lungs if it has already done that to palm trees?

Plant emissions have not affected the plant's landscaping, including the palm trees. A malfunction in the irrigation system, which was not immediately detected, led to insufficient watering of the landscape vegetation at the Keahole Generating Station. Neither the Agricultural Park nor its residents will be affected by plant emissions.

Why has HELCO addressed only the Agricultural Park and Palisades from the standpoint of their being affected?

The air quality impact analysis focused on the Keahole Agricultural Park and on Palisades because the community expressed concern that these areas were the most sensitive within the project's potential impact area. However, air quality modeling, required for the facility's air permit, assessed potential impacts at a radius of approximately 4 kilometers surrounding the Keahole plant.

What happens if or when a fuel storage tank ruptures for any reason and thousands of gallons of diesel fuel goes into the soil? Berms control what spreads but there is no possible way to control what sinks into the porous lava bed.

A bermed area with an impermeable surface capable of containing the contents of the tank will be constructed around each storage tank. This design will prevent fuel from ground contact.

How will HELCO handle such an occurrence (tank spill)?

In the event of a leak into the bermed area, the oil would be reclaimed by pumping the oil from the bermed area into a tanker truck. The reclaimed oil would be disposed of in compliance with all applicable State and federal regulations. The storage tank would subsequently be inspected, and the source of the leak identified and repaired.

What facilities does HELCO have immediately available in the event of a fire?

Currently, there are two County fire hydrants located at the Keahole site. One is located near the CT-2 unit and the other a short distance outside the existing entrance gate. In addition, each electro-motive diesel (EMD) unit is equipped with a 20-pound carbon dioxide (CO_2) extinguisher. There are also CO_2 extinguishers in and around the CT-2 unit and inside the control room. There is also a 150-pound, dry chemical, wheeled unit located in the adjacent substation.

How is HELCO actually prepared to handle the disastrous effects of any oil leakage that reaches the fish farms at NELHA?

Because design features, preventive maintenance procedures, and spill containment protocols are in place and will be expanded with the unit addition to the Keahole Generating Station, no impact to NELHA fish farms is anticipated from an oil spill.

How will HELCO prevent their brackish water with all its treatment chemicals from reaching the fish farms when performing the "reinjection" routines?

Extensive studies regarding potential groundwater impacts were evaluated and are detailed in Appendices C and D of the Draft EIS, Volume II, and summarized in Volume I, Section 3.1.4, of the Revised Draft EIS. The studies have concluded that there will be no impacts as a result of the injection process. The groundwater volume and movement will dilute and disperse the injectate.

What will those same brackish-water/treatment chemicals do to fish-life when it reaches the ocean?

Federal and State regulations require strict monitoring of the injectate. The wastewater that is ultimately permitted to be injected will contain a solution of salts that will be diluted and dispersed. No impact to marine life is expected.

How is HELCO going to handle whatever oil surfaces in our beautiful pristine ocean?

Because design features, preventive maintenance procedures, and spill containment protocols are in place and will be expanded with the unit addition to the Keahole Generating Station, there will be no fuel seepage into the ground and no impacts to the ocean. Any oil contained in the wastewater will be removed by the oil/water separator process.

Can seepage under a runway at the airport eventually create depressions which would result in a plane crash with massive injuries and loss of life? Would HELCO be prepared for that responsibility?

There will not be seepage of fuel under the runway at the airport because fuel unloading and storage at the Keahole facility occur on an impervious unloading area, and the unloading operation is monitored by the truck driver. Connecting hoses contain check valves to prevent the release of fuel. Any minor spills or drips are collected and recycled. Fuel storage tanks have a high-level alarm to prevent overfilling and a visible gauge that is monitored by the driver during the unloading operation. The fill point on the gauge is well below the point at which the high-level alarm is triggered. The impervious containment area has sufficient capacity to contain the entire contents of a storage tank. The tanks are cathodically protected to prevent any internal corrosion. As a precaution, bottom draw samples from the tanks are taken regularly and analyzed for contaminants that might indicate a corrosion problem in the tank. Employees at the facility are trained in the proper procedures for preventing, detecting, and controlling oil leaks.

What will HELCO have immediately available in the event of an explosion?

In addition to the fire-fighting equipment described previously, HELCO is proposing an additional 250,000 gallons of stored water, a sprinkler system, a 2,000-gallon-per-minute (gpm) electric fire pump, a 2,000-gpm backup diesel fire pump, and a 500-gpm brackish water supply pump. The equipment and fire-fighting systems meet all requirements of the National Fire Protection Association and HELCO's insurance agent, Industrial Risk Insurers.

What will the procedure be in the event of bodily injury to their own employees?

In the event of bodily injury to a HELCO employee, first aid will be rendered immediately by fellow employees. While first aid is being applied, calls will also be made to the Fire Department for emergency medical assistance if necessary. All employees are fully trained in first aid and completed a CPR Refresher Course in October 1993.

What actual safety measures will be in place?

HELCO complies with all applicable Occupational Safety and Health Administration (OSHA) requirements to prevent accidents and injuries to its employees. All fuel handling from the tanker into the bulk storage is the responsibility of the trucking contractor. The present contractor, Kuwaye Bros., complies with all training requirements imposed by the State Department of Transportation (DOT). All drivers are required to complete the annual Driver Improvement Program. In addition, all drivers have completed a Hazardous Material Safety Course and attend short training seminars whenever they are provided by HELCO's diesel fuel supplier, Chevron USA.

Company employees are trained in the proper use of fuel extinguishers and in the use and maintenance of the emergency oil spill response equipment provided onsite. Any spilled fuel cannot escape beyond the boundaries of the tank berms. The Civil Defense and Fire Department were not consulted directly concerning the training issue, but the Fire Department can offer comments on the final equipment layout, as it must approve the site and building plans.

What will HELCO's procedure be in the event of a larger disaster and it involves cars and people on the highway?

Should there be an accident on the highway involving a fuel truck and another vehicle, notification would probably be made to the proper authorities (police, fire, rescue) through a source other than HELCO. HELCO maintains no radio or other direct contact with the individual trucks, which are provided through a private contractor. Once notified, however, HELCO would respond as directed by the appropriate agency with any personnel and/or equipment requested.

What neutral color would HELCO choose?

There are a number of colors available for painting of the stack. A neutral color, such as an earth-tone color, will be used.

Where will HELCO find foliage tall enough to render the 4-story tank farm and its divided berms unnoticeable?

Renderings have been included in the Revised Final EIS showing the initial and the ultimate effect of the proposed landscaping for the site. Initial plantings will not be tall enough to completely screen the structures. As the landscaping grows over time, it is intended to provide adequate visual buffering as the plants increase in height, volume, and density.

Should all the communities, which are along this 100-mile route and are dependent primarily on the small-truck industry as a "supply-line provider" for all of our necessities, be subjected to and/or penalized by these traffic tie-ups/slow-downs caused by HELCO's tanker-traffic every 30 minutes? (12 hours & 24 trips).

There is no basis to conclude that slow-downs/tie-ups would occur as a result of HELCO tanker truck traffic. DOT conducted a vehicle type classification survey on Mamalahoa Highway near the east junction to Honokaa on June 22-23, 1992. The vehicle survey indicated that approximately 24 truck-trailers use this route daily. Fuel tanker trucks would be included in this vehicle classification. Truck-trailer traffic represents approximately 0.39 percent of the total traffic of 6,108 vehicles per day on this route. The additional fuel tanker truck traffic generated by the proposed Keahole expansion would increase the truck-trailer traffic to about 0.52 percent, or less than one percent of the total daily traffic.

In addition, HELCO expects to be trucking fuel from Kawaihae Harbor by the time the proposed Phase 1 expansion is finished (1995). Therefore, the trucks would not be traveling the 100 miles from Hilo to Keahole. If the fuel cannot be trucked from Kawaihae by the time the proposed plant expansion is finished, fuel would continue to be trucked from Hilo. The current route for trucking is from Hilo Harbor onto Route 19, through Waimea to Queen Kaahumanu Highway.

Do we need HELCO's stated increase of "up to 75 vehicular traffic daily into and out of their plant" at what is presently designated as the worst intersection on our Island?

Your reference to 75 vehicles reflects the total number of vehicles anticipated to enter the Keahole site over a 24-hour period in 1998. In response to public concerns about traffic safety at the referenced intersection, a traffic accident study was performed to evaluate safety issues associated with the Keahole Airport Access Road and the Kaiminani Drive intersections with Queen Kaahumanu Highway. The results of the accident study are included in the Revised Draft EIS and are briefly summarized here.

Between 1986 and 1990 (the most recent year for which data are available), there were 18 collisions at the Keahole Airport Access Road intersection, eight of which occurred in 1990. In 1990, the accident rate at this intersection was 1.87 accidents per million vehicles entering the intersection. Fifteen collisions occurred between 1986 and 1990 at the Kaiminani Drive intersection, with seven occurring in 1990 alone. Since 1990, improvements have been made at the intersection that have reduced the number of accidents from approximately eight per year to three within the last year.

The proposed expansion of Keahole Generating Station is expected to generate 16,790 vehicles per year. On the basis of the 1990 accident rate and projected annual traffic entering the intersection of Queen Kaahumanu Highway and the Keahole Airport Access Road, the proposed project could increase the number of accidents by 0.034 per year.

DOT intends to install a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway before the end of 1993. In addition, Queen Kaahumanu Highway is currently being master planned by DOT, with widening and further lane channelization proposed. The installation of a flashing amber light at the intersection of the Keahole Airport Access Road and Queen Kaahumanu Highway would precede Phase 1 of the proposed unit addition to Keahole Generating Station. This improvement, along with the long-term improvements described above, are expected to mitigate traffic safety problems currently associated with the Keahole Airport intersection. HELCO will coordinate its planning efforts with the DOT Highways Division to ensure that roadway improvements will accommodate fuel tanker trucks.

Is all this trucking of fuel the cheapest way to produce electricity? We must remember that HELCO's first choice of locations was Kawaihae.

As part of HELCO's Integrated Resource Planning process, the capital, operating, and externality costs of a wide variety of power generation options were evaluated. Even considering fuel transportation costs, installation of the combustion turbine technology at Keahole was the most cost-effective option that could provide the needed amount of generation capacity within the required time frame.

Who gets the water available? The people in this community should come first.

The Hawaii County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

Is HELCO going to get all the water they want . . . run day and night for big profits at our expense and we suffer while they do it?

HELCO is developing this additional capacity so that the residents of the Island of Hawaii will have reliable electric service. In addition, the County will be able to use the additional power to further develop adequate supplies of potable water.

Should we have to endure this destruction and devaluation of our home and property? There is no equality in HELCO's planned water consumption.

The County Department of Water Supply is providing HELCO with an allocation in order to ensure that the County does not again have rolling blackouts similar to those experienced in 1991-92. In addition, the County will be able to use the additional power for further development of potable water supplies. There is no evidence to support the conclusion that property will be devalued as a result of the project.

Will the 2,640-acre subdivision adjacent to HELCO (to the mauka side of the Agricultural Park, extending toward the Kaloko Industrial Park and upward to Kona Acres) be denied building permits because of the water shortage?

HELCO is not qualified to answer this question. As stated above, the County Department of Water Supply has evaluated the proposed project in terms of the County's water supply and the community's future needs, and will allocate water to the HELCO project. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will provide a reliable source of power to operate the Water

Department's pumps and will aid the County in developing further potable water sources for the area.

What about the water supply that will be required for the State University's 500 acres whose boundary closest to HELCO is less than half a mile?

HELCO can only address the power requirements for the proposed University of Hawaii, West Hawaii Campus. HELCO is not qualified to address the water supply to the facility. The Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area.

What happens to the water needed to supply the University's planned residential area?

Again, HELCO is not qualified to comment on water requirements for planned future development.

What happens to OUR water supply when HELCO cries wolf that they need MORE water after Phase 3 (they will), and the County agrees to give it to them (they will), and we are left surrounded by our devastated plant life, devalued property and our ocean is polluted?

The County of Hawaii Department of Water Supply's approval of HELCO's request for the use of potable water recognizes the importance of this project in terms of public infrastructure. Power from the Keahole expansion will aid the County in developing further potable water sources for the area. Finally, we do not agree with your characterization of the impacts. The studies performed for the EIS indicate no adverse impacts to plant life, property values, or the marine environment.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

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OCEA

October 7, 1993

Mr. Don Horiuchi
Dept. of Conservation and Environmental Affairs
Post Office Box 621
Honolulu, Hawaii 96804

RE: Comments on Revised Draft Environmental Impact Statement for Keahole Generating Expansion by HELCO

Dear Mr. Horiuchi:

After reviewing the Revised Draft EIS, I have the following comments and concerns:

HELCO's expansion location is terrible and the diesel fuel type plant is worse. With these two boo-boo's in their primary planning, I have grave questions about the rest of this whole affair. I would like some answers with facts and figures on each of the following questions:

1. Location: you own the land, clean water is available, location is on the right side of the Island . . . other than these reasons, have you any other for putting this big pollution-creating plant in this population and commerce center, immediately across from the airport serving West Hawaii, the gateway for our largest industry, tourism, and adjacent to residential subdivisions and the planned State University? There are additional plans for urban expansion in the area.

2. Air pollution: since you are getting an air quality exception now, and there is plenty of wilderness available, and this plant will be operating 25 or 30 years, why build in a population center where you will be creating health risks?

3. Commerce: Our airport expansion will soon be complete, which will help our Island's economy big time. How can you justify locating the plant in an area that will harm our tourist industry and our commercial ratepayers? Is HELCO attempting to stifle the need for future expansion?

4. Can this plant be operated at this location? A father uphill from this maximum pollution plant watches his children's health deteriorate; his house that took a decade of savings to get into devalues far below his years of investment; his family has trouble breathing, yet they can't move; month after month of watching this. Will he take action one night, wick and light off one of these diesel tanks in place? Community opposition is much too strong and the location of the plant too blatently ill-conceived and down right STUPID for the proposed expansion to be allowed.

5. Bad Public Relations: A tall, wide stack, big tanks, plus the rest of the plant, and a large addition to their monthly bill to pay for this monster . . . will not this plant cause much ill will with the ratepayers for many years to come?

6. HELCO's being replaced: After years of already high monthly electric bills, plus a big hike for building this plant and the injustice of the plant's location, coupled with the type of fuel used . . . will the fallout from the additional high cost on their already high electric bill cause a vote among ratepayers for HELCO's replacement?

7. Fuel consumed: At full and total output at Keahole, the turbines, and any and all diesel power of any type operating at 100%, all out, full bore, at maximum output, how many U.S. gallons of diesel would be consumed in a twenty-four hour day? Facts and figures, please.

8. Cost of this expansion: our present electric bills have a 3.8% surcharge to pay for Puna Geothermal Venture's plant. So, roughly, it would cost about another 16-1/2% for this expansion; what is the exact percentage that our bills would increase because of this Keahole expansion?

Thank you for your attention to this matter. I look forward to receiving your answers to my questions in the near future.

Sincerely,

Russell Wertz

RUSSELL WERTZ
73-1246 Kukuna
Kailua-Kona 96740

RWW/jc/3040w/1

CH2M HILL
Engineers
Planners
Economists
Scientists

December 7, 1993

Mr. Russell Wertz
73-1246 Kukuna
Kailua-Kona, HI 96740

Dear Mr. Wertz:

Thank you for your October 7, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our responses to your individual comments follow.

Other than land ownership, clean water, and location in West Hawaii, are there other reasons for putting the plant across from the airport and next to residential subdivisions and the planned state university?

It is important to remember that HELCO is not "putting" a new facility at Keahole; it is proposing to expand an existing facility that has been at that location since the mid-1970s. HELCO's Keahole facility was in existence before many of the surrounding land uses were developed.

HELCO is proposing a unit addition at Keahole because neither HELCO nor an independent power producer (IPP) has an alternative site to develop additional generating capacity within the time frame that the capacity is needed in 1995. Without additional capacity, HELCO may be unable to meet peak demands for electricity. None of the other alternatives evaluated (see Section 2 of the Revised Draft EIS), including other sites and IPPs, would be able to address this need in 1995.

As a point of clarification, the Keahole Generating Station is not located next to a residential subdivision. A residential subdivision is composed of land subdivided into relatively small parcels for residential development. The generating station is next to Keahole Agricultural Park, which was developed by the State for agricultural use. Although a single residence is permitted (but not required) on each agricultural lot, the Agricultural Park is not considered a residential subdivision.

Since you are getting an air quality exception now, and there are alternative locations, why build in a population center where you will be creating health risks?

HELCO assumes the "exception" you refer to in your comment relates to the existing CT-2 unit at Keahole. HELCO is not currently "getting an exception" for this unit. CT-2

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is in compliance with all permit conditions except the particulate emissions limit. The U.S. Environmental Protection Agency (EPA) has indicated that the particulate limit in CT-2's current permit is inappropriately low, and that it should be increased. HELCO is conducting a testing program, with State Department of Health (DOH) concurrence, to determine the appropriate particulate limit for CT-2; HELCO will modify the Prevention of Significant Deterioration (PSD) permit for CT-2 in accordance with the results of the testing program.

As air quality modeling has shown, expansion of the Keahole facility would not cause ambient air quality standards to be violated, and installation of a unit addition at Keahole will not create health risks. HELCO has collected air quality data and has modeled potential air quality impacts (this analysis was summarized in Section 3.1.1 of the Revised Draft EIS). This analysis supports the conclusion that no health risk will occur.

EPA has established air quality standards that are protective of human health and the environment. Federal Primary Air Quality Standards are based on protection of human health. Federal Secondary Air Quality Standards (which, in most cases, are no less stringent than the primary standards) are based on human "welfare," which includes such considerations as impacts to vegetation, animals, visibility, and comfort. On the basis of the air quality modeling, which indicates that primary and secondary air quality standards will not be exceeded, HELCO has concluded that no significant impacts to human health and the environment occur.

It is important to note that the PSD modeling process makes a number of conservative assumptions that overstate emissions from the proposed power plant expansion. Therefore, projected concentrations that result from the modeling can be considered "worst case," or conservatively high; typical ground-level concentrations are likely lower than those described in the PSD application. The post-construction air quality modeling associated with the project is designed to confirm that this is the case.

As stated in our response to your first question, HELCO is expanding an existing facility that has been in operation since the 1970s. This expansion is considered the only reasonable alternative to meet the projected demand for energy in the short term.

How can you justify locating the plant in an area that will harm tourism and our commercial ratepayers? Is HELCO attempting to stifle the need for future expansion?

As stated in the Revised Draft EIS, the project is not expected to have an impact on tourism, the tourism industry, or commercial ratepayers. The unit addition at Keahole is required to accommodate future growth in West Hawaii, not to stifle it. Land uses surrounding an airport are typically of an industrial nature and are not likely to affect vacation destination planning.

Can the plant be operated at this location (in light of community opposition and health issues)?

HELCO has no reason to believe that the proposed expansion will have any adverse impacts. If the project were not built, community reaction to the generating shortfall and associated power outages could be more intense and could result in adverse economic impacts. Faced with the possibility of a shortfall, HELCO is required to plan for and implement additional and adequate generating capacity. As explained previously, none of the other alternatives evaluated will be able to address this need in 1995.

Won't the plant cause much ill will with the ratepayers for many years to come?

Please see our response to your previous question.

Will the fallout from the additional high cost on already high electric bills cause a vote among ratepayers for HELCO's replacement?

HELCO anticipates that the additional costs to ratepayers for the Keahole project will be 1.76 cents per kilowatt-hour. HELCO does not anticipate that this increase would lead to a vote among ratepayers for "HELCO's replacement."

How many U.S. gallons of diesel would be consumed in a 24-hour day assuming full and total output of the turbines and all diesel power of any type, all at maximum output?

At its peak in 1998, prior to retirements of diesel units, approximately 477,026 barrels of fuel per year are estimated to be used at Keahole. At 42 gallons per barrel, this equates to 20,035,092 gallons of fuel per year or 54,891 gallons of fuel per day.

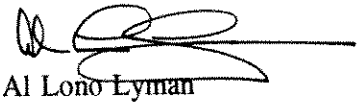
What is the exact percentage that our bills would increase because of the Keahole expansion?

As stated above, HELCO estimates the impact to ratepayers to be 1.76 cents per kilowatt-hour in 1998. The exact percentage would depend on each customer's bill.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL



Al Lono Lyman
Senior Project Manager

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September 4, 1993

Mr. Don Horiuchi
OFFICE OF CONSERVATION AND ENVIRONMENTAL AFFAIRS
DEPARTMENT OF LAND AND NATURAL RESOURCES
1151 Punchbowl Street Room 131
Honolulu, Hawaii 96813

Dear Mr. Horiuchi,

I am writing to you as a concerned citizen with some questions regarding the possible, future effects upon the basic necessities of life which the continued use of petroleum products for producing energy will have on this fragile island.

AIR QUALITY: What are the additive and cumulative effects on human welfare which will be produced from interaction of chemicals released by fossil fuel burning with those chemicals introduced into the air by the volcano by automobilesand by geothermal releases?

In the "summary of the Status of Vog Research" dated March 14, 1992 (a study of the effects of VOG and LAZE by a task force formed by the American Lung Association of Hawaii/ Hawaii Thoracic Society), lung capacity for adults and children were below the national average. School absenteeism rates increased corresponding to time periods of increased volcanic activity and consequent VOG exposure. Data collected by the Hawaii State Department of Health "suggests that individuals living in areas known to have high VOG levels have increased symptoms of a chronic respiratory nature." Health insurance data and State Department of Health data suggest increased morbidity of individuals with chronic respiratory conditions when exposed to VOG. The LAZE, an acid rain or steam composed of sodium, potassium, magnesium, calcium, chloride, bromine, and sulfur, having a salinity 2.3 times ocean water and a PH of 1.5 to 2.0 is a highly toxic liquid. "From an inhalation hazard standpoint, concentrations of hydrogen chloride in LAZE have been measured in excess of the OSHA standard of 7,000 micrograms/cubic meter."This is an amount not to be exceeded by any workers at any time! Although this study has revealed acute respiratory dangers, more research must be done to completely understand ent effects of Volcanic emissions on Humans. This study by the American Lung Association is not considered to be definitive and they along with the University of Hawaii School of Public Health, the Centers for Disease Control, and the State Department of Health are continuing research on this issue.

The impact on human welfare of automobile exhaust is widely recognised and documented. What will the cumulative effects be upon Humans when the emissions from autos, volcanoes, geothermal gases and fossil burning power plants be?

The chemicals in VOG are transformed as they leave the vent, enter the sea and mix with particulate matter in the air. How will these chemicals interact with those given off by a fuel burning power plant?

Will the chemicals found in the exhaust from this power plant be additive? Will they worsen respiratory conditions in humans who are already burdened by asthma, emphysema, bronchitis, sinusitis and other respiratory illnesses.

There is a definite respiratory effect to those Humans living on the Kona Coast which is documented by complaints of respiratory problems in much greater numbers than in other parts of the island or the State. The temperature inversion plus the blocking of winds by the 13,000 foot high volcano causes emissions of any type to settle and remain in the Kona area. Any new emissions which can be controlled must be prevented from entering and accumulating in this area.

There is a definite respiratory effect to those Humans living on the Kona Coast which is documented by complaints of respiratory problems in much greater numbers than in other parts of the island or the State. The temperature inversion plus the blocking of winds by the 13,000 foot high volcano causes emissions of any type to settle and remain in the Kona area. Any new emissions which can be controlled must be prevented from entering and accumulating in this area.

Sincerely,

Jane Wilson
P.O. BOX 2613
Kailua-Kona Hawaii 96745

Engineers
Planners
Economists
Scientists

December 7, 1993

Ms. Jane Wilson
P.O. Box 2613
Kailua-Kona, HI 96745

Dear Ms. Wilson:

Thank you for your September 4, 1993, letter concerning the Keahole Revised Draft Environmental Impact Statement. Our response to your comment follows.

What are the additive and cumulative effects on human welfare which will be produced from interaction of chemicals released by fossil fuel burning with those chemicals introduced into the air by the volcano, cars, and geothermal releases? Concerned about respiratory effects.

No special or unique interaction is expected with power plant emissions and vog or emissions from cars and geothermal activities.

Vog is primarily an acid aerosol composed of fine particles made up of sulfuric acid and its neutralization products. In addition, when lava flows into the ocean, its interaction with seawater results in the generation of hydrogen chloride at rather high concentrations in the immediate vicinity.

These emissions differ from those of automobiles, geothermal production, and the power plant. Emissions from cars consist primarily of carbon monoxide, nitrogen oxides, and hydrocarbons with lesser amounts of particulate matter and very small amounts of sulfur oxides. The principal pollutant associated with geothermal emissions is hydrogen sulfide. Emissions from the power plant include particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and hydrocarbons, all of which (except hydrocarbons) must meet health-based ambient air quality standards.

Concerning the interaction of these various pollutants, we would offer the following comments. The seawater-generated hydrogen chloride ("laze") and the geothermal hydrogen sulfide are essentially minimal to Kona due to the distance from the sources. Increasing automotive pollutants will contribute, in the long run, to a change in Kona's air quality, but at present are limited to discrete "hot spot" intersections. Limited automotive-related air quality data for the Kona area indicate that levels are currently well below health-based ambient standards.

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Power plant emissions will simply be another contributor to ambient pollution levels within the impact area and must comply with health-based ambient standards. They will be chemically different from vog constituents. As these emissions move downwind, some of them will undergo chemical transformation to sulfates and nitrates. Because of dispersion, however, the addition is not likely to be noticeable within the normal variation in vog concentrations.

In summary, "laze" and geothermal emissions do not factor into the air quality of Kona. Automotive emissions will contribute to the overall pollution burden in Kona but have no unique interaction with vog or power plant emissions. Power plant emissions are initially distinct from vog and within health standards, and they will eventually contribute insignificantly to aerosol acidity on a downwind area basis. In terms of potential adverse health effects, vog will continue to be the primary contributor for years to come.

Thank you for taking the time to review the Revised Draft EIS. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

CH2M HILL

Al Lono Lyman
Senior Project Manager

Section 8

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8.1 CH2M HILL

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Char & Associates—Botanical Resources
Cowell & Co., Inc.—Property Value Impacts
Karen Stabenow—Consultant for the Revised Final EIS
Landscape Images, Inc. – Landscape Architect
Locations, Inc.—Real Estate Value Analysis
Masa Fujioka & Associates—Geotechnical and Volcanic Hazards
Mike Chu—Landscape Architect
Paul H. Rosendahl, Ph.D., Inc.—Archaeological and Cultural Resources
Phil Bruner—Fauna Resources
The Traffic Management Consultant—Traffic Analysis
Water Resources Associates—Hydrogeology and Groundwater Resources
Y. Ebisu & Associates—Acoustical and Electronic Engineers

8.3 HELCO/HECO Subconsultants

Black & Veatch—Resource Planning
Ogden Environmental and Energy Services—Air Quality
Risk Science Associates – Ecological Risk
Stone & Webster Engineering Corporation—Engineering
James W. Morrow—Air Quality
B. D. Neal & Associates—Air Quality

Summary of Air Quality Studies at the Keahole Agricultural Park

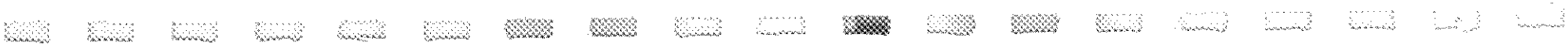
Prepared for

The Hawaii Electric Light Company

Prepared by

CH2M HILL

November 8, 1993



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Attachment A: Letter from Ogden Environmental and Energy Services
Attachment B: Plume Impact Study at Keahole Agricultural Park
Attachment C: Air Quality Study—Acid Aerosol and Ethylene
Attachment D: Focused Ecological Risk Characterization
Attachment E: Focused Ecological Risk Characterization
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Figures

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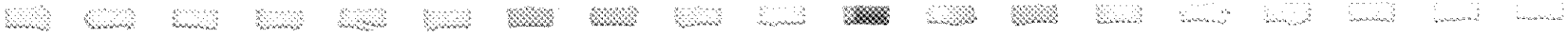


Introduction

The Hawaii Electric Light Company (HELCO) has proposed to add 56 megawatts (MW) of net generating capacity at the Keahole Generating Station. Draft and revised draft environmental impact statements (EIS's) were prepared to identify potential environmental impacts and potential mitigation measures for the project. During public review of the environmental documents, residents of the adjacent Keahole Agricultural Park voiced concerns about potential air quality impacts of the project. To address these concerns, HELCO commissioned additional air quality studies to examine the site-specific issues raised by Agricultural Park residents.

A literature search for information on potential plant effects was conducted by Ogden Environmental and Energy Services. The search focused on the criteria pollutants sulfur dioxide (SO_2), carbon monoxide (CO), ozone, nitrogen dioxide (NO_2), and particulate matter (PM). The report is provided as Attachment A.

Plume Impact Study at Keahole Agricultural Park (the *Plume Impact Study*), conducted by B. D. Neal & Associates, examined impacts of the existing generating station operations. The study focused on meteorological data collected at the power plant and on nitrogen oxides data collected at the Agricultural Park. The nitrogen oxides data serve as an indication of power plant emissions impact. The report is provided as Attachment B.

Air Quality Study—Acid Aerosol and Ethylene (the *Acid Aerosol and Ethylene* study), conducted by James W. Morrow, studied existing levels of acid emissions at the Agricultural Park. The study also considered potential ethylene impacts, which are of particular concern to commercial flower growers. The report is provided as Attachment C. Both the *Plume Impact Study* and the *Acid Aerosol and Ethylene* study were short-term in nature. The studies indicate that a more long-term study is not warranted.

Risk Science Associates prepared three separate *Focused Ecological Risk Characterization* reports. The three reports considered potential impacts to Agricultural Park crops from the following components of facility emissions: ethylene, oxides of sulfur and nitrogen, and H_2SO_4 mist. The reports are provided as Attachments D, E, and F.

The studies listed above were conducted in addition to the extensive air quality modeling that is required as part of the Prevention of Significant Deterioration (PSD) air quality permit application. The studies and PSD modeling results are described in the following sections.

Literature Search

Comment letters on the Draft EIS expressed concerns over possible effects of gaseous emissions from the proposed unit addition at Keahole. A literature search (Ogden) was conducted to examine phytotoxicity data for five pollutants and to compare published data to projected pollutant levels based on air quality modeling. The literature review

addressed SO_2, CO, ozone, NO_2, and PM. For all pollutants, the lowest levels at which acute and chronic effects have been observed are higher than anticipated short- and long-term average levels projected by PSD modeling. Projected levels of pollutants ranged from several times to several orders of magnitude lower than levels at which plant impacts were identified.

Data regarding combined effects of gaseous pollutants indicate that concentrations necessary to induce damage are below expected concentration levels, although the interactions of the various pollutants are complex and cannot be completely predicted. Based on available literature, typical levels associated with negative effects on plants, and the low levels of projected concentrations, there is no indication that the Agricultural Park will be adversely affected by emissions from the project.

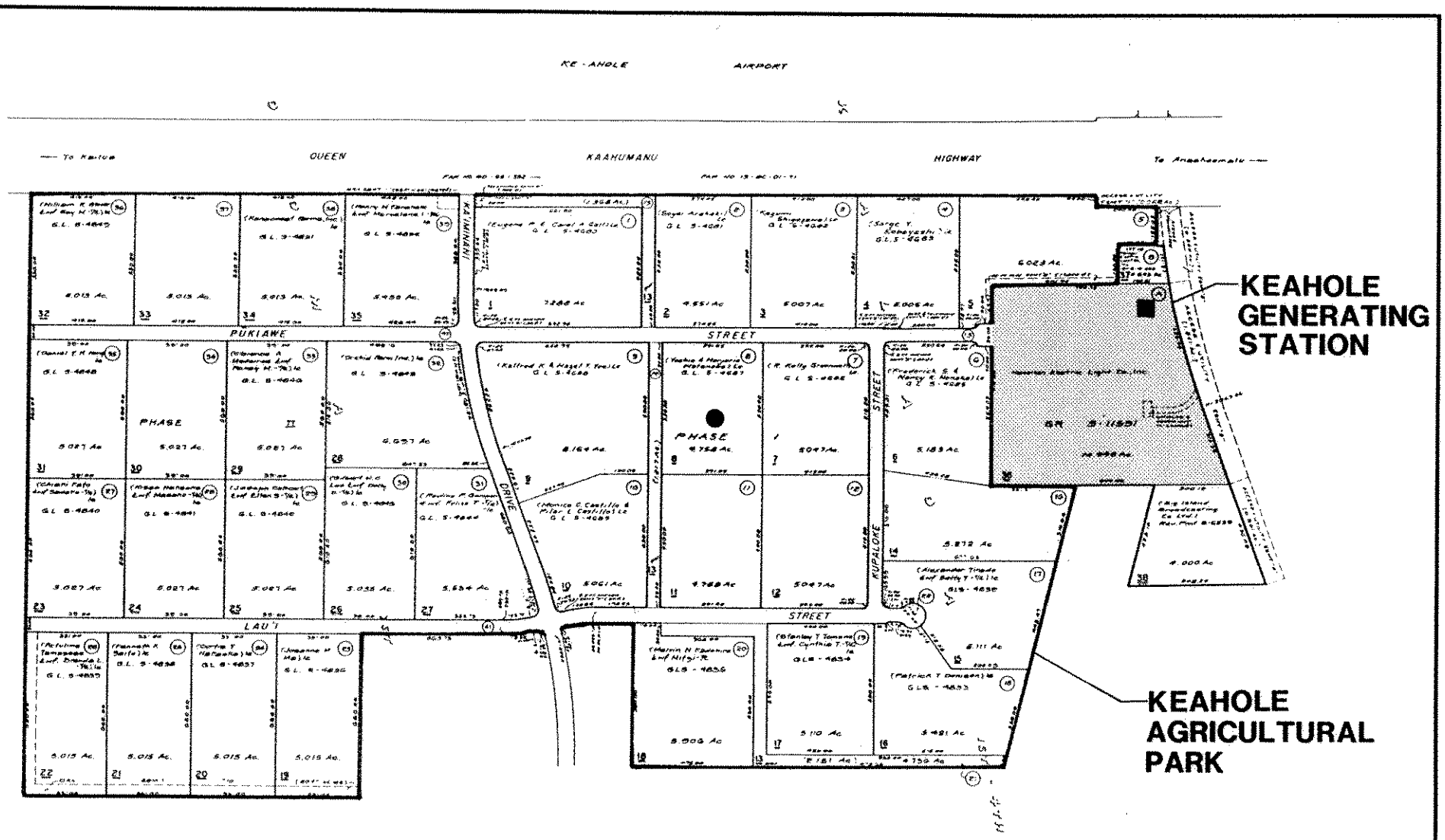
Plume Impact Study

The *Plume Impact Study* (Neal) examined whether emissions from existing operations reach the Keahole Agricultural Park. Data collection began during mid-July 1993 and was concluded toward the end of August 1993. Meteorological data were collected at two sites during the study. One site was the 32-meter meteorological tower, located at the generating station, and the other was a wind monitor at Kona Orchid Farm within the Keahole Agricultural Park. Nitrogen oxide levels were also monitored at the Kona Orchid Farm. The two monitoring locations are shown in Figure 1. In addition, power plant operations data were collected during the study period.

During July 1993, winds were predominantly from the southeast, south, and southwest. During August 1993, wind directions were more variable. Winds exhibited a definite diurnal pattern, with nighttime winds coming predominantly from the southeast, and daytime winds blowing mostly from the west or southwest. Winds at the Keahole Agricultural Park were very similar to those measured at the generating station.

To determine when and if plume impact occurred at the Keahole Agricultural Park, dispersion calculations were performed on emissions from the diesel generator units. A total of 3,264 15-minute periods in July and August were analyzed. Of these monitoring periods, only 23 periods (slightly less than 1 percent) were identified as having the required combination of wind direction, wind speed, and atmospheric stability that could potentially result in plume impact within the Keahole Agricultural Park. Power plant operations data showed that one or more diesel units were operating during all but one of these periods.

To determine if plume impact actually did occur during the potential plume impact periods, data from the nitrogen oxides monitor located in the Agricultural Park were reviewed for periods of elevated concentrations. Periods of elevated nitrogen oxides were assumed to reflect plume impact at the Agricultural Park. These periods were compared to those of the potential plume impact periods. Measured concentrations of nitrogen oxides were near zero throughout the 1-month monitoring program, except for a



LEGEND

- ■ Meteorological Monitoring Station
- ● Wind and Air Quality Monitoring Station

NOTE: Tax Map Key Number - Zone 7 Section 3 Plat 49

Source: State of Hawaii, Department of Taxation, 1992

FIGURE 1

AIR QUALITY MONITORING LOCATIONS

NORTH 0 500 FEET

CH2MHILL

few brief periods. Of the total of 3,264 15-minute averaging periods, only 66 averages (2 percent) were in the 10 to 100 parts per billion (ppb) range, and 7 (less than 1 percent) were greater than 100 ppb.

This comparison showed that more than half of the periods of elevated nitrogen oxide levels were predicted by dispersion calculations. Remaining periods of elevated measurements were either due to other emission sources or to light and variable wind conditions.

Based on the data collected, emissions from the existing power plant operations impacted the Keahole Agricultural Park approximately 2 percent of the time. These impact events ranged in duration from a few minutes to a few hours. Operations of these existing units are expected to be curtailed with the proposed unit addition.

The 1-month average nitrogen oxides concentration at the Agricultural Park was approximately 2 ppb; longer-term measurements would likely yield an annual average of less than 2 ppb. The national ambient air quality standard for nitrogen dioxide is 53 ppb. The state standard is 37 ppb. Both national and state standards pertain to annual averaging times (there are no shorter-term ambient air quality standards for nitrogen dioxide). Thus, nitrogen oxides concentrations attributable to the diesel generator units are well within ambient air quality standards.

Acid Aerosol Study

The acid aerosol study (Morrow) was designed to determine whether acid aerosols from existing operations may affect the Keahole Agricultural Park. Air samples were collected and analyzed for a variety of acid gases, such as sulfur dioxide, hydrogen chloride, and nitric acid, as well as fine particles, including sulfuric acid. Due to the diurnal onshore and offshore wind pattern in this area, day and night acid aerosol sampling periods were defined as 7:00 a.m. to 7:00 p.m., and 7:00 p.m. to 7:00 a.m. respectively. Twelve-hour samples were collected every other day from July 23 to August 22, 1993, except August 16, because of an approaching hurricane.

The acid aerosol study found that sulfur dioxide concentrations were low (mostly less than 5 micrograms per cubic meter [ug/m^3]) with occasional excursions into the 10 to 20 ug/m^3 range. These values were comparable to the sulfur dioxide data collected by the State Department of Health at Captain Cook (about 20 miles to the south). There was a statistically significant difference between the higher daytime and lower nighttime SO_2 levels. The higher daytime levels are most likely attributable to onshore (generally southwesterly) breezes bringing in vog-laden air. Winds were generally east-southeasterly at night.

Hydrogen chloride (HCl) levels were negligible on all dates but one. Although the mean nighttime level was greater than the daytime value, this difference was not statistically significant.

Nitric acid concentrations were also negligible most of the time, but a few excursions above 5 ug/m^3 occurred during the day and night.

Levels of sulfuric acid and its neutralization products were comparable to concentrations measured at Captain Cook. There was a statistically significant difference between the mean values for day and night, with the daytime value being greater than the nighttime value. This could be attributable to onshore breezes during the day, which transport vog into the area, and the presence of sunlight which accelerates oxidation of SO_2. The levels of acid aerosols measured in the study were also comparable to concentrations measured in volcanic air pollution studies at Captain Cook.

The studies found no indication of elevated levels of acid aerosols at the Keahole Agricultural Park which might be attributable to current power plant operations. Recent health effects research suggests that long-term exposure to acidity at these levels may result in increased rates of bronchitis in school-aged children, although there is no evidence of phytotoxic effects at the acidity levels measured.

Ethylene Study

Ethylene is a byproduct of fuel oil combustion. Low levels of ethylene are required by plants for normal development, although excessive levels can be phytotoxic. The ethylene study (Morrow) was designed to measure levels of ethylene at the Keahole Agricultural Park. Six 6-hour ethylene samples were collected from August 15 to 20, 1993. A background sample was collected at night (9:00 p.m. to 3:00 a.m.) on August 15. The remaining five samples were collected during the daytime (7:00 a.m. to 1:00 p.m.), when plume impaction was most probable based on the diurnal pattern of meteorological conditions.

A tracer gas study was also conducted. Sulfur hexafluoride (SF_6) is a non-toxic gas that does not occur in nature and is virtually absent from normal atmospheres. It can be detected at extremely low concentrations (in the parts per trillion range). These properties make it an ideal gas to use in tracer studies. It can be released from a source in question and sampling can be performed ta a given location to determine if emissions from the source affected the sampling location during or after the release.

A review of wind data for several weeks indicated that morning hours between about 7 a.m. and noon would be the most likely time of day for emissions from the Keahole Generating Station to impact the Keahole Agricultural Park. Tracer gas was released from one of the power plant stacks on August 18, 1993 from 7:00 a.m. until 1:00 p.m. and on August 19, 1993 from 7:00 a.m. until approximately 10:00 p.m. Intensive sampling was conducted during the period in which the tracer gas, sulfur hexafluoride (SF6), was released.

During the study, ethylene was found at levels consistent for the level of automobile and air traffic in the region. However, both wind data and SF6 tracer results indicated that

emissions from the facility were not reaching the Agricultural Park during the study. Therefore, it is not possible to determine from this study alone whether emissions from the existing generating units can affect concentrations of ethylene at the Agricultural Park. In light of the low risk of ethylene impacts from the unit addition (see Ecological Risk Assessment, below) and the infrequency of plume impact at the Agricultural Park, the study was not repeated.

Ecological Risk Assessment

Three ecological risk assessments (Risk Science Associates) were conducted to examine the risk of impacts from generating station emissions to crops grown in the adjacent Agricultural Park. A risk assessment does not determine whether an adverse effect will or will not occur. Rather, it describes the chances that adverse effects may occur.

Three conditions must exist simultaneously for an adverse effect to occur:

- A substance toxic to plants must be present.
- The substance must be present in sufficient quantity to affect plants.
- Plants must come into contact with a sufficient quantity of the substance.

If any of the three conditions do not exist, an adverse effect will not occur.

Ethylene

Ethylene is a naturally occurring and essential plant hormone which, in high concentrations, may be phytotoxic. Predicted maximum ground level concentrations of ethylene at the Keahole Agricultural Park range from 2 to 4 orders of magnitude (100 to 10,000 times) below the concentrations that have been shown to produce adverse effects in orchids. Because such small quantities of ethylene will be emitted from the proposed unit addition at Keahole, it is highly unlikely that exposures to ethylene emissions at the Keahole Agricultural Park will adversely affect the orchids grown there.

Sulfur and Nitrogen Oxides

Only two studies were identified that had direct bearing on orchids or flowers. Both studies had modelled no effect levels that ranged from about 100 to 700 times higher than predicted maximum ground level concentrations at the Keahole Agricultural Park. These studies indicate, it is highly unlikely that SO2 and NOx emissions from the project would adversely affect orchids grown in the Agricultural Park. There is some uncertainty associated with this conclusion, given the relative paucity of work on the potential effects of these compounds on orchids, in particular, and flowers in general.

Acid Precipitation

The potential risk to commercially grown plant species found near Keahole Generating Station is difficult to quantify because little is known about acid precipitation in the tropics. The severity of adverse effects to plants because of exposure to acid precipitation depends on a number of factors, such as pH, number and size of droplets, and plant sensitivity.

No data were found in the scientific literature that address the effects of acid precipitation on the plant species grown at the Keahole Agricultural Park. Based on the information available for other species, it appears that a risk of injury to flowers exists below pH 4. A risk to fruits, nuts, and leaves exists below pH 3. The pH of aerosol emissions from the proposed unit addition is not known, so it is not possible to determine from this study alone whether the plant species grown in the Agricultural Park may be at risk from these emissions. However, the acid aerosol study (Morrow) indicated that elevated acid aerosol levels in the Agricultural Park are not attributable to current plant emissions, and plume rise and dispersion calculations associated with PSD modeling (see below) indicate that emissions from the proposed project would have virtually no impact within the Keahole Agricultural Park. As a result, it may be concluded that adverse impacts from acid precipitation will not occur.

PSD Modeling

A PSD application was prepared in accordance with U. S. Environmental Protection Agency (EPA) guidelines and submitted to the Department of Health on January 13, 1993. The application addressed both emissions control and resulting impacts on air quality. EPA guideline models were used to assess dispersion of pollutants and resulting impacts on air quality. Because modeling must be used by environmental regulators to help make project decisions before actual operations can be observed, these models are conservative. "Conservative", when used in the context of impact assessment, means that worst-case conditions are assumed and are used to ensure that impacts are not under-estimated. For example, on Maui the post-construction monitoring station showed measured pollutant levels about four times less than those predicted by modeling.

As part of the modeling effort, predicted concentrations of pollutants from the proposed facility are added to measured background concentrations plus modeled impacts from existing sources. Plume rise and dispersion calculations for the proposed combustion turbine units at Keahole indicate that emissions would have virtually no impact within the Keahole Agricultural Park. Even when the occasional northerly winds transport emissions toward the Agricultural Park, plume rise should be sufficient to keep the plume aloft. The model results show that predicted air quality will remain well within the national and state ambient air quality standards for all modeled parameters, and confirm that the proposed unit addition will make a negligible contribution to pollutant concentrations in the Keahole Agricultural Park.

Conclusions

The studies and modeling efforts described above each provide useful information about potential air quality impact. They must be viewed together to understand the risks associated with air quality emissions from the proposed unit addition.

Existing Emissions

Emissions from existing diesel generating units are transported to the Keahole Agricultural Park under certain meteorological conditions. Based on the data collected, emissions from the power plant are transported to the Agricultural Park approximately 2 percent of the time. Monitoring shows that nitrogen oxide levels attributable to plant emissions are well within federal and state standards. Acid aerosol concentrations at the Agricultural Park are comparable to concentrations at Captain Cook, indicating that plant emissions do not add to the impact of the existing vog conditions.

Future Emissions

Construction of a unit addition at Keahole and the associated decrease in use of the diesel generating units is expected to result in a decrease in the level of emission impacts within the Keahole Agricultural Park. As use of the diesel units is decreased, plume impacts that result from their use will be reduced. Retirement of these units will eliminate emissions from these units. Thus, as the Keahole diesel generator units are retired in favor of combustion turbine units, air quality impacts from the power plant will lessen within the Keahole Agricultural Park. Diesel generator units at Keahole are scheduled for retirement in 1999 and 2000. Their use will likely be curtailed before these dates, following installation of the proposed unit.

Plume rise and dispersion calculations for the proposed combustion turbine units at Keahole indicate that emissions would have virtually no impact within the Keahole Agricultural Park. Even when the occasional northerly winds transport emissions toward the Agricultural Park, plume rise should keep the plume aloft.

Criteria Pollutants

The literature survey (Ogden) looked at potential impacts to vegetation associated with sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and particulate matter. That study concluded that the projected short- and long-term average levels projected by the PSD modeling will not result in levels at which acute and chronic effects have been observed to occur in plants.

The interactions of pollutants is complex and cannot be completely predicted. However, based on available literature; typical levels associated with negative effects on plants; wind direction and velocity; topography; and the low levels of projected concentrations;

there are no indications that the Agricultural Park will be adversely affected by the combined effects of emissions from the project.

The conservative assumptions incorporated into PSD modeling introduce an additional safety factor into these conclusions. The plume impact study (Neal) demonstrated that plume impacts at the Agricultural Park occur about 2 percent of the time. Diesel unit retirements will reduce existing plume impacts, and design changes associated with the unit addition will prevent future plume impacts.

Ethylene

Although the ethylene study (Morrow) was inconclusive, the ecological risk assessment of ethylene (Risk Science Associates) indicates that exposure to ethylene in emissions from the project is highly unlikely to have an adverse effect on orchids in the Agricultural Park. The conservative assumptions incorporated into PSD modeling introduce an additional safety factor into this conclusion. The plume impact study (Neal) indicates that plume impacts at the Agricultural Park occur about 2 percent of the time. Diesel unit retirements will reduce existing plume impacts, and design changes associated with the unit addition will prevent future plume impacts.

Acid Precipitation

Although the ecological risk assessment of acid precipitation (Risk Science Associates) was inconclusive, the acid aerosol study (Morrow) indicates that levels of acid aerosol measured in the Agricultural Park are comparable to concentrations about 20 miles south at Captain Cook. There was no indication of elevated levels attributable to current power plant operations. The plume impact study (Neal) indicates that plume impacts at the Agricultural Park occur about 2 percent of the time. Diesel unit retirements will reduce existing plume impacts, and design changes associated with the unit addition will prevent future plume impacts.

Attachment A
Letter from Odgen Environmental and Energy Services

ATTACHMENT A

OGDEN ENVIRONMENTAL AND ENERGY SERVICES

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930122/5171
March 31, 1993

Mr. William A. Bonnet
Manager, Environmental Department
Hawaiian Electric Company
PO Box 2750
Honolulu, HI 96840-0001

Subject: Response to Keahole Generating Station Draft EIS Comment Letters Regarding Agricultural Park

Dear Mr. Bonnet:

Enclosed for your review is the response to the Keahole Generating Station Draft EIS Comment Letters relating to the impact of the proposed project stack emissions on vegetation. The letters reviewed, expressed concern over possible effects of gaseous emissions from the expansion at the Keahole Generating Station on the Keahole Agricultural Park. In summary, based upon a search of available literature, the Keahole expansion should have no significant adverse effects on vegetation at the Keahole Agricultural Park.

The results of a literature search for the criteria pollutants sulfur dioxide (SO_2), carbon monoxide (CO), ozone, nitrogen dioxide (NO_2) and particulate matter (PM) are presented below:

Sulfur Dioxide (SO_2)

At high SO_2 concentrations, obvious visible injury to plants can occur. At low concentrations, physiological and biochemical changes can be induced, such as alteration of intracellular ionic balance and pH (Kropff, 1991). It is thought that some damage occurs due to increased formation of oxygen free radicals (Rao and Dubey, 1990). These radicals can oxidize proteins, lipids and damage DNA. Antioxidants, such as superoxide dismutase and peroxidase, are involved in scavenging the toxic radicals. Changes in abundances of proteins and antioxidant enzymes in plant tissue are believed to be useful for detecting unseen physiological responses to pollution.

Rao and Dubey (1990) conducted a year-long study of the effects of gaseous pollutants on mango. They found an average annual SO_2 level of 48.4 $\mu g/m^3$ was attained before there were significant changes in content of sulphate and protein in foliage, or superoxide dismutase and peroxidase activities. The maximum predicted annual SO_2 levels at the agricultural park are about one fifth that considered as background level of 10.4 $\mu g/m^3$ in the Rao and Dubey study (1990), and 9.0 $\mu g/m^3$ in another study (Kropff, 1991).

A four year study of the effects of gaseous emissions on fruit production by orange trees examined the size of fruit, number of fruit per tree, tree growth and fruit quality (eg. color, total soluble solids and titratable acidity; Olszyk et al., 1990). It was concluded that SO_2 concentrations (annual average of 0.09 ppm or approximately 236 $\mu g/m^3$) had only "marginally significant" effects (Olszyk et al., 1990). These marginal concentrations were approximately 118 times higher than the anticipated maximum annual average SO_2 concentration.

Short term effects of SO_2 on plants were studied by Setterstrom and Zimmerman (1939), using two species (buckwheat and alfalfa) known for their sensitivity to SO_2 injury. There were no adverse effects at 0.87 ppm SO_2 (approximately 2200 $\mu g/m^3$), the lowest levels used in the study. In contrast, the maximum predicted SO_2 level from the Keahole expansion plus background is approximately 213 $\mu g/m^3$ (this is for a three hour sample – the longer averaging periods have values that are considerably lower). Therefore, the maximum projected levels are at least one order of magnitude lower than the lowest level detected to have even marginally adverse effects. While buckwheat and alfalfa are not grown at the Keahole Agricultural Park, they are relevant because of their sensitivity to SO_2 injury.

Zimmerman and Hitchcock (1956) found none to moderate leaf marking in fruit and flower crop species (cherry, apricot, prune, apple, tulip, iris, rose) when exposed four to eight hours to 0.5 ppm SO_2 (approximately 1300 $\mu g/m^3$). Some other species were more affected. Examination of relative susceptibility to 0.1 - 1.0 ppm SO_2 (approximately 260 - 2600 $\mu g/m^3$) of 28 species (including plum, plantain, azalea, hibiscus and lily) showed some degree of susceptibility to SO_2. The lowest level used (approximately 260 $\mu g/m^3$) over a four to eight hour exposure, was higher than the highest projected level, which is for a three hour period.

It seems apparent, based upon the literature and projected maximum emission levels, that the plants at the agricultural park would experience no significant impact from chronic SO_2 emissions. This conclusion indicates that no significant adverse economic impacts attributable to SO_2 emissions are expected at the Keahole Agricultural Park.

Carbon Monoxide (CO)

At high concentrations, CO as been shown to induce epinastic or hyponastic growth of leaves, aging of leaves, and abscission of leaves, flowers and fruits (Zimmerman et al., 1933).

Zimmerman et al. (1933) found no adverse effects on 108 plant species, including Bougainvillea, at CO levels of 0.01% (over 100,000 $\mu g/m^3$). In contrast, the maximum projected CO level in the agricultural park is 2838 $\mu g/m^3$ (this is for a one hour sample – the longer sampling periods have values that are substantially lower). Therefore, the maximum projected levels are several orders of magnitude lower than the lowest level of CO determined to have adverse effects.

Ormrod (1978) reports a general lack of data on the effects of CO on horticultural plants, but that injury due to CO is not likely at average urban concentrations. Because CO concentrations are lower in rural areas than urban, and Keahole is classified as rural, plant injury due to CO exposure is not expected to occur.

Ozone

Ozone has been cited as inducing injury in plants, including modification of leaf conductance, alteration of cell membrane permeability, inhibition of photosynthesis (Tingey and Taylor, 1982; Chappelka and Chevone, 1992), growth and development of leaves and yield (Jacobson, 1982).

In a four year study of the effects of gaseous emissions on fruit production by orange trees, it was concluded that ozone concentrations (annual averages between 0.040 and 0.075 ppm or approximately 79 to 147 $\mu g/m^3$) had only "marginally significant" effects (Olszyk et al., 1990). Based on monitoring data collected from Puna, the maximum annual average concentration of ozone is expected to be less than these

levels. This study examined fruit production, size of fruit, number of fruit per tree, tree growth and fruit quality (eg. color, total soluble solids and titratable acidity).

In seven-hour exposures to ozone, Heagle et al. (1979) found some foliar damage and reduced shoot weight in spinach at ozone concentrations between 0.06 and 0.13 ppm (approximately 118 to 225 $\mu g/m^3$). The maximum anticipated annual and hourly ozone concentrations are significantly lower, 35 and 94 $\mu g/m^3$, respectively.

Tingey and Taylor (1982) cite data that exposure to 0.1 ppm ozone (approximately 197 $\mu g/m^3$) produced only a very slight effect on photosynthesis after one hour exposure. Lefohn (1992), after reviewing a number of ozone studies, presents 147 $\mu g/m^3$ as the recommended 1-hr maximum concentration for sensitive vegetation. Recommended maximums for vegetation with intermediate and lower sensitivities were more than two and three times higher than for sensitive species, respectively (Lefohn, 1992). The highest projected hourly ozone levels in the agricultural park is significantly below this level. Therefore, it does not seem likely that the projected ozone concentration would have any significant effect on plants in the agricultural park.

Nitrogen Dioxide (NO_2)

Nitrogen oxides have been found to cause visible leaf injury at high concentrations, reduce growth at lower concentrations over longer periods (Ormrod, D. P., 1978) and reduce photosynthesis (Malhotra and Khan, 1984).

A one year study on mango (Rao and Dubey, 1990) concluded that an annual NO_2 level of 12.4 $\mu g/m^3$ could be tolerated before significant changes in foliage or photosynthetic enzymes were found. This is almost five times the projected maximum annual NO_2 level.

Ormrod (1978) reports that NO_2 concentrations between 0.1 - 0.4 ppm were considered below the threshold of injury from NO_2. Malhotra and Khan (1984) report reduction in several photosynthetic enzymes from birch and alder at NO_2 concentrations of 0.2 ppm (approximately 376 $\mu g/m^3$). The highest projected levels for these compounds are at least two orders of magnitude lower than this. Therefore, there should be little chance of injury from projected NO_2 emissions.

Particulates (PM)

Concerns about particulate matter include leaf damage, occlusion of stomata, reduction of CO_2 uptake and attenuation of incident sunlight (Lerman and Darley, 1975; Ricks and Williams, 1974; Lodge et al., 1981).

Blockage of sunlight to the plant by particulates would occur in extreme situations, "correspond[ing] to a rather excessive level of dustfall" (Lodge et al., 1981), which is clearly not the case here. Other effects could occur at lower levels. However, in comparison with other pollutants, relatively few studies have been conducted to assess the role of particulate air pollution on vegetation (Lerman and Darley, 1975; Lodge et al., 1981). In general, except for fluorine, a rather toxic substance to plants (and not a component of existing or proposed emissions), the concentrations of particulates required to cause damage are several orders of magnitude greater than the proposed maximum particulate emissions (Lerman and Darley, 1975).

In their long-term study of pollutants on mango, Rao and Dubey (1990) found that the annual particulate concentration needed to be at least 242.5 $\mu g/m^3$ before there were significant changes in stomatal conductances. This is at least 15 times higher than the maximum projected annual average.

Some pollutants can act together to cause plant injury at concentrations lower than those needed with only a single pollutant (Reinert et al, 1975). In this way, the chemical entities are said to act in an additive or synergistic manner. Data regarding combinatory effects of gaseous pollutants indicate that the concentrations needed to induce damage in a variety of species, including flowers, ornamentals and citrus fruit, are below the expected concentration levels (Ormrod, 1978; Taylor et al., 1975; Reinert et al, 1975).

The interactions of the various pollutants of concern can be almost infinitely complex, given the number of compounds, varying concentration levels, exposure durations and range of sensitivities of different plant species. It is therefore not possible to guarantee that certain responses will or will not occur in relation to a proposed project. However, based on a review of the literature available at this time, the typical levels needed for negative effects on plants, and the low levels of projected concentrations, it appears that the agricultural park will not be adversely affected by emissions from the proposed HELCO expansion.

If you have any further questions, please call.

Sincerely,

Helen Mary Wessel
Manager, Air Quality

HMW/sw

Enclosures: Attachment 1 - References

cc: Al Lyman CH2M Hill

ATTACHMENT I
Reference

Chappelka, Arthur H. and Boris I. Chevone. 1992. Tree responses to ozone. In: Surface Level Ozone Exposures and Their Effects on Vegetation. Allen S. Lefohn, editor. Chelsea. Lewis Publishers, Inc.

Heagle , A. S., R. B. Philbeck, and M. B. Letchworth. 1979. Injury and yield responses of spinach cultivars to chronic doses of ozone in open-top field chambers. Journal of Environmental Quality. 8(3):368-373.

Jacobson, Jay S. 1982. Ozone and the growth and productivity of agricultural crops. In: Effects of gaseous air pollution in agriculture and horticulture. M. H. Unsworth and D. P. Ormrod, editors. London. Butterworth Scientific.

Kropff, M. J. 1991. Long-term effects of SO_2 on plants, SO_2 metabolism and regulation of intracellular pH. Plant and Soil. 131: 235-245.

Lefohn, Allen S. 1992. Ozone standards and their relevance for protecting vegetation. In: Surface Level Ozone Exposures and Their Effects on Vegetation. Allen S. Lefohn, editor. Chelsea. Lewis Publishers, Inc.

Lerman, Shimshon, L. and Ellis F. Darley. 1975. Particulates. In: Responses of Plants to Air Pollution. J. Brian Mudd and T. T. Kozlowski, editors. New York. Academic Press.

Lodge, James P., Jr., Alan P. Waggoner, Donald T. Klodt, and Clark N. Crain. 1981. Non-health effects of airborne particulate matter. Atmospheric Environment. 15:431-482.

Malhotra, S. S. and A. A. Khan. 1984. Biochemical and physiological impact of major pollutants. In: Air pollution and plant life. Michael Treshow, editor. New York. John Wiley & Sons.

Olszyk, D. M., G. Kats, C. L. Morrison, P. J. Dawson, I. Gocka, J. Wolf, and C. R. Thompson. 1990. 'Valencia' orange fruit yield with ambient oxidant or sulfur dioxide exposures. Journal of the American Society for Horticultural Science. 115(6):878-883.

Ormrod, D. P. 1978. Pollution in horticulture. New York. Elsevier Scientific.

Rao, M. V. and P. S. Dubey. 1990. Explanations for the differential response of certain tropical tree species to SO_2, under field conditions. Water, Air, and Soil Pollution. 51:297-305.

Reinert, R. A., A. S. Heagle, and W. W. Heck. 1975. Plant responses to pollutant combinations. In: Responses of Plants to Air Pollution. J. Brian Mudd and T. T. Kozlowski, editors. New York. Academic Press.

Ricks, G. C. and R. J. H. Williams. 1974. Effects of atmospheric pollution on deciduous woodland Part 2: Effects of particulate matter upon stomatal diffusion resistance in leaves of Quercus petraea (Mattuschka) Leibl. Environmental Pollution. 6:87-109.

Setterstrom, C. and P. W. Zimmerman. 1939. Factors influencing susceptibility of plants to sulfur dioxide injury. I. Contributions From Boyce Thompson Institute. 10:155-180.

Taylor, O. C., C. R. Thompson, D. T. Tingey, and R. A. Reinert. 1975. Oxides of nitrogen. In: Responses of Plants to Air Pollution. J. Brian Mudd and T. T. Kozlowski, editors. New York. Academic Press.

ATTACHMENT I (continued)
Reference

Tingey, David T., and George E. Taylor, Jr. 1982. Variation in plant response to ozone: a conceptual model of physiological events. In: Effects of gaseous air pollution in agriculture and horticulture. M. H. Unsworth and D. P. Ormrod, editors. London. Butterworth Scientific.

Zimmerman, P. W. and A. E. Hitchcock. 1956. Susceptibility of plants to hydrofluoric acid and sulfur dioxide gases. Contributions From Boyce Thompson Institute. 18:263-279.

Zimmerman, P. W., William Crocker and A. E. Hitchcock. 1933. The effect of carbon monoxide on plants. Contributions From Boyce Thompson Institute. 5:195-211.

Attachment B
Plume Impact Study at Keahole Agricultural Park

ATTACHMENT B

PLUME IMPACT STUDY AT

KEAHOLE AGRICULTURAL PARK

KEAHOLE, HAWAII

Prepared for:

Hawaiian Electric Company, Inc.

September 1993

B. D. NEAL & ASSOCIATES

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TABLES (cont.)

Table

3 Daytime/Nighttime Vector Winds at Keahole Agricultural Park, July 21 - August 22, 1993

APPENDICES

Appendix

A Monthly Summaries of Hourly Average Temperature, Wind Speed and Wind Direction for July and August 1993, Keahole Tower, 10-m Level

B Hourly Averages of Wind Speed and Direction for July 20 through August 22, 1993, Keahole Agricultural Park

C Time Series Plots of Wind and Nitrogen Oxides Data for Keahole Agricultural Park, July 20 through August 22, 1993

D Plant Operations Data for Keahole Generating Station, July 20 through August 21, 1993

1.0 INTRODUCTION

Hawaii Electric Light Company (HELCO) is proposing to expand its Keahole Generating Station by adding a 56-megawatt (MW), dual-train, combined-cycle, combustion turbine (CT) generator to the existing facilities. The project would be completed in three phases with Phase 1 adding a 20-MW simple-cycle CT in 1994, Phase 2 adding a second 20-MW simple-cycle CT in 1996, and Phase 3 providing an additional 16-MW of capacity in 1997 through the conversion of the two simple-cycle units into a dual-train, combined-cycle unit. Existing facilities at Keahole Generating Station include six 2.75-MW diesel generating units and one 13.75-MW simple-cycle CT.

As required by state law, HELCO prepared an Environmental Impact Statement (EIS) in December 1992 detailing the expected environmental impacts from the proposed expansion. Mitigation measures and project alternatives were also discussed in the EIS. During public review of the document, a question was raised by Mr. Clarence Ono concerning potential air pollution impacts from the existing facility on his orchid farm located within the adjacent Keahole Agricultural Park. Mr. Ono's Kona Orchid Farm is located approximately 1000 feet (300 meters) almost directly south of Keahole Power Plant. Mr. Ono had questions concerning potential impacts from existing emissions from the power plant and expressed concern that expanding the generating station further might adversely effect orchid production at his farm as well as at other orchid farms located within the Keahole Agricultural Park. In an effort to be responsive to Mr. Ono's concerns, HELCO sponsored the design and implementation of a study to evaluate air pollution impacts from the existing generating units at Keahole Agricultural Park. Due to time constraints, the study was relatively short-term in nature but designed to indicate whether a more long-term study

might be warranted. Data collection began during mid-July 1993 and was concluded near the end of August 1993.

Several consultants were involved in various aspects of the study. This report describes only the portions of the study concerned with the collection of continuous meteorological and nitrogen oxides data, the release of tracer gas from the generating units, and the projection of incidents of potential plume impact at the Keahole Agricultural Park based on atmospheric dispersion calculations. Other consultant reports address various other aspects of the study.

2.0 DATA COLLECTION PROGRAM

2.1 Meteorological Measurements

Air pollution emissions from Keahole Power Plant are transported and dispersed by the local winds in the Keahole area. Wind and other meteorological data were collected at two sites during the course of the study. One site was a 32-meter meteorological tower located at Keahole Generating Station, and the other was a wind monitor located at Kona Orchid Farm within the Keahole Agricultural Park. The 32-meter meteorological tower located at Keahole Generating Station is associated with an ongoing data collection program for the proposed power plant expansion project. Instruments are mounted on a guyed 32-m metal tower equipped with instrument elevators. The following primary meteorological parameters are measured at the site:

- Horizontal wind speed
- Horizontal wind direction
- Vertical wind speed

- Temperature
- Solar radiation

All parameters are measured at 10-m and 32-m levels on the tower except for solar radiation measurements which are made at 3 m only. Temperature is also measured at the 2-m level. Other data, such as horizontal wind direction standard deviation (sigma-theta), vertical wind speed standard deviation (sigma-w) and vertical temperature difference (delta-T), are derived from the primary measurements. Instantaneous data from the instruments are input to a micro data logger that averages the data over 15-minute periods. The recorded 15-minute averages are then transmitted periodically to Hawaiian Electric Company's (HECO's) Environmental Department in Honolulu via telephone.

As indicated above, wind and temperature instruments are mounted at two levels on the tower (10 m and 32 m) and are identical at each level. Horizontal wind speed and direction are measured by means of Met-One Model 010B/020B cup-and-vane wind systems. Vertical wind speed is measured using an R.M. Young Model 27106 anemometer equipped with a 22-cm expanded polystyrene propeller. Temperature is monitored at each of the two levels and at 2 m with a Met-One Model 076B aspirated shield fitted with a linearized thermistor network. Solar radiation is measured by an Eppley Black & White pyranometer (at the 3-m level only).

To provide additional meteorological data for the study, a wind monitoring system was temporarily installed at the Kona Orchid Farm within Keahole Agricultural Park during mid-July 1993. A Climatronics Model F460 cup-and-vane wind system was mounted on a mast at approximately 6 meters above ground near the center of the orchid farm. This placed the sensors approximately 1 meter above the shade cloth used to cover the orchid field. Instantaneous data

from the wind sensors were input to a micro data logger that averaged the data over 15-minute periods. The recorded 15-minute averages were then transmitted periodically to HECO's Environmental Department in Honolulu via telephone.

2.2 Nitrogen Oxides Monitoring

Air pollution emissions from Keahole Power Plant consist primarily of nitrogen oxides and sulfur dioxide. As part of the effort to determine whether or not emissions from the plant could be impacting the Keahole Agricultural Park, a Monitor Labs Model 8410 nitrogen oxides monitor was installed at Mr. Ono's Kona Orchid Farm on July 20, 1993 and was operated until August 23, 1993. The monitor was installed near the center of the orchid farm in a small area that was semi-enclosed with corrugated roofing and tarpaulins. Air samples were drawn from above the shade cloth via a teflon tube. Data from the nitrogen oxides monitor were continuously recorded by a strip chart recorder. A dilution calibration system was also provided to periodically verify monitor performance and accuracy. Calibration gases of known concentrations were introduced to the monitor via the calibration system at the time of installation and every few days thereafter; output concentrations were then noted and checked against the input concentration values.

2.3 SF6 Tracer Gas Release

An intensive sampling period was conducted during the study period during which sulfur hexafluoride (SF6) gas was released. SF6 is a non-toxic gas that does not occur in nature and is virtually absent from normal atmospheres. In addition, it can be detected at extremely low concentrations (in the parts per trillion range). These properties make it an ideal gas to use in tracer studies. It can be released from a source in question and sampling can be

performed at a given location to determine if emissions from the source affected the sampling location during or after the release.

SF6 tracer gas releases occurred on August 18, 1993 from 7 am until 1 pm and on August 19, 1993 from 7 am until approximately 10 pm. A review of wind data for the previous several weeks indicated that the morning hours between about 7 am and noon would be the most likely time of day when emissions from Keahole Power Plant could impact the agricultural park area. SF6 tracer gas was injected into the stack of an operating diesel generator unit at a rate of approximately 1.7 pounds per hour. Sampling for the tracer gas at the Keahole Agricultural Park was performed during the release periods by J.W. Morrow. SF6 sampling procedures and results are provided in the J.W. Morrow report for this project.

2.4 Power Plant Operations

Power plant operations data were collected by computer and by plant personnel during the study period. Hours of operation of each diesel unit were recorded for each day during the period from July 20 through August 21, 1993.

3.0 DATA SUMMARIES

3.1 Meteorological Data

Monthly summaries of hourly average temperature, wind speed and wind direction for July and August 1993 for the 10-meter level of the meteorological tower located at Keahole Power Plant are included as Appendix A of this report. Wind direction standard deviation (sigma theta) data are also included in this appendix.

Sigma theta is a measure of atmospheric stability which is related to the plume dispersion pattern for a given source.

Tables 1 and 2 are wind frequency summaries for July 1993 and August 1-22, 1993, respectively, for the 10-m level of the Keahole meteorological tower. These are based on the hourly wind speed and direction data included in Appendix A. Graphical summaries of these data are given in the wind roses presented as Figures 1 and 2. Note that wind speeds are indicated in units of meters per second and wind directions represent the directions the winds were blowing from. A review of these tables and figures will show that during July 1993 wind directions predominantly had a south component with wind speeds mostly in the 2 to 5 meter per second range; winds from the north were relatively infrequent. During August 1993, wind directions became more variable and wind speeds were lighter. The hourly data given in Appendix A show that winds exhibited a definite diurnal pattern with nighttime winds coming predominantly from the southeast and daytime winds blowing mostly from the west or southwest. Temperatures were relatively constant throughout the 2-month period varying mostly between about 20 and 30 degrees C (68 and 86 degrees F).

Hourly averages of wind speed and direction as measured by the wind monitor located at Keahole Agricultural Park are given in Appendix B for the period July 20 through August 22, 1993. Table 3 is a summary based on the hourly data showing daytime/nighttime vector-averaged winds. Winds at the Keahole Agricultural Park were very similar to those measured at Keahole Generating Station. Winds were predominantly from either the southeast or southwest with a strong diurnal pattern.

3.2 Nitrogen Oxides Data

Data from the nitrogen oxides monitor located at the Keahole Agricultural Park are displayed graphically in Appendix C along with wind speed and direction data from the collocated wind monitor. The data given in this appendix are based on 15-minute averages of the measured 1-second samples. Given in Figure 3 is a frequency distribution of 15-minute averages for the study period (July 20 through August 22, 1993). Measured concentrations of nitrogen oxides were near zero throughout the one-month monitoring program except for a few brief periods. Out of the total of 3264 15-minute averaging periods during the study, 2931 averages were less than 10 parts per billion (ppb), 66 were in the 10 to 100 ppb range and 7 were greater than 100 ppb. Valid data were available 92 percent of the time. The highest 15-minute average concentration measured was 250 ppb while the average for the entire study period was 2 ppb.

3.3 Power Plant Operations

Power plant operations data for the period of interest are included in Appendix D. As indicated in this appendix, the diesel generator units at Keahole were operated primarily during the daytime and evening hours. Typically, all six units do not operate simultaneously. However, during the intensive sampling period of August 16-21 an attempt was made to operate all units simultaneously during the hours from approximately 7 am until 1 pm.

4.0 DATA ANALYSIS

The data analysis described in this report will focus primarily on the meteorological and nitrogen oxides data collected during the study period. As noted previously, the Keahole Agricultural Park

is located almost directly south of Keahole Generating Station. Thus, winds from the north can be expected to transport emissions from the plant toward the agricultural park. Considering the variability of the wind direction and the unavoidable small errors of a few degrees in the measurement of the wind direction, mean winds between 340 and 20 degrees could potentially result in plume impact at the agricultural park. In addition to wind direction, wind speed and atmospheric stability are important factors in determining whether or not emissions from the plant could impact the agricultural park area. Wind speed affects both plume rise and initial plume dilution at the source, and atmospheric stability affects the spread of the plume in both the vertical and the horizontal.

In an effort to determine when and if plume impact occurred at the agricultural park, dispersion calculations were performed on the emissions from the diesel generator units. Wind data from the 10-meter level of the Keahole meteorological tower were used to define plume transport and dispersion conditions. A total of 3264 15-minute periods during the July 20 through August 22, 1993 study period were analyzed. Out of the more than 3000 15-minute periods analyzed, only 23 periods were identified as having the required combination of wind direction, wind speed and atmospheric stability that could potentially cause plume impact within the agricultural park area. These periods were as follows:

Date	Period
7-24	0800, 1000, 1130
8-1	0830
8-2	0845
8-5	0815
8-6	0800
8-9	1215 - 1400
8-13	0915 - 0930

8-15	0845 - 0900
8-15	1445
8-17	1045
8-17	1400 - 1700

Power plant operations data show that one or more diesel units were operating during all of these periods except for August 1 at 0830.

In an effort to determine if plume impact actually did occur during the potential plume impact periods, data from the nitrogen oxides monitor located at the agricultural park were reviewed for periods of elevated concentrations and compared to the predicted plume impact periods. During the study, there were only a few relatively brief periods when the 15-minute average nitrogen oxides concentrations were above 10 ppb. These were as follows:

Date	Period
7-22	1515 - 2015
7-24	0900 - 1100
7-24	2030 - 2045
7-31	0815 - 0930
8-5	0800
8-9	1145 - 1345
8-13	0915
8-15	1345 - 1400
8-15	1900 - 1915
8-17	1345 - 1800
8-20	0745
8-20	2215 - 2245
8-21	0815

During the first period, July 22, 1515-2015, winds were from the north at moderate speeds. Measured nitrogen oxides concentrations reached a maximum of 250 ppb over a 15-minute averaging period.

Power plant operations data show that four diesel units were operational during this time. Dispersion calculations for this period indicated that the plume would remain aloft over the agricultural park and thus would not impact the area. It was noted in the site log, however, that well drilling equipment located adjacent to the power plant was operating during this period. This was the likely source of the measured nitrogen oxides concentrations measured on July 22, 1993.

The elevated nitrogen oxides concentrations measured on July 24 between 0900 and 1100 correspond with a predicted period of potential plume impact. Power plant data indicate that two of the six diesel units were operating during this time. Hence, emissions from the power plant were the likely source. The highest 15-minute average concentration measured during this time was 100 ppb.

Another brief period of slightly upscale nitrogen oxides concentrations was recorded later in the day on July 24 between 2000 and 2100 hours. Fifteen-minute average concentrations of 20 ppb and 25 ppb were measured at 2030 and at 2045, respectively. Three diesel units were operating at this time. Based on the coincident meteorological data, plume impact was not predicted. However, winds were light and variable during this period, and plume meandering (not accounted for in dispersion calculations) probably caused emissions from the power plant to slightly affect the area.

On July 31 between 0815 and 0930, 15-minute average nitrogen oxides concentrations varied between about 5 and 45 ppb. Winds were from the north periodically during this time, although dispersion calculations did not predict plume impact (i.e., the plume was estimated to remain aloft over the agricultural park area). Four diesel units were operating during this time.

Plume dispersion calculations predicted brief periods of potential plume impact between 0800 and 0900 hours on August 1, 2, 5 and 6. On August 1 at this time, no diesel units were operating and nitrogen oxides data do not show any elevated readings. On August 2, very slightly elevated concentrations were recorded but all were less than 10 ppb over a 15-minute average; either two or three diesel units were operational. On August 5, one 15-minute average of 20 ppb was measured at 0800; two diesel units were operational at this time. No elevated nitrogen oxides concentrations were measured on August 6 even though five diesel units were operating between 0800 and 0900 hours.

On August 9 between approximately 1200 and 1400 both plume dispersion calculations and nitrogen oxides data indicate plume impact at the agricultural park area. The highest 15-minute average concentration measured during this time was 25 ppb. Power plant data indicate that diesel units D-20 and D-21 were operating at this time.

On August 13 between 0900 and 0930 both plume dispersion calculations and nitrogen oxides data indicate plume impact at the agricultural park. The highest 15-minute average concentration measured during this period was 15 ppb. Three diesel units were operational.

On August 15 a brief period of potential plume impact between 0845 and 0900 was identified based on plume dispersion calculations, but no elevated nitrogen oxides concentrations were recorded. Two diesel units were operational. Plume dispersion calculations indicate another short period of impact at 1445. Nitrogen oxides measurements do not reflect impact at this time; however, 15-minute

averages of 20 and 30 ppb were recorded the previous hour. Three diesel units were operational. Wind direction conditions were variable, and hence it is likely the slightly elevated concentrations were due to power plant emissions during varying wind conditions.

Nitrogen oxides data indicate another brief period of slightly elevated concentrations on August 15 between 1900 and 1915, although plume dispersion calculations did not identify this as a period of plume impact. Fifteen-minute average concentrations of 15 and 20 ppb were measured. Power plant data show that five diesel units were operational. Winds during this time were from the southwest or west. Thus, it is likely that emissions from some other source impacted the area at this time.

Plume impact is indicated by dispersion calculations on August 17 at 1045 and again between 1400 and 1700. Nitrogen oxides data are not available for the 1045 period; data for the 1400 through 1700 period show elevated concentrations with 15-minute averages ranging between about 20 and 50 ppb. Four diesel units were operating during most of this time.

Brief periods of slightly elevated nitrogen oxides concentrations occurred on August 20 at 0745 and again between 2215 and 2245. Six units were operating during the morning period and five units were operating during the evening hours. Although plume dispersion calculations did not identify these times as periods of plume impact, winds were light and variable, and thus it is likely the power plant was the source of emissions.

The nitrogen oxides data show one brief 15-minute period at 0815 on August 21 when the measured concentration increased to 60 ppb. All six diesel units were operating. Plume impact was not predicted based on dispersion calculations, but wind conditions were again light and variable, suggesting the likelihood that the emissions probably originated at the power plant.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Winds at the Keahole Generating Station and the Keahole Agricultural Park are very similar. A mean wind direction difference of only 2 degrees was measured between the locations. Some or all of this is probably accounted for by instrumental error or by wind meandering during light wind conditions.

Dispersion calculations were reasonably accurate in predicting periods of plume impact at the agricultural park. More than half of the incidents of elevated concentrations measured by the nitrogen oxides monitor were predicted by dispersion calculations. Periods of elevated concentrations not identified as plume impact periods by dispersion calculations were either due to other emission sources or to light and variable wind conditions (which cannot be accurately represented in the dispersion estimates).

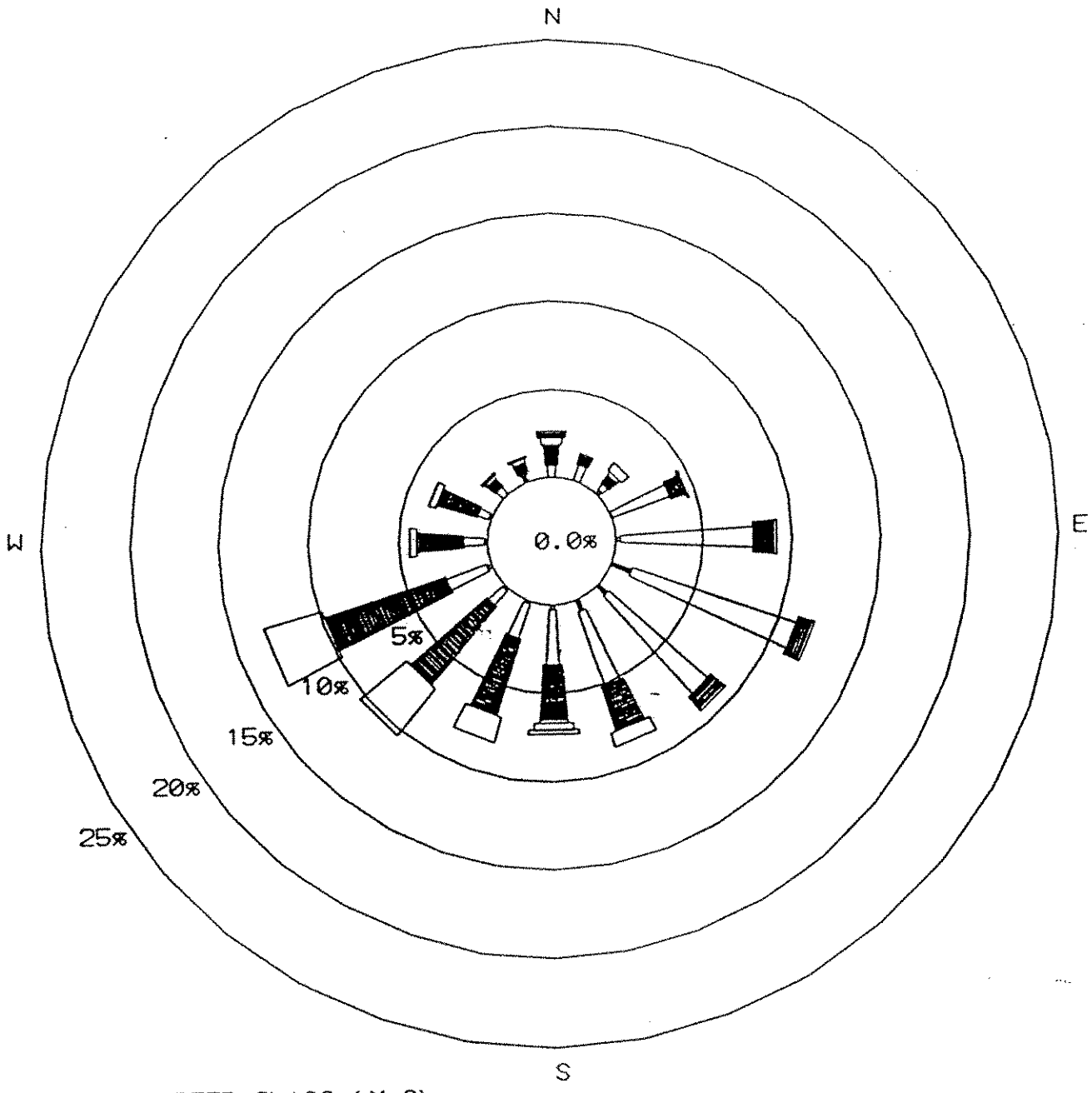
Based on the meteorological and nitrogen oxides data collected during the study and on atmospheric dispersion calculations, it appears that emissions from the Keahole diesel generator units may affect ground-level concentrations within the Keahole Agricultural Park area on an occasional basis for brief periods of a few minutes to a few hours. Based on the data collected during the study period, emissions from the power plant impact the agricultural park

area less than 1 percent of the time. A review of long-term wind data for the area suggests a similar long-term (annual) frequency.

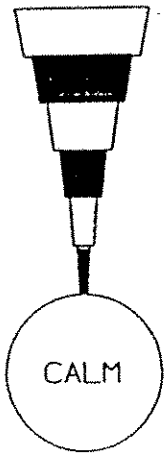
While elevated nitrogen oxides concentrations for short periods apparently do occur on occasion, long-term concentrations are relatively low. The relative significance of the measured concentrations can be ascertained by comparison with the state and national ambient air quality standards. The national ambient air quality standard for nitrogen dioxide is 53 ppb while the state standard is 37 ppb; both national and state standards pertain to annual averaging times. (There are no shorter-term ambient air quality standards for nitrogen oxides.) The one-month average nitrogen oxides concentration at the Keahole Agricultural Park was approximately 2 ppb; longer term measurements would likely yield an annual average of less than 2 ppb. Thus, nitrogen oxides concentrations attributable to the diesel generator units are likely well within ambient air quality standards.

Plume rise and dispersion calculations for both the existing and the proposed combustion turbine units at Keahole indicate that emissions would have virtually no impact within the Keahole Agricultural Park. Even when the occasional northerly winds transport emissions toward the agricultural park, plume rise should be sufficient to keep the plume aloft. Thus, as the Keahole diesel generator units are retired in favor of combustion turbine units, any potential air quality impacts within the agricultural park area should lessen. Diesel generator units at Keahole are scheduled for retirement during 1999 and 2000, although it is expected that their use will be curtailed before this after the installation of additional combustion turbine units.

Any air quality impacts at Keahole Agricultural Park attributable to Keahole Power Plant should remain at existing levels until the diesel generator units either are retired or their hours of operation are reduced. The addition of combustion turbine units at the plant will reduce the need for operating the diesel generator units. Hence, if the existing relatively low levels of air pollution can be tolerated by the orchid growing operations, the addition of combustion turbine units at the generating station should be no cause for concern and should in fact reduce any impacts within the agricultural park area. Based on the data collected to date and in view of the plans to retire the diesel generating units in the next 5 to 6 years, further study of this problem is probably unwarranted.



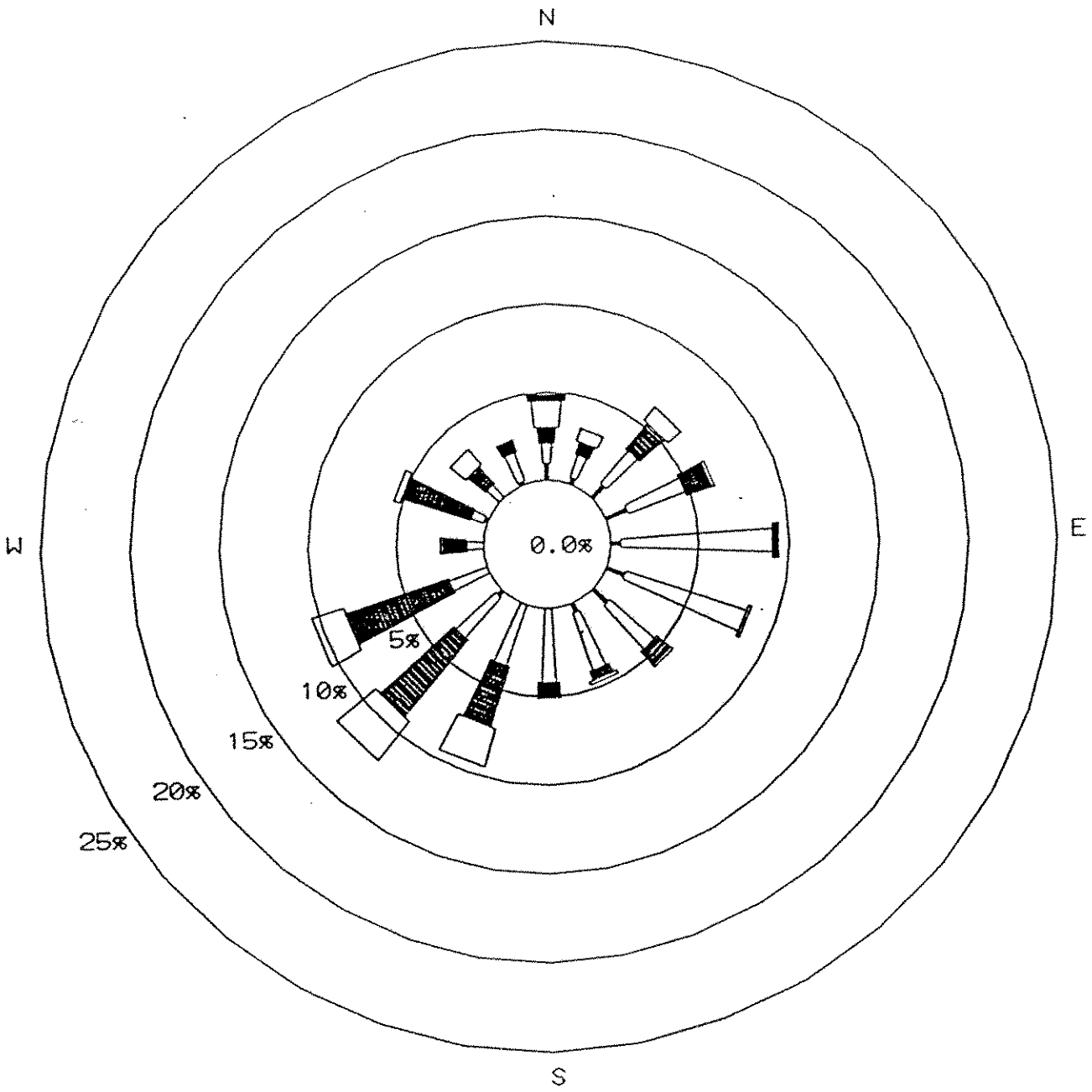
WIND SPEED CLASS (M/S):



11.0 - 99.0
8.5 - 11.0
5.4 - 8.5
3.6 - 5.4
1.8 - 3.6
0.5 - 1.8

WIND ROSE
KEAHOLE MET. TOWER, 10-M LEVEL
JULY 93

Figure 1



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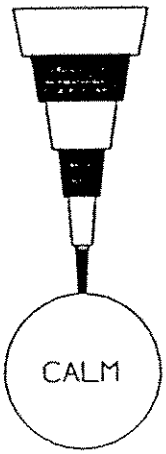


11.0 - 99.0
8.5 - 11.0
5.4 - 8.5
3.6 - 5.4
1.8 - 3.6
0.5 - 1.8

WIND ROSE
KEAHOLE MET. TOWER, 10-M LEVEL
AUG 1-22, 93

Figure 2

Figure 3

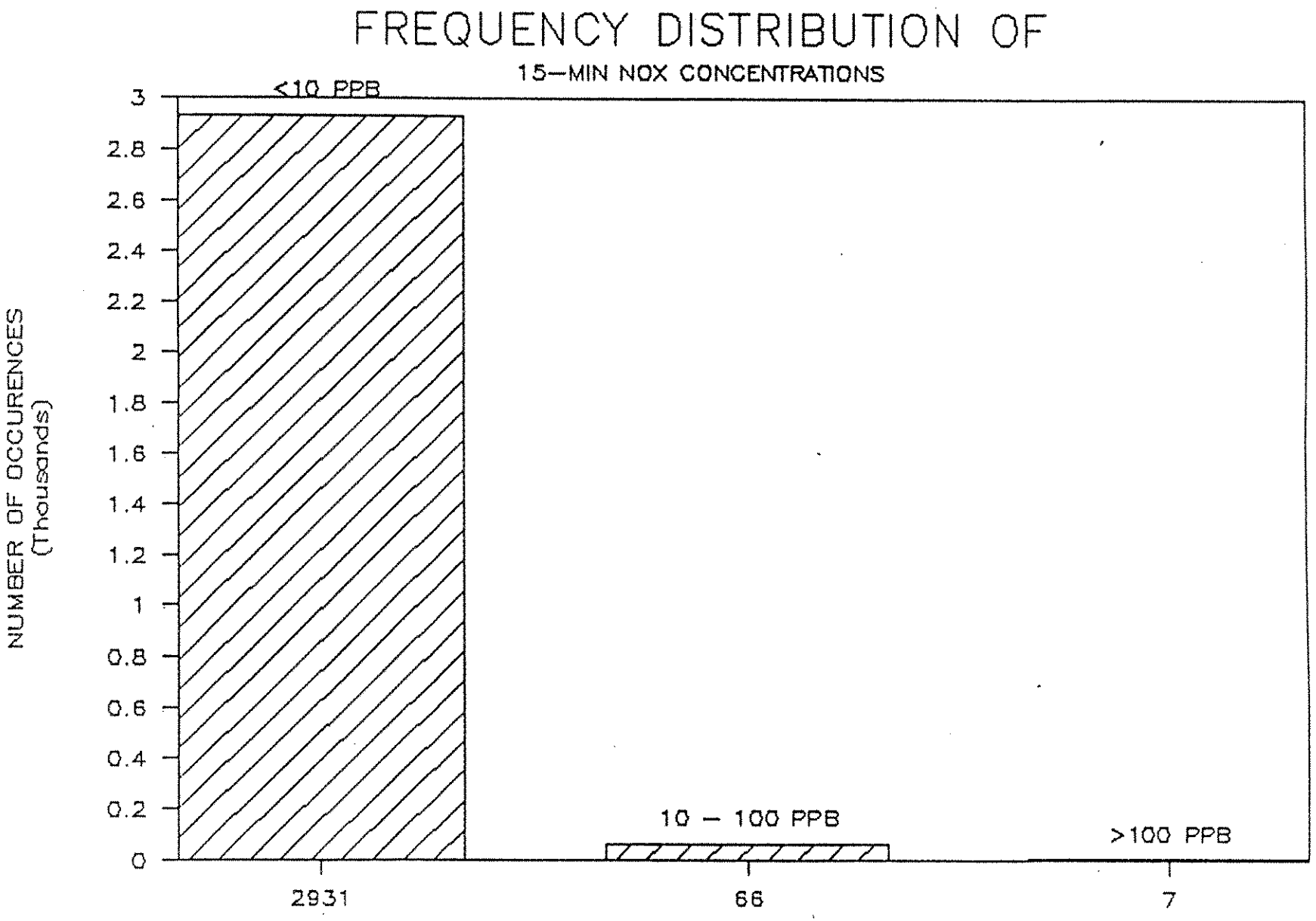

FREQUENCY DISTRIBUTION OF
15—MIN NOX CONCENTRATIONS
NUMBER OF OCCURENCES
(Thousands)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
<10 PPB
10 — 100 PPB
>100 PPB
2931
66
7

TABLE 1

WIND FREQUENCY TABLE

KEAHOLE METEOROLOGICAL TOWER (10-M LEVEL), JULY 93

FREQUENCY OF OCCURRENCE (HOURS)

WIND DIRECTION FROM

SPEED (MPS)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.5 - 1.8	0	0	2	0	2	9	5	5	2	1	1	2	1	1	0	3	34
1.8 - 3.6	5	7	3	26	56	73	56	33	23	15	8	18	9	5	4	1	342
3.6 - 5.4	9	5	6	7	10	7	8	20	25	34	43	53	20	18	6	6	277
5.4 - 8.5	3	0	4	1	0	0	0	6	3	11	25	25	3	3	1	1	86
8.5 - 11.0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5
11.0 - 99.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	20	12	15	34	68	89	69	64	55	61	77	98	33	27	11	11	744

RELATIVE FREQUENCY (%)

WIND DIRECTION FROM

SPEED (MPS)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	.00
.5 - 1.8	.00	.00	.27	.00	.27	1.21	.67	.67	.27	.13	.13	.27	.13	.13	.00	.40	4.57
1.8 - 3.6	.67	.94	.40	3.49	7.53	9.81	7.53	4.44	3.09	2.02	1.08	2.42	1.21	.67	.54	.13	45.97
3.6 - 5.4	1.21	.67	.81	.94	1.34	.94	1.08	2.69	3.36	4.57	5.78	7.12	2.69	2.42	.81	.81	37.23
5.4 - 8.5	.40	.00	.54	.13	.00	.00	.00	.81	.40	1.48	3.36	3.36	.40	.40	.13	.13	11.56
8.5 - 11.0	.40	.00	.00	.00	.00	.00	.00	.00	.27	.00	.00	.00	.00	.00	.00	.00	.67
11.0 - 99.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	2.69	1.61	2.02	4.57	9.14	11.96	9.27	8.60	7.39	8.20	10.35	13.17	4.44	3.63	1.48	1.48	100.00

TABLE 2

WIND FREQUENCY TABLE

KEAHOLE METEOROLOGICAL TOWER (10-M LEVEL), AUGUST 1-22, 93

FREQUENCY OF OCCURRENCE (HOURS)

WIND DIRECTION FROM

SPEED (MPS)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	0
.5 - 1.8	5	2	5	7	3	6	6	3	0	0	2	0	0	1	0	1	41
1.8 - 3.6	6	7	13	18	45	38	18	18	22	19	16	12	5	4	5	9	255
3.6 - 5.4	5	4	10	9	2	1	6	3	5	19	30	33	8	22	7	4	168
5.4 - 8.5	8	4	5	0	0	0	0	1	0	12	15	10	0	2	6	0	63
8.5 - 11.0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
11.0 - 99.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	26	17	33	34	50	45	30	25	27	50	63	55	13	29	18	14	529

RELATIVE FREQUENCY (%)

WIND DIRECTION FROM

SPEED (MPS)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM																	.00
.5 - 1.8	.95	.38	.95	1.32	.57	1.13	1.13	.57	.00	.00	.38	.00	.00	.19	.00	.19	7.75
1.8 - 3.6	1.13	1.32	2.46	3.40	8.51	7.18	3.40	3.40	4.16	3.59	3.02	2.27	.95	.76	.95	1.70	48.20
3.6 - 5.4	.95	.76	1.89	1.70	.38	.19	1.13	.57	.95	3.59	5.67	6.24	1.51	4.16	1.32	.76	31.76
5.4 - 8.5	1.51	.76	.95	.00	.00	.00	.00	.19	.00	2.27	2.84	1.89	.00	.38	1.13	.00	11.91
8.5 - 11.0	.38	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.38
11.0 - 99.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOTALS	4.91	3.21	6.24	6.43	9.45	8.51	5.67	4.73	5.10	9.45	11.91	10.40	2.46	5.48	3.40	2.65	100.00

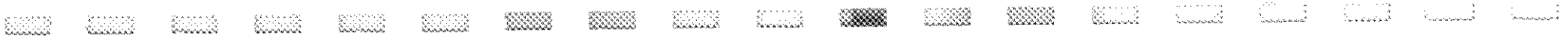
Table 3

Daytime/Nighttime Vector Winds at
Keahole Agricultural Park, July 21 - August 22, 1993

Date Period Begins	7 am - 7 pm		7 pm - 7 am	
	Direction (deg)	Speed (m/s)	Direction (deg)	Speed (m/s)
7-21	241	1.3	126	1.3
7-22	319	1.0	94	1.1
7-23	278	1.4	173	3.0
7-24	231	0.9	120	0.5
7-25	203	2.6	124	1.6
7-26	215	2.6	146	1.8
7-27	188	2.3	110	1.0
7-28	231	2.3	111	1.1
7-29	236	2.2	115	1.4
7-30	234	2.5	92	0.8
7-31	250	2.1	53	0.5
8-1	262	2.4	103	0.9
8-2	286	1.9	136	1.2
8-3	243	2.5	89	1.2
8-4	229	2.8	126	0.9
8-5	279	2.4	153	1.0
8-6	301	2.4	208	0.5
8-7	232	2.4	124	1.2
8-8	225	2.2	61	1.3
8-9	234	1.2	121	1.4
8-10	218	2.7	108	1.5
8-11	217	2.4	101	1.6
8-12	232	2.4	114	1.2
8-13	240	2.0	129	1.4
8-14	254	2.2	119	1.0
8-15	213	1.5	40	1.7
8-16	2	1.3	81	1.1
8-17	352	2.7	64	1.3
8-18	-	-	-	-
8-19	-	-	39	1.2
8-20	-	-	54	1.5
8-21	-	-	68	1.6
8-22	220	1.4	-	-

Appendix A

Monthly Summaries of Hourly Average Temperature, Wind Speed and Wind Direction for July and August 1993, Keahole Tower, 10-m Level



METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > JULY, 1993

WIND DIRECTION (DEG)

(SCALAR HOURLY AVERAGES)

	HOUR																							24HR
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE
DAY																									
1	159	134	109	127	96	74	127	123	182	201	209	226	264	245	245	241	207	185	116	114	67	18	83	104	151
2	135	48	114	78	111	105	105	154	196	223	239	222	214	226	186	192	195	140	197	186	57	50	79	80	150
3	107	99	107	119	112	97	66	338	252	221	241	230	240	246	240	243	229	214	189	208	80	64	151	155	178
4	149	128	126	128	125	124	117	112	266	257	233	241	249	246	239	233	202	184	183	182	215	233	240	242	197
5	148	105	122	120	105	86	100	158	192	182	218	217	223	229	218	221	227	215	192	211	258	296	32	54	181
6	40	49	346	85	78	45	89	140	179	173	272	249	240	230	220	198	198	208	192	183	73	116	94	79	148
7	135	96	77	123	130	115	117	113	181	223	237	237	244	240	233	227	213	210	201	187	172	115	134	120	170
8	78	72	88	97	83	106	63	85	67	320	286	289	278	284	269	257	243	231	215	196	174	169	166	159	172
9	131	125	133	81	63	68	67	48	130	232	250	211	237	240	245	246	249	246	248	264	286	357	47	84	200
10	127	96	101	105	119	84	142	110	168	189	190	173	246	252	245	235	229	247	251	237	194	123	104	95	167
11	165	149	113	138	166	158	117	114	224	247	263	262	283	285	297	290	310	321	332	355	354	17	19	22	290
12	72	99	92	91	98	108	110	161	202	211	203	223	232	244	252	283	309	331	0	5	10	7	357	21	40
13	100	123	108	111	111	102	102	153	194	223	235	252	274	297	288	295	281	263	237	186	150	161	150	137	182
14	119	105	89	57	43	19	47	30	359	309	284	272	268	266	252	240	233	213	200	187	173	124	81	117	163
15	96	60	62	76	59	86	68	193	317	316	280	289	269	250	268	281	300	279	239	196	167	117	151	131	239
16	130	130	94	101	96	79	85	120	336	300	279	249	243	243	245	232	239	239	238	280	332	314	3	17	263
17	74	122	122	128	108	86	75	139	216	232	247	236	237	254	253	237	221	205	190	259	84	145	129	122	173
18	123	97	102	105	95	101	84	37	259	239	299	271	242	264	245	192	205	198	49	165	145	139	158	134	158
19	130	125	116	112	91	74	101	149	166	288	254	258	248	240	236	227	194	141	156	123	101	114	180	162	158
20	137	126	161	134	136	139	153	161	215	212	241	244	263	266	241	251	184	168	166	170	166	153	139	135	178
21	100	83	108	85	83	103	111	139	175	190	205	226	254	298	331	300	276	250	197	195	161	152	149	130	164
22	129	86	297	98	99	131	118	152	166	165	195	206	242	292	319	353	357	3	9	12	12	37	59	151	80
23	189	154	138	136	135	120	110	59	46	35	296	285	282	256	288	256	247	228	197	193	190	193	192	184	194
24	176	173	172	168	163	164	161	154	332	5	352	344	258	214	191	185	173	198	226	315	330	355	107	156	191
25	130	167	25	253	164	122	123	153	174	191	200	195	217	227	253	226	223	189	146	117	69	126	136	95	167
26	98	130	196	75	151	160	128	96	156	171	182	216	213	236	248	244	241	230	215	178	149	157	155	140	175
27	173	152	135	119	124	143	159	151	164	175	197	218	235	225	196	162	176	184	172	187	178	150	134	122	167
28	88	105	147	120	79	103	95	116	184	264	206	194	210	236	248	252	263	266	220	142	134	102	91	122	160
29	119	81	173	108	121	104	108	130	229	242	241	233	232	238	242	239	236	245	211	194	127	139	107	93	177
30	125	134	134	124	86	79	104	90	345	271	265	240	229	229	231	234	232	227	222	225	209	175	115	85	183
31	93	104	99	101	86	70	71	59	6	356	312	253	243	238	231	226	232	225	217	216	217	204	176	353	194

100.0% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

08/30/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > JULY, 1993

WIND SPEED (MPS*10)

(SCALAR HOURLY AVERAGES)

										H O U R												24HR AVE	1HR MAX	1HR MIN
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
19	25	33	34	34	40	28	38	37	51	57	51	42	48	48	52	44	53	42	37	66	52	36	26	41	66	19
36	15	14	25	29	37	29	34	34	38	33	41	47	46	44	47	48	34	29	23	21	33	37	26	33	48	14
28	31	31	22	27	33	22	15	14	35	48	52	53	51	54	48	40	37	25	26	22	25	20	29	33	54	14
33	38	31	27	38	25	22	15	13	25	41	38	44	45	45	48	53	61	60	49	42	34	25	29	37	61	13
16	11	21	29	29	28	28	12	22	35	53	57	65	67	68	68	61	49	35	26	24	38	51	52	39	68	11
54	50	49	33	42	45	35	27	32	36	43	60	62	62	55	50	49	46	38	26	28	33	40	24	42	62	24
26	45	30	25	29	32	28	32	30	39	50	49	56	53	55	52	49	50	41	32	26	20	23	19	37	56	19
31	30	39	36	21	26	27	34	25	40	44	45	48	50	49	47	41	40	41	40	39	37	29	18	37	50	18
17	10	17	21	28	38	39	28	23	23	46	48	61	63	62	54	49	47	41	39	38	33	41	28	37	63	10
29	28	31	27	27	37	28	25	26	35	43	52	53	58	58	45	36	38	43	31	18	31	38	20	36	58	18
17	21	30	34	30	36	27	20	11	31	38	38	47	45	34	39	40	44	45	39	39	33	22	18	32	47	11
21	27	30	31	31	25	21	22	34	41	50	49	41	33	27	31	37	49	50	46	39	30	38	24	34	50	21
20	17	21	23	26	30	20	23	36	39	46	44	48	45	45	44	36	27	29	28	23	29	39	29	32	48	17
28	28	33	21	30	27	40	37	31	35	37	46	53	58	56	56	55	55	60	46	31	21	21	23	39	60	21
29	31	49	51	31	36	26	13	25	38	40	49	52	57	56	50	43	31	35	38	32	24	41	35	38	57	13
32	34	32	27	34	33	29	15	17	31	40	46	53	54	55	56	54	43	34	25	20	23	22	28	35	56	15
25	28	38	34	34	37	25	20	29	40	45	48	58	58	59	54	49	40	34	26	24	35	30	32	38	59	20
34	33	29	28	37	34	29	16	26	28	45	39	42	43	45	45	53	55	55	42	25	29	38	26	36	55	16
33	29	30	29	33	29	29	32	31	36	38	42	39	43	49	48	43	42	38	31	52	31	24	28	36	52	24
34	17	13	23	30	26	32	23	33	39	41	48	60	50	50	36	35	35	38	25	16	32	31	35	33	60	13
32	33	27	30	34	32	27	26	30	39	58	56	39	29	48	43	42	24	39	30	39	33	38	28	36	58	24
33	30	16	15	24	26	29	46	54	58	69	59	66	66	77	82	87	73	64	52	45	37	26	19	48	87	15
24	49	29	26	32	20	19	25	56	66	70	55	42	28	31	41	41	37	42	43	36	40	40	43	39	70	19
42	40	40	59	75	63	63	22	39	88	103	63	32	71	87	86	64	49	25	22	42	36	15	36	53	103	15
22	31	21	16	25	32	13	38	41	44	51	60	54	51	47	45	49	41	38	35	41	36	41	25	37	60	13
23	26	22	23	22	41	45	35	46	49	46	54	49	58	57	49	47	49	46	40	44	38	37	33	41	58	22
28	23	22	23	18	26	34	43	49	52	56	49	48	46	33	32	38	38	33	18	27	23	19	17	33	56	17
19	20	20	30	27	31	30	25	25	34	50	67	68	66	62	43	41	31	28	29	21	20	21	28	35	68	19
31	18	18	20	19	23	26	13	20	32	41	46	53	53	42	46	43	34	29	31	25	32	23	21	31	53	13
33	34	33	31	30	22	20	9	15	25	32	47	60	64	57	56	51	46	47	39	23	14	11	23	34	64	9
30	31	34	35	28	30	29	24	37	48	47	41	47	54	54	58	58	58	56	46	41	27	12	18	39	58	12

100.0% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

MAXIMUM WIND SPEED FOR MONTH - 10.3 MPS

MINIMUM WIND SPEED FOR MONTH - 0.9 MPS

08/30/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > JULY, 1993

WIND DIRECTION STD DEVIATION RMS (DEG) (SIGMA THETA)

(HOURLY AVERAGES)

	HOUR																							24HR
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE
DAY																									
1	23	14	10	9	5	7	10	13	12	13	14	14	18	14	16	13	14	13	24	24	10	16	13	32	15
2	11	43	33	13	9	5	13	10	15	17	15	13	12	13	19	16	13	27	38	14	50	16	11	26	19
3	25	5	7	25	7	3	23	20	40	27	15	15	14	16	17	17	19	17	26	16	41	34	44	7	20
4	9	9	14	12	9	9	10	11	48	35	19	22	16	16	17	16	16	12	9	9	10	9	13	11	15
5	19	31	9	9	8	10	5	23	20	31	14	15	15	13	16	13	14	16	24	25	36	15	18	9	17
6	8	12	23	28	23	9	17	20	16	36	18	12	13	15	17	15	15	13	13	37	29	31	12	16	19
7	22	10	11	17	10	10	14	14	18	17	12	15	12	15	17	18	17	16	13	13	11	31	21	28	16
8	10	14	7	8	8	11	14	21	29	19	12	14	16	13	14	15	15	14	13	10	10	7	18	18	14
9	22	31	28	36	29	15	11	23	23	43	13	16	13	14	12	14	15	12	13	11	11	18	13	23	19
10	15	7	5	7	9	7	16	14	22	15	14	16	17	10	12	12	16	13	9	9	29	20	5	38	14
11	29	16	7	9	14	16	11	29	42	17	16	18	16	14	18	17	16	14	12	11	8	9	13	11	16
12	11	3	2	3	2	5	13	16	15	15	12	14	21	24	22	14	14	11	8	7	7	8	6	13	11
13	13	13	8	6	8	7	17	10	17	16	13	18	15	13	16	14	16	19	16	15	21	5	6	10	13
14	8	4	4	16	14	5	8	10	14	12	14	14	14	12	15	15	14	12	11	12	18	16	23	34	13
15	22	21	9	7	13	9	13	34	29	17	17	15	15	13	13	13	16	15	14	10	19	29	13	12	16
16	9	9	10	4	4	4	4	33	30	20	15	14	14	15	12	14	15	15	13	19	16	10	16	11	13
17	11	15	10	8	7	8	8	13	16	16	14	14	14	14	14	13	15	14	20	32	45	14	18	11	15
18	9	13	5	5	4	5	9	22	21	39	18	16	16	17	16	26	13	14	33	27	29	14	6	11	16
19	9	8	7	7	6	3	9	12	24	34	16	16	13	16	17	18	19	17	11	35	15	22	15	11	15
20	12	15	20	11	10	14	10	13	13	17	16	14	11	14	15	14	14	12	9	8	19	10	13	7	13
21	7	5	5	12	7	5	8	15	15	17	12	16	16	18	13	10	13	24	12	11	8	7	9	14	11
22	8	11	22	15	5	11	8	10	11	15	11	15	12	11	10	10	9	9	9	8	7	6	16	20	11
23	12	12	12	9	9	9	20	9	15	16	9	10	17	15	20	17	16	15	10	9	9	8	8	9	12
24	9	8	9	9	14	11	10	22	21	11	8	14	23	13	11	10	13	15	25	25	12	26	37	13	15
25	15	22	31	26	8	10	22	10	16	15	14	11	16	15	12	11	11	19	18	32	13	17	12	11	16
26	8	13	29	17	24	10	12	15	13	15	19	14	18	15	16	16	13	12	13	12	9	8	9	10	14
27	12	9	11	9	10	11	9	9	12	12	12	14	12	13	27	24	14	14	9	21	8	11	10	11	13
28	6	6	16	9	8	5	8	13	24	15	14	11	12	11	14	13	9	15	28	16	15	17	16	9	13
29	6	18	20	10	10	3	6	23	25	13	14	14	13	14	14	14	15	13	14	13	24	14	28	15	15
30	9	8	8	8	9	5	5	22	29	23	25	14	14	15	14	15	14	16	13	10	12	16	20	4	14
31	4	3	4	4	4	3	3	11	10	11	17	17	15	13	13	14	14	12	11	10	9	9	42	26	12

100.0% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

08/30/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > JULY, 1993

AIR TEMPERATURE 2 METERS (DEG C*10)

(HOURLY AVERAGES)

HOUR																								24HR	1HR	1HR
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE	MAX	MIN
229	229	216	220	215	220	217	248	263	269	273	278	283	288	286	281	267	265	266	261	259	256	247	246	254	288	215
236	238	224	222	217	220	222	246	258	263	260	265	268	263	259	260	260	262	259	254	254	249	229	223	246	268	217
224	212	208	214	209	207	223	244	253	267	269	273	273	277	278	277	275	273	268	260	260	257	248	248	250	278	207
241	242	242	234	225	223	225	239	256	265	278	279	289	292	294	296	295	288	275	262	258	256	255	253	261	296	223
248	241	233	232	225	220	225	249	262	275	281	288	290	288	289	286	282	271	263	259	257	257	259	255	260	290	220
252	244	241	236	242	237	229	253	264	275	274	275	280	283	272	270	271	275	270	265	260	246	243	240	259	283	229
238	239	232	226	225	224	228	248	262	272	279	286	287	290	290	286	285	277	269	262	256	248	245	238	258	290	224
234	233	233	224	222	217	224	247	265	277	278	280	285	286	290	288	284	281	274	264	260	258	258	255	259	290	217
252	249	246	243	242	242	249	263	271	280	275	285	292	293	291	289	284	276	270	262	261	260	260	253	266	293	242
252	243	234	234	234	235	244	252	265	272	278	282	281	275	273	272	268	266	263	260	257	249	245	245	257	282	234
238	234	229	236	242	240	233	239	255	264	269	271	273	272	273	274	271	278	273	262	258	255	253	243	256	278	229
234	228	225	222	220	218	223	249	262	273	275	285	281	271	272	275	279	280	272	265	264	262	260	256	256	285	218
251	250	238	232	237	238	238	253	268	274	279	287	293	293	298	291	285	279	272	266	264	256	259	256	265	298	232
245	236	234	236	238	238	245	260	269	272	278	278	284	285	286	288	282	280	270	260	256	250	240	239	260	288	234
249	246	236	238	236	223	232	249	269	280	283	291	298	299	300	298	292	288	284	270	263	257	253	251	266	300	223
245	242	238	229	225	225	225	251	268	278	283	287	290	292	291	290	287	276	269	265	264	260	258	255	262	292	225
248	243	239	241	233	230	235	257	271	281	288	290	286	284	282	275	271	270	268	264	253	249	251	245	261	290	230
241	243	237	226	226	228	232	256	266	274	284	279	286	289	294	292	288	282	288	269	261	257	254	249	263	294	226
246	239	235	234	231	227	225	254	270	278	280	276	274	280	287	290	291	285	273	272	271	269	264	259	263	291	225
241	234	239	236	236	235	239	243	254	263	264	271	275	271	277	267	268	266	263	257	249	251	248	245	254	277	234
241	239	229	232	229	222	225	250	264	272	278	281	274	270	262	257	262	262	258	254	248	244	242	238	251	281	222
236	236	237	224	219	222	226	246	265	278	291	296	297	293	291	285	287	289	281	275	273	272	276	271	265	297	219
267	262	255	254	252	253	256	265	280	288	279	275	289	282	288	298	296	288	278	268	262	261	261	259	272	298	252
257	255	253	252	243	238	239	245	255	272	273	283	292	307	306	301	296	295	279	272	271	273	261	256	270	307	238
258	252	256	251	244	243	246	257	270	281	290	289	283	282	271	265	269	264	265	261	262	254	254	245	263	290	243
237	236	247	247	236	233	238	255	270	281	291	294	291	294	283	277	286	284	277	269	263	261	257	253	265	294	233
247	246	250	247	245	245	240	251	271	283	281	269	271	270	268	257	267	268	265	260	256	253	250	246	259	283	240
244	240	247	241	231	226	228	253	270	271	281	290	291	284	283	261	263	265	267	258	251	246	241	240	257	291	226
237	232	238	240	239	236	233	248	259	264	268	274	279	280	274	281	274	267	265	262	257	252	251	251	257	281	232
248	247	249	245	236	228	227	246	265	276	276	281	289	291	283	286	285	277	272	265	263	263	255	244	262	291	227
235	229	228	225	226	228	228	248	273	283	291	283	290	295	301	300	290	284	274	265	261	259	257	259	263	301	225

100.0% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

MAXIMUM AIR TEMPERATURE FOR MONTH - 30.7 DEGREES C.

MINIMUM AIR TEMPERATURE FOR MONTH - 20.7 DEGREES C.

08/30/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > AUGUST, 1993

WIND DIRECTION (DEG)

(SCALAR HOURLY AVERAGES)

	HOUR																							24HR
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE
DAY																									
1	70	88	50	6	31	44	29	14	333	248	240	245	246	237	247	262	285	315	319	321	358	74	180	149	326
2	150	143	120	96	95	84	103	47	341	337	332	304	304	303	301	267	235	214	190	177	187	214	227	161	202
3	118	135	121	123	129	97	59	354	236	235	254	239	236	239	240	244	243	232	223	189	108	81	86	90	178
4	82	80	65	103	130	106	70	98	163	192	215	220	233	230	239	236	245	247	242	220	175	159	184	158	177
5	115	126	125	105	59	44	46	37	336	290	289	288	285	279	280	277	259	252	233	212	187	190	165	178	239
6	177	145	146	166	107	89	71	165	297	299	285	290	296	293	305	318	314	308	277	214	193	182	167	189	233
7	213	226	335	331	335	348	45	26	286	232	242	235	241	241	240	228	219	216	203	182	162	161	164	134	231
8	77	73	88	92	101	100	94	152	224	209	202	209	238	247	253	247	233	215	233	89	52	52	53	55	145
9	210	310	359	110	66	96	209	82	272	212	236	283	347	0	298	221	223	195	194	169	185	162	145	136	201
10	132	109	121	100	94	106	93	148	193	226	235	228	235	236	224	216	223	202	192	175	71	68	48	156	164
11	92	89	133	127	107	118	103	144	205	252	246	227	221	213	209	196	203	211	236	74	88	91	104	77	155
12	110	137	124	128	106	84	90	121	181	222	235	229	234	219	236	244	251	252	259	193	82	183	153	97	176
13	124	129	115	84	105	101	113	133	223	359	261	244	239	274	258	245	229	203	199	189	174	151	168	155	178
14	134	136	139	94	119	95	81	143	227	239	246	246	252	286	292	288	281	242	205	195	172	173	142	188	193
15	61	116	92	26	70	71	99	116	87	193	209	231	250	251	355	192	194	222	206	245	149	18	78	41	132
16	70	42	19	18	18	32	26	15	357	5	2	7	4	159	224	253	203	181	182	208	115	71	73	66	41
17	81	45	64	108	69	38	64	52	48	355	1	325	289	324	349	357	352	352	5	7	35	50	101	112	30
18	110	113	105	107	108	107	103	59	-	-	-	290	293	290	293	292	277	290	327	347	360	322	215	170	358
19	153	209	141	40	6	21	0	22	335	322	319	307	289	269	247	239	237	243	241	217	158	102	56	335	295
20	12	4	31	57	50	56	54	49	210	207	206	220	216	209	211	225	255	297	319	324	9	50	29	89	356
21	95	128	101	71	69	132	120	110	9	288	222	207	217	210	202	206	205	210	250	88	69	55	75	76	135
22	46	64	85	65	105	81	111	49	213	212	229	241	225	235	231	241	240	222	52	49	53	208	88	82	134
23	86	141	101	107	105	112	95	115	174	231	259	264	247	249	250	245	240	214	208	199	175	159	138	114	176
24	65	97	103	70	87	100	113	151	189	209	226	228	248	286	324	359	10	5	18	52	144	154	127	138	107
25	131	97	99	92	64	70	134	155	196	216	244	248	243	225	239	248	247	247	214	188	130	133	112	100	172
26	111	109	107	94	93	102	115	123	202	253	278	248	252	240	236	240	242	238	242	245	249	236	8	21	212
27	78	78	77	87	88	82	64	49	353	327	317	303	317	298	297	296	270	242	229	211	191	166	160	154	348
28	132	110	115	102	93	95	95	75	2	347	308	274	262	267	261	250	251	240	230	244	275	330	67	95	258
29	83	106	78	62	88	72	83	125	206	232	275	310	286	253	240	241	245	219	200	195	194	203	222	163	195
30	137	120	108	112	106	90	91	80	35	331	320	318	297	290	286	295	311	318	314	325	16	99	114	112	27
31	112	110	102	98	86	95	109	87	345	278	293	298	292	268	252	253	247	239	236	211	175	156	148	118	184

99.6% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

09/01/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > AUGUST, 1993

WIND SPEED (MPS*10)

(SCALAR HOURLY AVERAGES)

HOUR																						24HR	1HR	1HR
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE	MAX	MIN
32	24	36	31	33	41	34	26	24	34	50	59	59	60	55	51	41	39	32	20	16	13	24	23	36	60	13
26	30	34	35	33	20	22	11	19	38	44	45	54	56	50	45	44	43	43	39	29	18	22	20	34	56	11
21	20	30	32	36	33	23	13	20	38	35	44	47	47	49	56	54	40	38	32	22	22	24	30	34	56	13
28	30	23	24	29	27	29	20	38	55	51	58	64	61	58	50	47	45	36	27	26	29	29	26	38	64	20
20	17	19	14	10	18	24	28	27	37	43	42	44	46	51	50	49	46	42	29	31	33	31	28	32	51	10
28	21	13	11	19	25	16	10	19	25	28	46	50	57	58	59	57	42	30	32	42	41	39	35	33	59	10
25	10	16	34	38	27	23	20	16	29	39	42	43	45	50	51	54	53	50	53	51	26	22	20	35	54	10
9	13	23	28	27	28	30	19	23	35	49	58	48	44	37	37	34	38	34	37	47	69	71	44	37	71	9
24	22	23	23	45	26	21	23	33	41	36	35	43	35	36	37	34	40	37	19	20	31	35	39	32	45	19
25	23	25	30	29	24	30	25	24	31	44	54	50	59	54	58	56	41	35	27	32	53	31	29	37	59	23
27	16	20	21	26	27	29	15	19	31	45	42	43	49	55	56	49	42	27	39	28	25	25	31	33	56	15
18	36	40	34	26	14	32	24	27	32	46	56	58	53	56	53	42	34	25	24	18	30	31	21	35	58	14
23	34	31	25	28	26	19	20	13	16	33	43	44	52	46	45	43	46	42	34	23	15	28	33	32	52	13
34	37	36	31	20	33	28	16	36	35	39	45	49	50	38	46	35	31	38	35	33	18	17	20	33	50	16
21	33	20	13	20	27	32	14	13	26	42	37	34	37	46	52	56	34	23	26	28	30	29	28	30	56	13
26	31	44	55	61	59	49	55	74	76	89	81	87	55	48	30	50	41	33	30	15	16	30	26	48	89	15
27	24	32	31	36	31	19	39	50	50	61	57	43	52	67	70	58	52	51	40	27	18	20	16	40	70	16
27	29	33	31	30	30	25	15	-	-	-	45	48	47	48	49	43	37	31	26	19	18	22	27	32	49	15
24	31	18	11	11	15	16	25	28	35	47	50	49	53	55	54	51	43	34	25	18	13	12	20	31	55	11
28	34	37	49	40	42	39	16	19	27	44	58	64	71	73	59	46	46	53	57	61	67	53	32	46	73	16
29	32	31	21	34	17	29	27	30	37	37	60	65	71	73	71	67	42	18	46	44	32	43	42	42	73	17
29	23	34	37	25	19	15	13	23	38	50	46	50	51	45	41	33	30	56	69	37	34	29	25	35	69	13
18	22	34	39	39	36	36	27	32	41	39	47	48	51	54	47	51	48	36	34	33	31	20	27	37	54	18
22	22	24	26	32	36	30	30	46	46	47	58	53	50	48	45	36	30	31	23	42	37	25	18	36	58	18
31	29	33	37	33	34	31	27	34	42	51	53	53	52	57	44	46	43	37	27	15	11	16	33	36	57	11
26	32	34	38	30	25	31	18	15	24	38	55	59	62	59	56	60	52	52	57	54	32	23	26	40	62	15
23	29	30	37	46	36	41	36	35	41	44	40	39	42	50	47	39	32	33	35	44	49	57	46	40	57	23
37	35	25	28	29	34	36	23	20	37	48	44	46	53	56	57	52	46	36	26	30	28	21	38	37	57	20
39	28	24	25	27	33	25	21	24	32	33	52	54	57	60	49	48	47	53	50	49	41	42	43	40	60	21
38	33	31	27	32	36	35	33	22	27	42	42	45	45	46	48	43	39	29	22	15	23	24	28	34	48	15
31	30	32	33	34	32	31	19	10	27	34	39	44	48	53	50	46	41	35	33	34	23	21	26	34	53	10

99.6% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

MAXIMUM WIND SPEED FOR MONTH - 8.9 MPS

MINIMUM WIND SPEED FOR MONTH - 0.9 MPS

09/01/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > AUGUST, 1993

WIND DIRECTION STD DEVIATION RMS (DEG) (SIGMA THETA)

(HOURLY AVERAGES)

	HOUR																							24HR
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE
DAY																									
1	13	8	9	10	11	9	7	10	26	17	13	12	11	14	15	14	14	13	11	13	10	26	17	8	13
2	9	10	9	4	6	6	4	29	24	17	14	13	12	12	14	16	14	14	10	8	9	12	8	17	12
3	9	11	8	8	8	8	8	25	29	14	19	17	16	14	16	14	14	15	14	10	34	20	6	6	14
4	3	5	20	12	10	14	11	24	25	14	14	14	13	15	14	14	15	14	12	14	13	16	11	12	14
5	10	12	9	24	27	8	5	9	18	14	14	17	17	16	17	17	15	15	14	13	8	9	8	9	13
6	15	11	13	14	11	6	13	43	22	15	23	15	15	15	15	15	12	13	17	11	9	8	8	10	15
7	10	23	24	7	6	9	8	20	33	24	16	17	16	17	13	13	14	13	10	9	9	16	11	13	15
8	23	28	5	4	5	6	3	17	24	18	13	11	14	16	16	19	19	17	16	35	13	15	12	16	15
9	27	34	32	12	7	25	22	42	24	18	22	24	21	24	27	20	21	12	11	40	20	7	10	8	21
10	11	8	9	4	4	13	5	13	23	18	14	15	17	14	16	13	16	21	12	19	29	12	41	15	15
11	13	16	13	11	7	8	8	19	25	13	10	14	16	15	12	12	14	13	19	32	13	11	15	6	14
12	32	10	8	10	21	27	5	15	17	23	15	13	13	16	15	14	15	17	20	35	29	8	11	14	17
13	10	9	9	8	8	7	13	26	44	35	23	17	14	16	17	17	18	17	11	9	14	30	6	10	16
14	9	8	11	11	11	5	4	22	16	14	15	16	15	14	17	14	15	21	11	10	9	11	46	18	14
15	41	10	27	27	18	6	5	24	36	40	18	19	18	36	32	15	11	17	30	24	31	10	11	18	22
16	29	10	8	7	7	6	6	8	8	11	8	10	9	40	22	32	23	12	15	12	44	29	27	30	17
17	14	13	9	6	10	14	39	23	27	38	12	14	19	22	13	10	13	13	8	8	10	15	12	18	16
18	5	7	4	5	4	3	18	35	-	-	-	14	15	15	15	16	22	21	18	13	13	11	12	9	13
19	12	20	26	39	22	12	16	8	12	10	10	13	16	15	14	15	16	15	16	11	30	40	35	25	18
20	14	10	11	6	7	4	4	22	23	19	19	15	14	13	12	16	16	15	11	9	15	10	16	15	13
21	13	8	9	15	12	17	9	20	38	16	24	12	12	13	13	12	12	16	41	19	23	24	9	9	16
22	39	27	4	7	17	24	14	11	44	20	15	17	16	15	16	19	20	23	22	10	20	11	22	12	19
23	13	22	4	7	4	5	6	15	16	15	19	16	16	18	16	15	15	15	15	11	7	15	20	7	13
24	14	8	11	5	3	4	4	12	11	15	18	16	16	17	22	18	21	18	17	17	25	11	15	17	14
25	8	6	3	3	8	16	12	10	14	15	13	11	15	16	13	16	17	13	12	11	36	36	31	4	14
26	4	5	4	5	7	8	5	20	43	36	18	15	15	15	16	15	12	13	11	8	8	14	42	32	15
27	21	15	10	9	8	9	7	9	14	14	19	17	15	16	12	12	14	14	13	8	8	7	6	9	12
28	10	8	9	5	3	2	2	22	24	19	14	18	16	15	15	13	14	13	15	15	14	27	28	7	14
29	13	14	12	11	14	9	28	15	18	22	18	16	15	14	14	16	15	13	9	8	8	9	10	19	14
30	11	13	6	4	4	2	2	3	13	20	14	15	16	17	16	16	21	21	15	10	25	6	21	4	12
31	4	5	3	5	3	3	3	36	37	20	16	15	15	16	15	17	17	17	15	13	9	26	27	18	15

99.6% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

09/01/93

METEOROLOGICAL MONITORING PROGRAM

STATION: 62 - KEAHOLE, HAWAII < 10 M LEVEL > AUGUST, 1993

AIR TEMPERATURE 2 METERS (DEG C*10)

(HOURLY AVERAGES)

												HOUR											24HR	1HR	1HR
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	AVE	MAX	MIN
255	241	248	249	248	251	249	261	275	276	287	289	292	297	297	297	291	282	278	270	267	264	260	255	270	297	241
251	248	248	240	237	234	231	257	278	296	300	306	309	309	303	302	297	292	280	278	276	274	268	261	274	309	231
255	255	252	251	251	244	249	263	275	285	281	293	296	301	298	297	291	287	281	270	263	253	249	245	270	301	244
244	246	248	239	244	244	247	258	269	278	286	293	290	291	291	284	282	278	268	264	263	265	261	260	266	293	239
254	246	241	244	248	242	238	253	267	276	273	277	281	287	291	291	286	281	270	263	260	259	254	252	264	291	238
248	247	248	244	240	238	242	252	260	265	274	282	287	291	290	292	292	281	274	269	265	261	261	261	265	292	238
260	258	257	257	257	256	253	261	272	282	292	296	297	302	302	303	301	294	280	275	273	278	275	272	277	303	253
263	252	245	243	243	240	239	259	270	280	284	284	283	278	277	282	281	284	276	276	270	268	264	257	267	284	239
259	252	251	234	244	238	240	263	273	284	284	285	287	289	292	291	283	276	271	261	256	251	253	250	265	292	234
250	246	243	233	234	230	231	252	269	277	280	287	282	294	286	294	286	275	273	268	265	258	261	254	264	294	230
253	256	253	244	235	235	239	257	269	272	276	278	283	286	289	284	277	278	275	272	261	251	243	243	263	289	235
240	247	245	244	245	238	229	253	270	283	285	296	291	293	296	292	286	285	277	272	271	266	259	255	267	296	229
247	249	248	244	234	234	238	252	265	281	295	303	308	309	301	307	304	300	288	277	272	266	262	263	273	309	234
261	259	261	254	247	237	239	261	275	279	284	294	299	296	292	302	298	296	286	276	273	267	267	263	274	302	237
255	246	246	245	232	229	224	245	265	272	282	277	280	287	301	293	289	282	278	271	264	255	247	253	263	301	224
248	245	248	250	251	247	246	258	279	301	307	317	323	306	296	292	291	285	284	277	263	257	252	255	274	323	245
247	247	242	228	232	236	240	258	280	295	302	302	301	309	319	310	309	299	285	273	271	261	249	251	273	319	228
246	245	242	239	237	238	237	256	-	-	-	298	305	305	304	299	296	287	280	274	273	272	268	261	270	305	237
259	259	248	252	252	252	252	254	264	266	269	273	281	289	290	289	287	281	272	270	267	267	263	264	268	290	248
259	260	258	257	255	250	246	258	272	283	293	299	303	306	306	298	292	289	280	275	272	268	267	253	275	306	246
253	247	245	244	244	239	235	259	280	286	288	297	296	297	296	297	296	284	277	276	270	258	255	251	270	297	235
249	238	232	235	231	226	232	254	273	286	293	291	300	289	285	287	279	275	281	268	261	257	253	242	263	300	226
232	230	227	234	228	227	228	251	269	275	280	282	291	295	295	290	294	283	275	268	262	261	259	243	262	295	227
240	237	233	232	227	223	225	253	272	284	292	295	295	297	302	296	288	288	288	281	272	267	258	253	267	302	223
249	242	235	234	235	240	236	257	272	280	288	290	293	300	299	289	291	284	275	269	261	254	247	245	265	300	234
240	235	233	233	232	221	220	247	268	280	290	296	296	294	294	292	287	280	274	266	264	264	259	251	263	296	220
250	252	249	241	249	242	243	260	273	280	283	285	286	296	299	298	295	283	276	271	270	265	259	260	269	299	241
256	244	238	229	228	226	225	248	272	290	289	290	295	297	296	294	290	285	276	270	269	268	256	253	266	297	225
260	249	241	238	227	231	231	249	271	284	289	300	298	297	296	293	295	287	276	267	264	263	263	249	267	300	227
236	233	234	229	224	220	218	235	260	272	277	276	276	273	278	283	283	278	270	262	256	244	239	230	254	283	218
227	226	222	220	219	215	215	239	264	276	280	287	293	295	293	288	285	281	273	269	263	261	257	240	258	295	215

99.6% OF HOURLY AVERAGE VALUES OBTAINED

100.0% OF DAILY AVERAGE VALUES OBTAINED

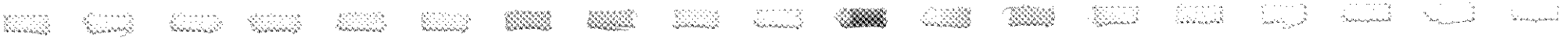
MAXIMUM AIR TEMPERATURE FOR MONTH - 32.3 DEGREES C.

MINIMUM AIR TEMPERATURE FOR MONTH - 21.5 DEGREES C.

09/01/93

Appendix B

Hourly Averages of Wind Speed and Direction for July 20 through August 22, 1993, Keahole Agricultural Park



METEOROLOGICAL MONITORING PROGRAM

STATION 63 - KEAHOLE AG PARK - JULY 1993

WIND DIRECTION (DEG) (SCALAR HOURLY AVERAGES)

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	--	81	100	91	73	81	89	132	172	194	214	224	259	299	316	296	282	257	200	192	158	136	142	129
22	127	87	17	68	82	127	114	148	164	162	192	204	241	296	321	352	0	6	13	16	19	41	66	156
23	179	154	137	127	135	107	100	63	47	37	300	288	285	244	287	256	247	219	202	192	192	193	191	183
24	174	170	170	167	163	164	161	154	332	6	354	346	271	214	192	186	172	194	229	313	327	28	95	157
25	132	171	15	242	159	126	124	153	172	196	196	202	218	229	250	230	221	190	150	135	86	128	135	98
26	91	122	190	61	146	161	133	109	156	174	181	219	216	240	249	247	249	234	210	176	138	142	153	140
27	177	152	133	117	128	144	159	146	163	173	198	219	236	224	190	133	174	186	168	192	165	130	128	111
28	69	80	145	117	71	91	91	113	179	272	210	201	213	239	253	258	268	278	227	145	123	89	74	127
29	120	85	177	97	120	83	98	107	209	242	245	238	230	239	250	244	238	241	220	193	127	121	111	100
30	122	131	132	122	85	70	67	58	285	229	271	244	224	220	229	246	238	232	222	225	217	162	92	65
31	70	88	87	85	66	71	71	68	18	358	309	254	250	242	230	225	235	225	220	222	218	201	153	30

METEOROLOGICAL MONITORING PROGRAM

STATION 63 - KEAHOLE AG PARK - JULY 1993

WIND SPEED (MPS*10) (SCALAR HOURLY AVERAGES)

DAY	HOUR 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
16	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
21	--	14	14	16	16	15	13	18	24	30	22	24	27	15	29	29	29	17	26	20	24	18	23	17
22	22	19	11	14	14	15	18	30	38	42	46	40	43	47	57	55	60	56	51	41	34	23	15	13
23	14	38	21	17	20	13	12	17	38	42	47	38	31	21	22	31	30	26	27	28	23	24	26	28
24	27	27	28	38	53	44	45	17	28	62	64	44	26	49	58	57	44	33	17	17	32	17	11	28
25	14	19	13	11	14	23	11	30	30	32	36	42	36	36	31	29	31	27	24	23	21	28	31	17
26	14	14	13	12	13	29	36	26	38	36	34	38	35	41	39	35	34	34	30	26	28	21	26	23
27	16	13	14	17	12	20	23	31	35	39	38	31	32	31	22	21	25	23	22	11	16	11	13	10
28	11	11	12	18	15	14	15	18	19	25	36	46	47	42	41	26	26	24	19	24	15	13	13	14
29	19	12	11	10	12	11	12	10	17	23	28	33	35	35	31	34	30	22	19	18	18	16	13	14
30	22	22	23	23	17	14	14	08	11	19	25	35	40	44	38	39	37	31	33	24	14	09	10	14
31	13	13	14	14	17	15	13	13	28	33	34	30	34	38	39	42	41	38	36	28	24	15	08	13

METEOROLOGICAL MONITORING PROGRAM

STATION 63 - KEAHOLE AG PARK - AUGUST 1993

WIND DIRECTION (DEG) (SCALAR HOURLY AVERAGES)

	HOUR																							
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	69	68	46	14	40	46	31	18	306	238	228	241	245	241	256	258	278	314	319	312	19	87	169	141
2	152	143	117	91	71	66	69	19	339	336	328	312	299	301	298	267	242	209	188	174	181	208	225	155
3	114	134	121	122	124	95	68	17	224	234	254	242	248	253	249	247	249	225	224	183	106	78	69	72
4	72	63	53	89	129	103	74	103	155	196	218	222	234	238	242	242	243	249	243	215	160	152	182	155
5	107	103	113	88	72	63	62	46	338	296	293	294	300	292	268	264	257	251	235	212	184	190	164	177
6	176	145	119	85	91	83	79	123	302	277	273	296	297	299	307	321	313	307	279	208	194	179	164	190
7	220	183	342	334	337	359	54	30	300	247	233	248	249	241	237	224	222	212	203	182	162	156	160	135
8	90	71	69	77	77	86	79	142	216	208	206	210	232	246	254	251	237	219	233	140	57	59	56	57
9	228	69	5	77	66	78	211	62	259	209	231	281	345	317	293	220	226	200	200	162	158	152	132	134
10	130	103	118	98	82	108	81	138	196	223	235	231	237	232	214	214	215	204	192	175	86	74	103	157
11	98	102	131	99	95	117	99	127	205	242	240	228	219	220	213	196	202	216	234	84	82	85	109	70
12	87	133	124	128	102	76	84	118	180	226	235	224	234	214	235	247	248	251	253	169	133	179	146	86
13	121	124	109	68	101	88	82	114	213	1	236	247	246	276	261	248	245	204	199	189	158	116	163	151
14	130	137	138	91	110	88	68	135	231	248	249	253	253	287	294	275	260	229	203	195	164	133	110	164
15	87	120	78	76	72	68	81	108	87	186	207	216	263	253	342	189	199	214	191	236	130	33	89	75
16	66	50	24	22	24	36	33	25	0	8	4	17	7	185	224	236	200	179	174	207	116	87	76	98
17	88	61	68	94	73	41	80	67	65	27	4	321	293	331	345	358	352	350	7	18	55	79	61	76
18	109	115	103	101	108	109	78	342	199	241	254	288	299	293	270	263	256	268	312	337	351	305	194	160
19	147	198	95	55	58	43	44	6	321	322	316	301	292	259	243	237	236	242	233	211	131	75	70	343
20	6	350	24	50	45	49	58	15	187	208	210	216	216	213	204	227	257	298	313	319	5	47	31	92
21	83	120	89	74	70	109	105	108	351	254	212	201	212	206	203	201	200	199	224	76	67	56	76	65
22	44	58	69	66	67	68	71	65	167	201	222	233	214	218	218	245	234	218	55	45	41	175	85	68
23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
26	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
27	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

METEOROLOGICAL MONITORING PROGRAM

STATION 63 - KEAHOLE AG PARK - AUGUST 1993

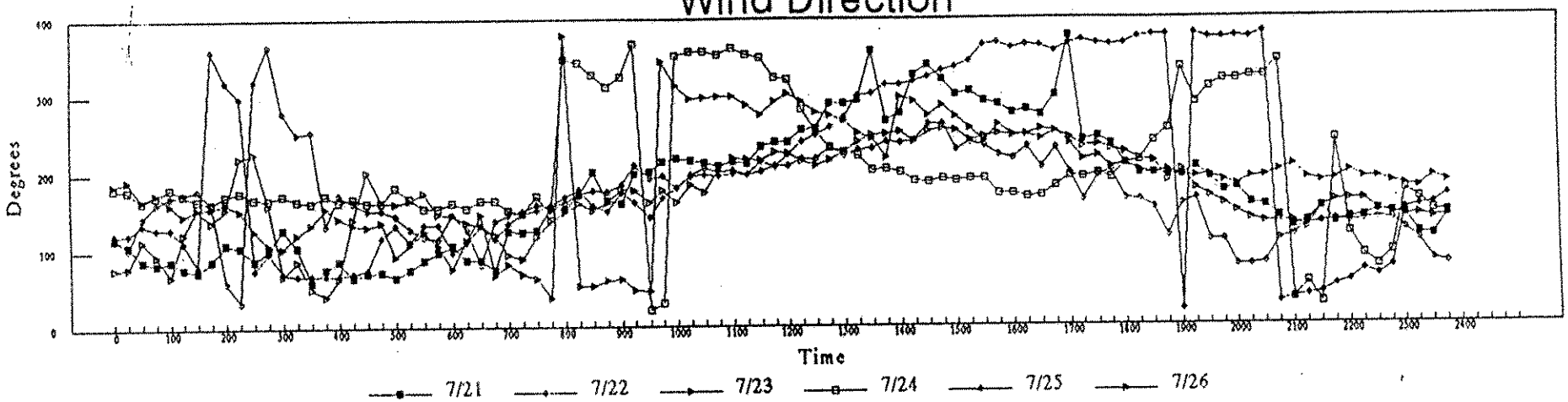
WIND SPEED (MPS*10) (SCALAR HOURLY AVERAGES)

DAY	HOUR																							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	20	12	21	21	18	22	19	17	20	25	34	40	41	42	39	36	30	29	23	15	11	8	15	13
2	16	21	23	16	15	16	15	10	15	28	32	37	39	40	38	34	33	30	29	23	18	11	13	12
3	13	13	20	21	24	19	13	10	15	28	26	31	35	38	35	41	38	28	24	19	12	14	14	16
4	14	16	13	13	21	16	16	11	27	37	36	41	43	44	40	36	33	30	24	17	15	19	18	18
5	12	9	10	9	10	14	15	20	23	27	31	31	33	35	38	36	35	32	28	18	19	21	18	18
6	17	15	8	10	13	13	10	10	15	19	21	33	38	42	41	42	40	30	21	20	26	26	24	22
7	16	7	11	20	23	18	13	14	15	22	29	33	33	34	36	36	37	36	33	36	35	17	13	13
8	11	13	14	14	11	13	13	14	17	25	33	39	35	31	25	26	24	27	23	14	28	44	40	20
9	15	14	19	14	25	13	16	16	24	27	28	22	26	24	21	29	24	27	24	17	13	16	21	24
10	19	15	17	16	14	11	13	17	19	26	32	37	36	41	36	40	36	26	23	20	17	31	20	24
11	17	12	17	13	15	18	16	12	15	22	30	29	31	36	36	38	32	29	19	23	17	13	20	16
12	11	26	29	26	17	13	17	18	20	23	33	39	40	36	39	40	29	25	19	16	9	19	18	13
13	13	24	20	16	14	13	11	13	11	14	26	31	34	37	35	33	33	30	27	22	13	11	15	21
14	21	26	27	17	13	14	15	11	27	27	29	34	37	35	28	33	25	23	25	24	21	10	11	12
15	15	24	12	11	14	15	14	14	12	21	30	26	27	27	30	37	37	27	15	17	16	17	15	13
16	15	19	29	35	38	35	29	39	52	54	62	54	63	35	29	25	37	30	25	18	12	13	17	14
17	16	14	17	19	17	19	14	24	36	35	42	40	33	35	45	49	39	38	37	27	16	8	11	10
18	17	16	17	16	20	18	13	11	19	28	30	34	36	--	--	--	33	28	15	18	12	12	13	19
19	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17	21	15	11	8	9	12
20	19	23	21	29	23	22	18	--	--	--	--	--	--	--	--	--	--	12	34	41	40	43	34	21
21	15	21	20	14	16	12	13	--	--	--	--	--	--	--	--	--	--	--	--	21	20	19	24	23
22	17	12	17	20	18	16	14	10	13	25	11	31	35	32	30	29	23	20	41	37	27	20	18	15
23	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
26	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
27	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
31	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

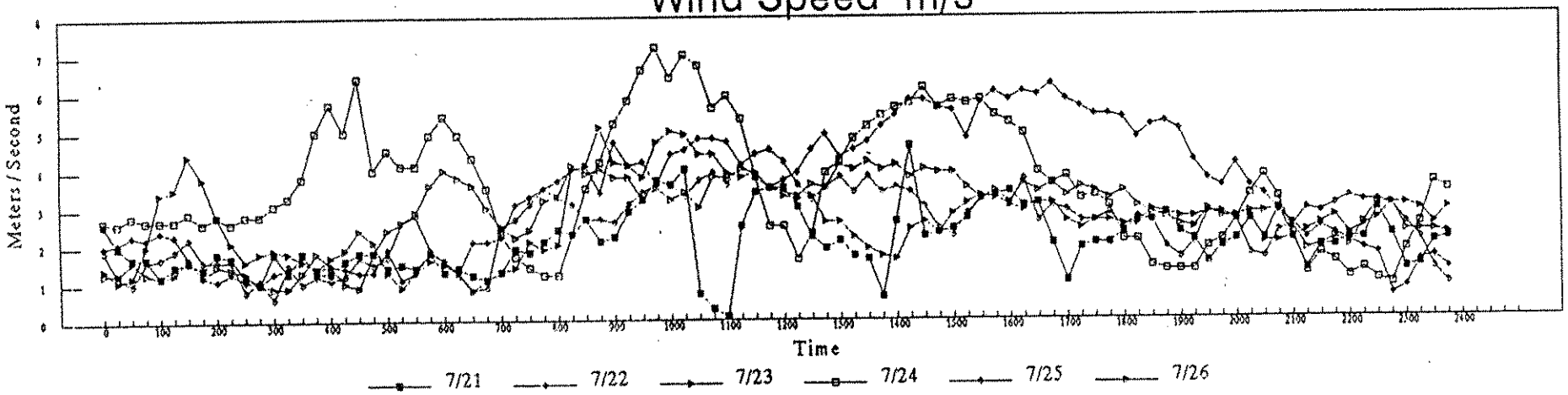
Appendix C

Time Series Plots of Wind and Nitrogen Oxides Data for Keahole Agricultural Park, July 20 through August 22, 1993

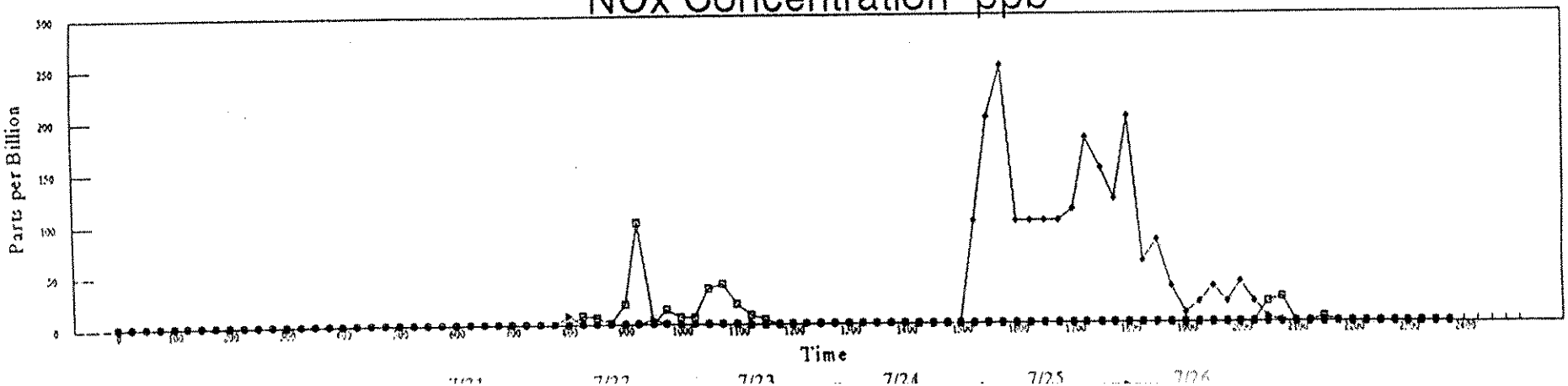
Wind Direction



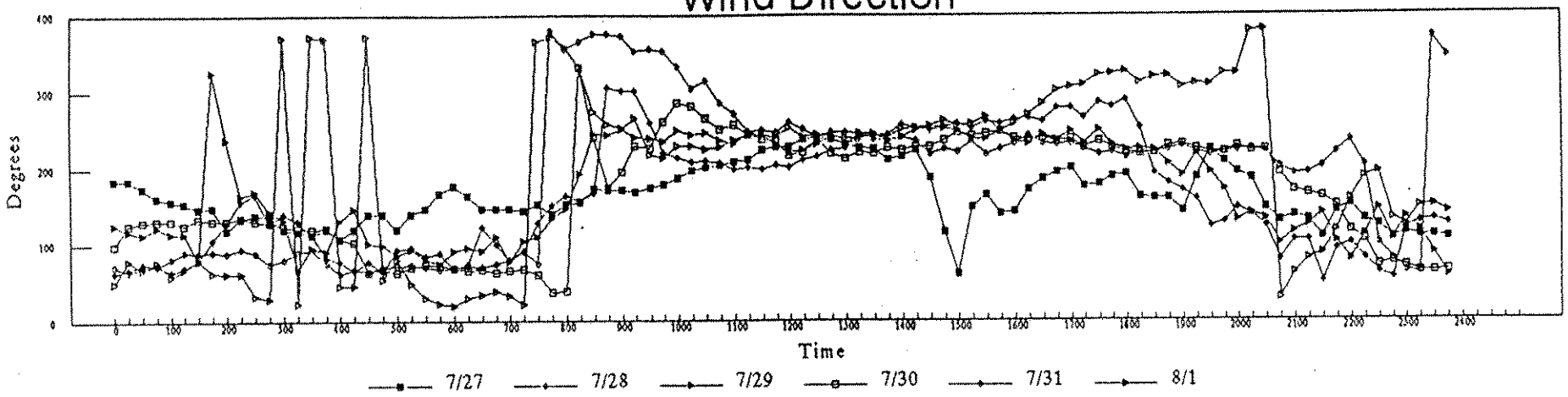
Wind Speed m/s



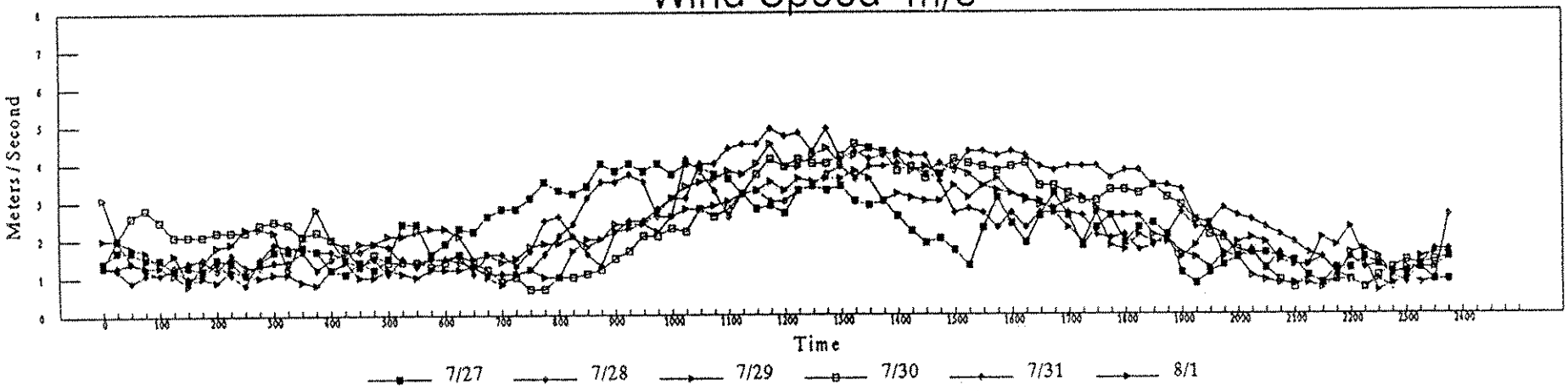
NOx Concentration ppb



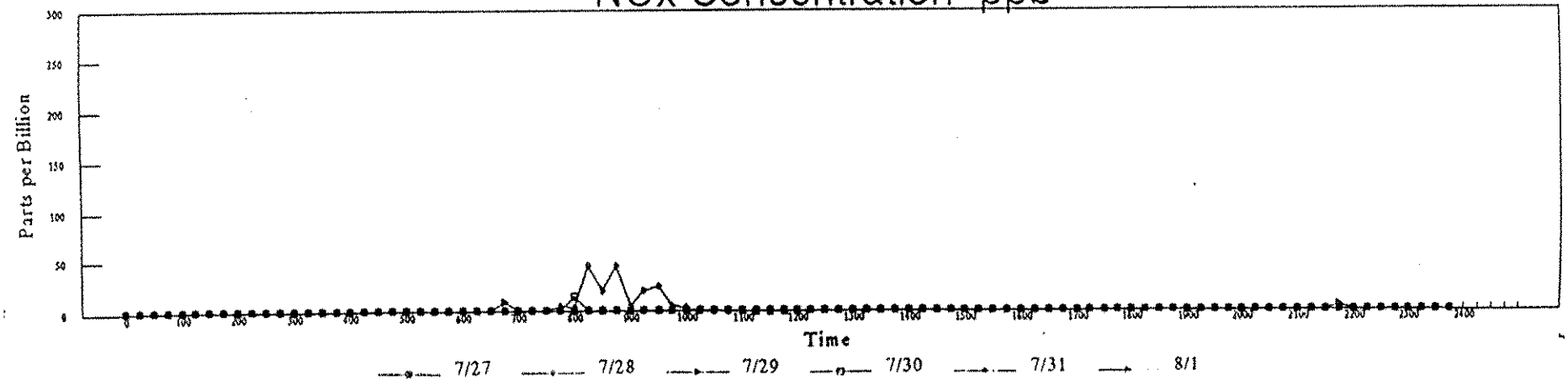
Wind Direction



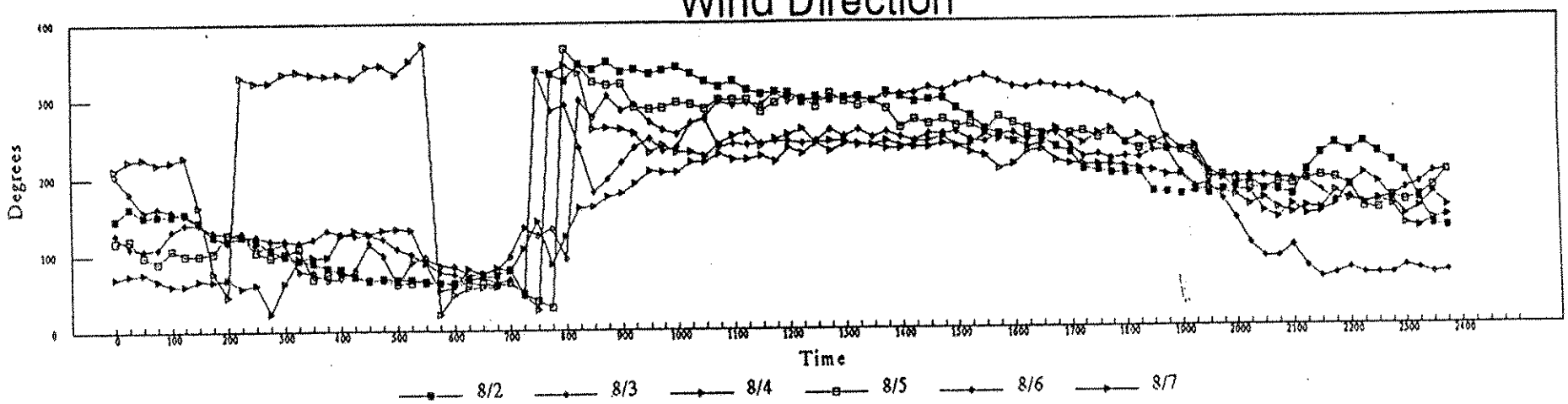
Wind Speed m/s



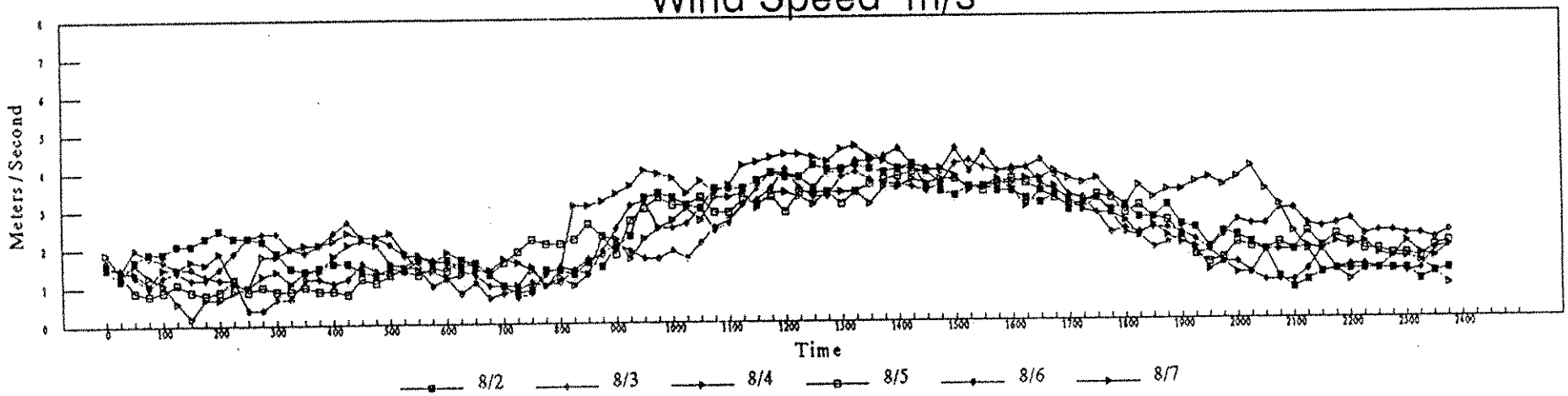
NOx Concentration ppb



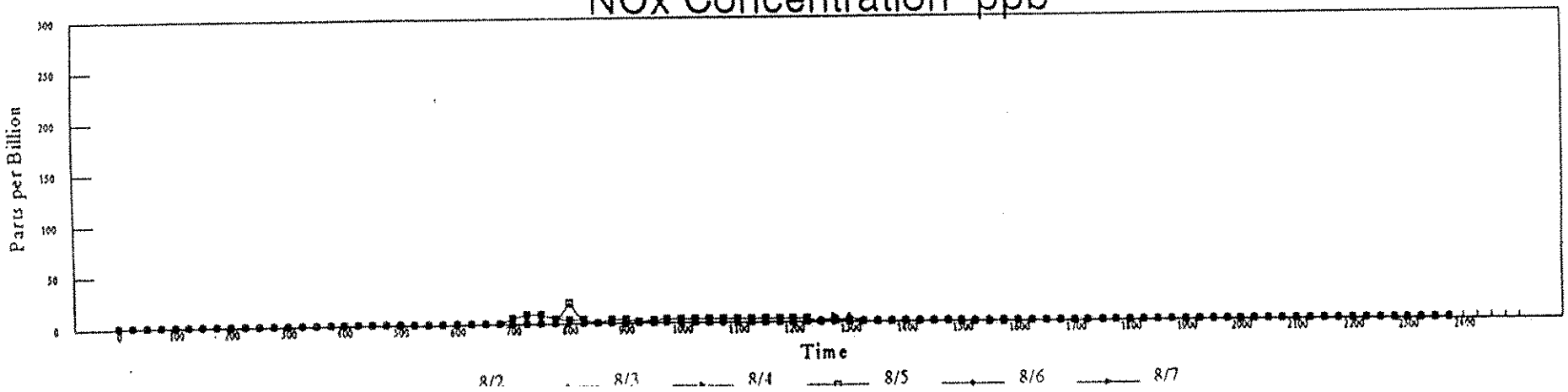
Wind Direction



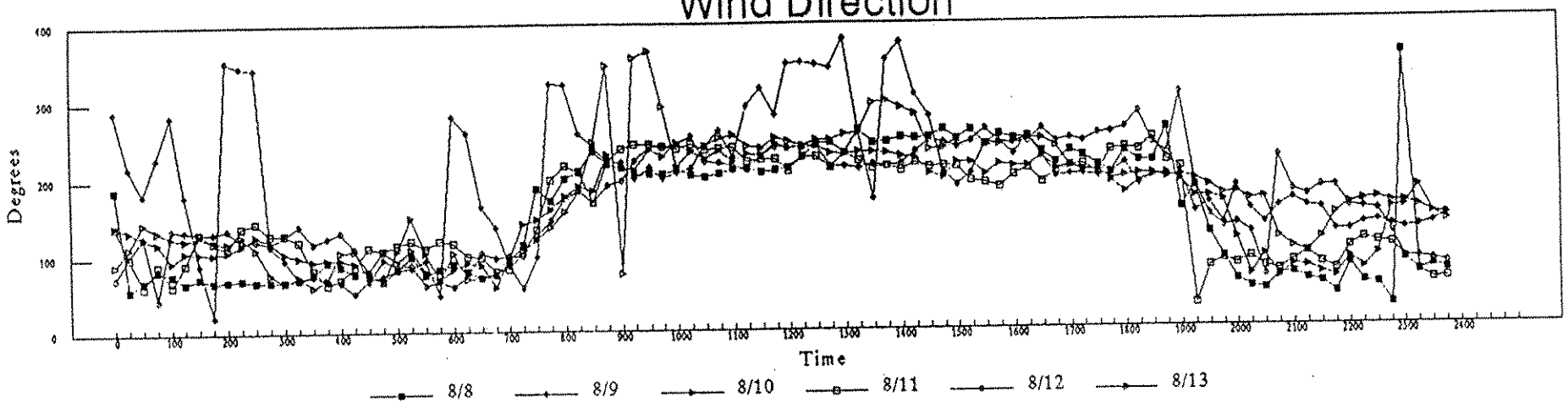
Wind Speed m/s



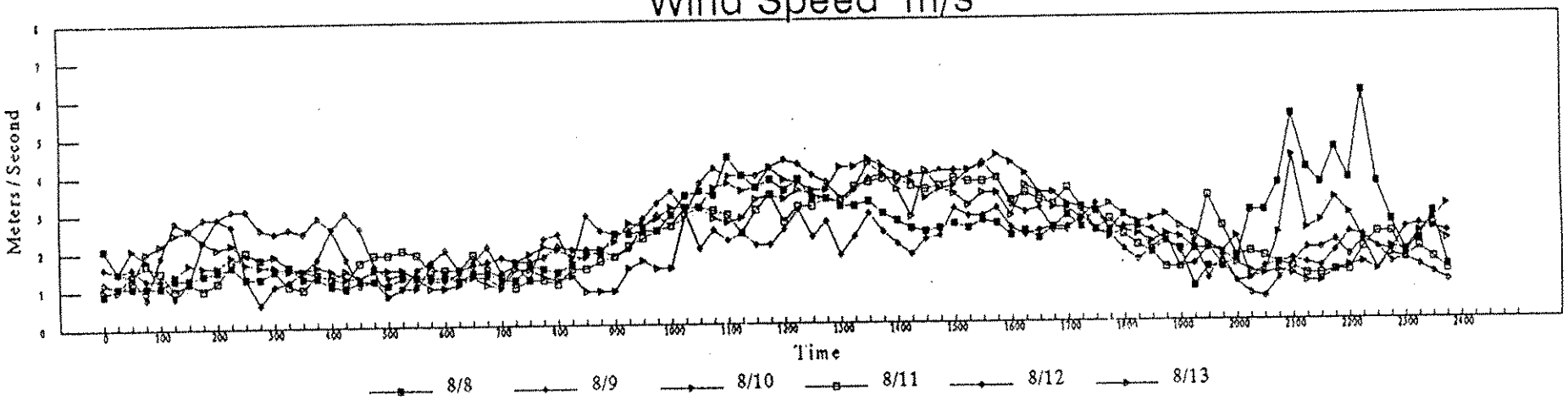
NOx Concentration ppb



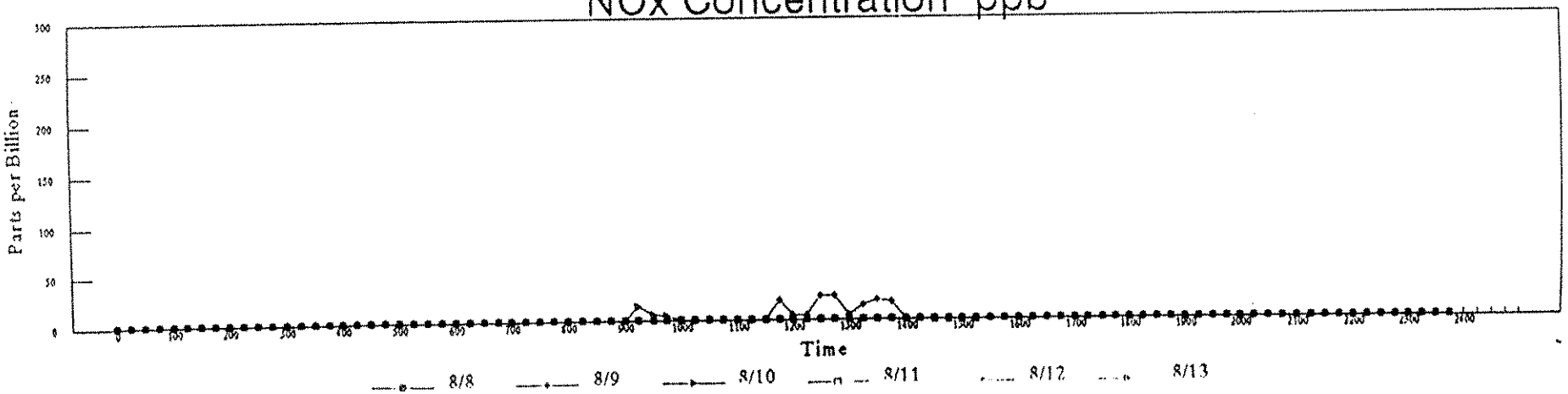
Wind Direction



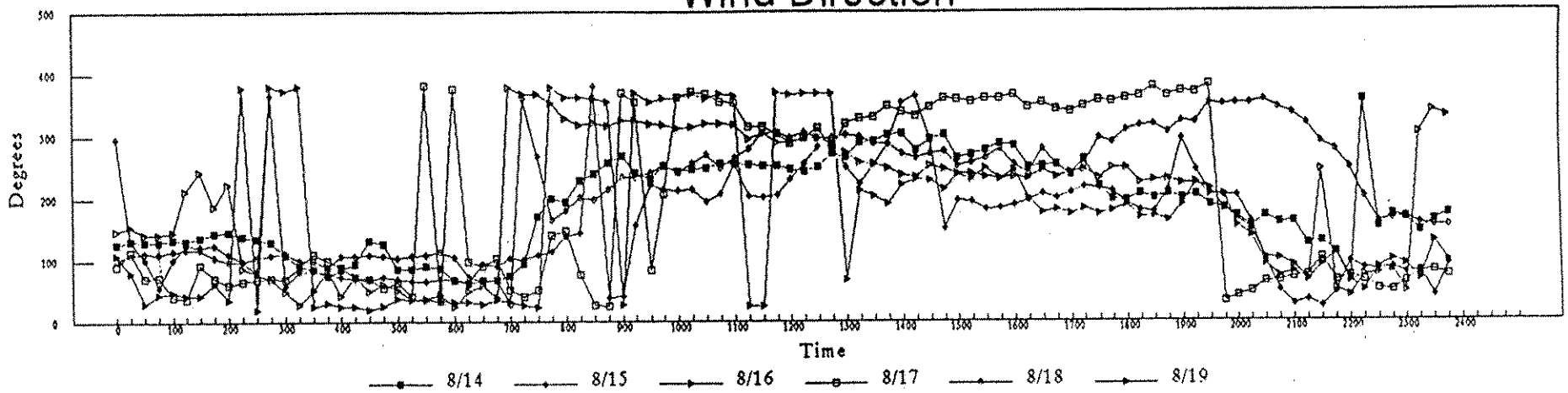
Wind Speed m/s



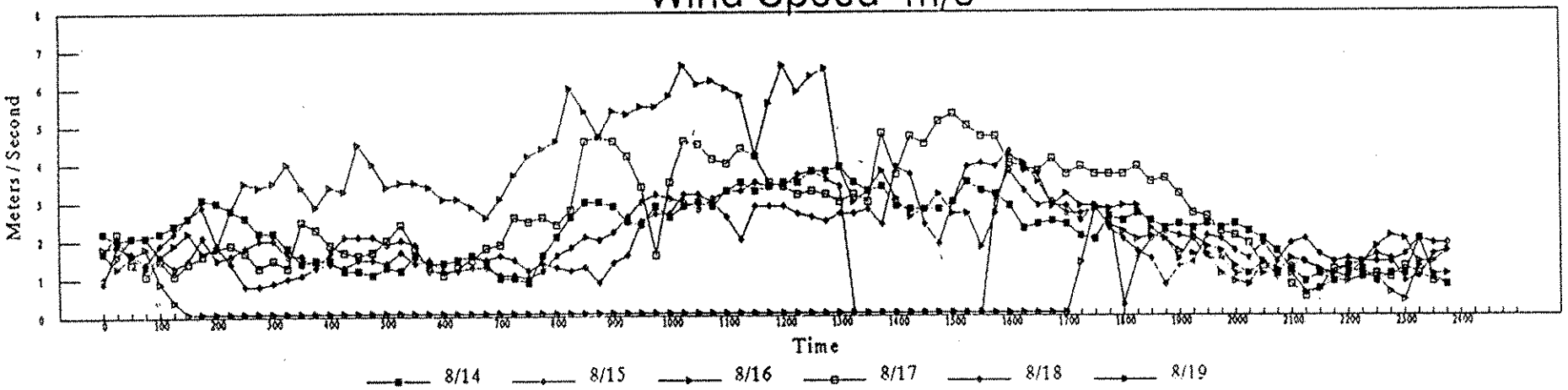
NOx Concentration ppb



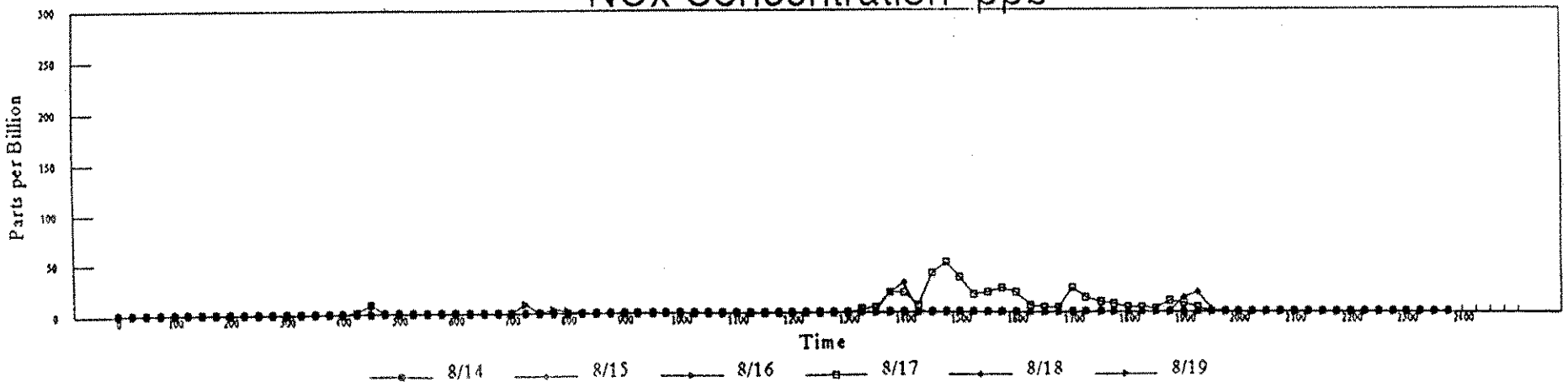
Wind Direction



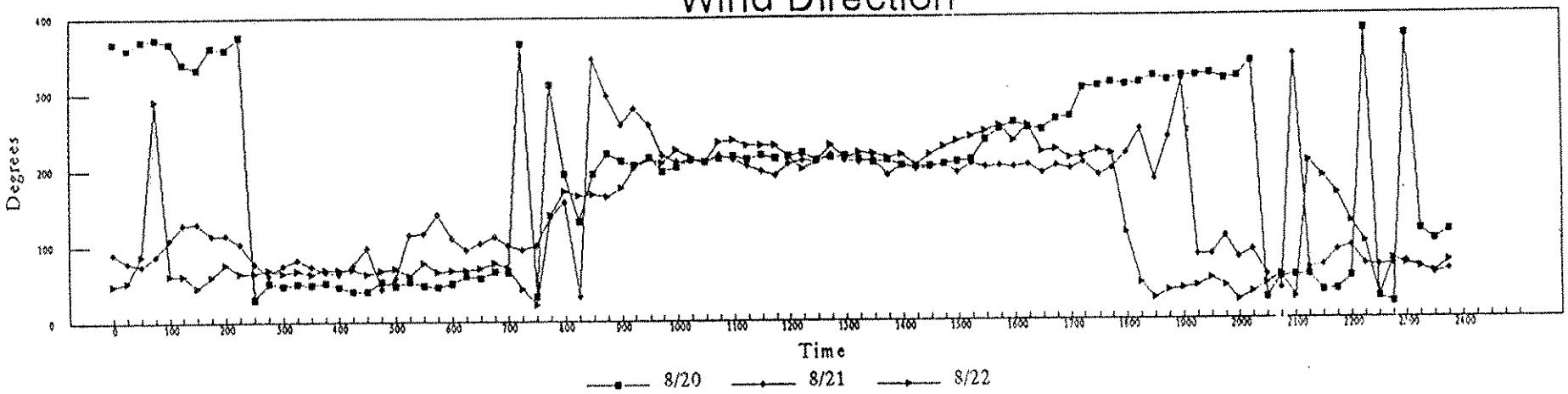
Wind Speed m/s



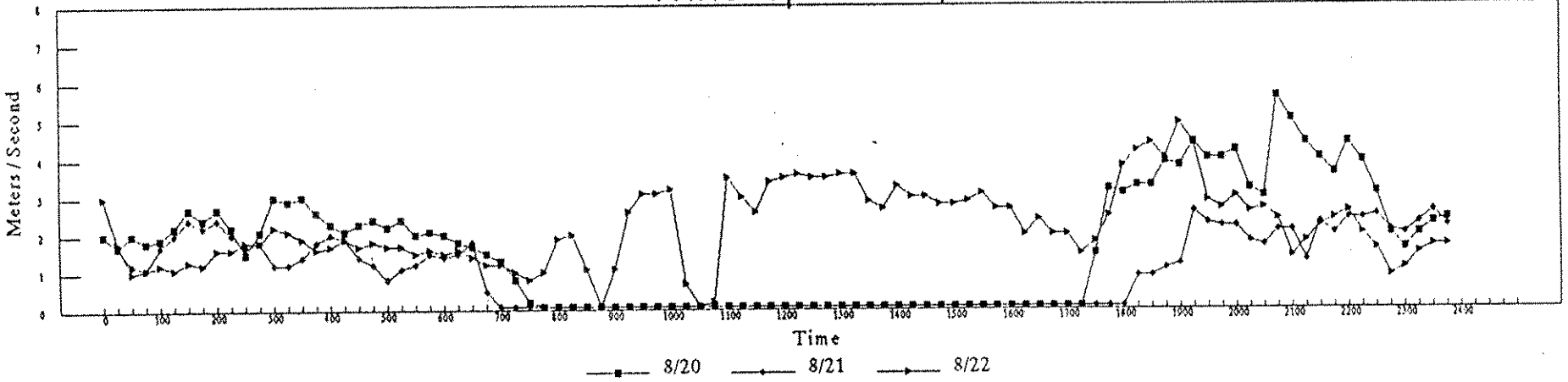
NOx Concentration ppb



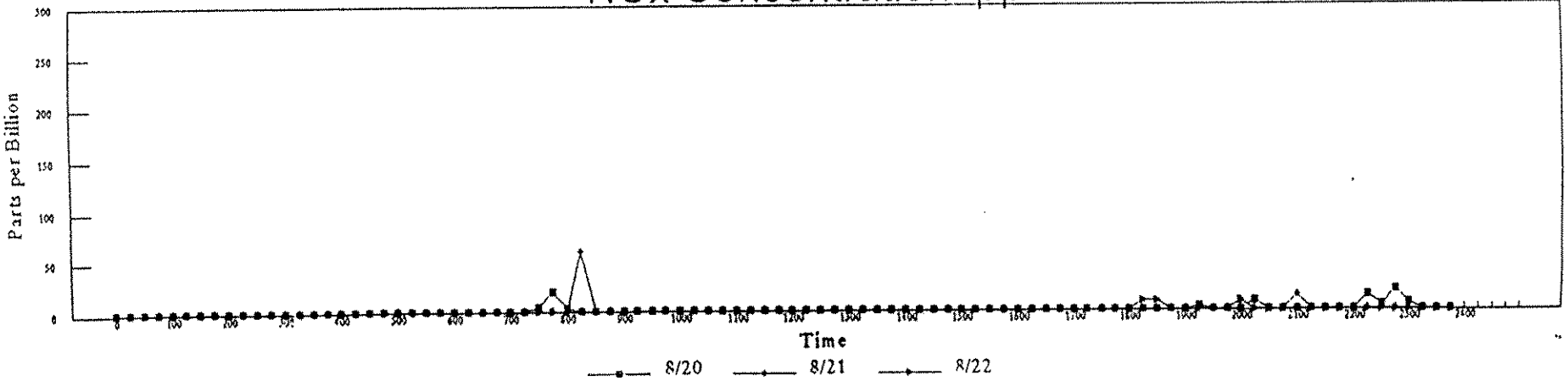
Wind Direction



Wind Speed m/s



NOx Concentration ppb

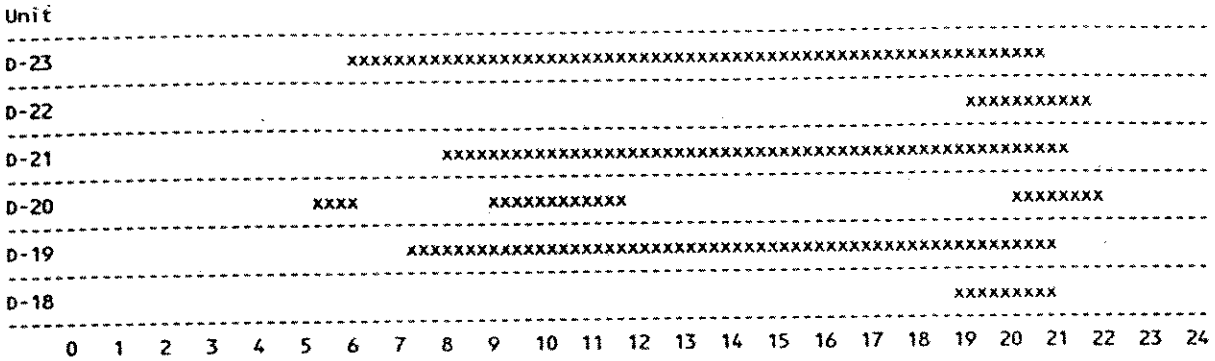


Appendix D

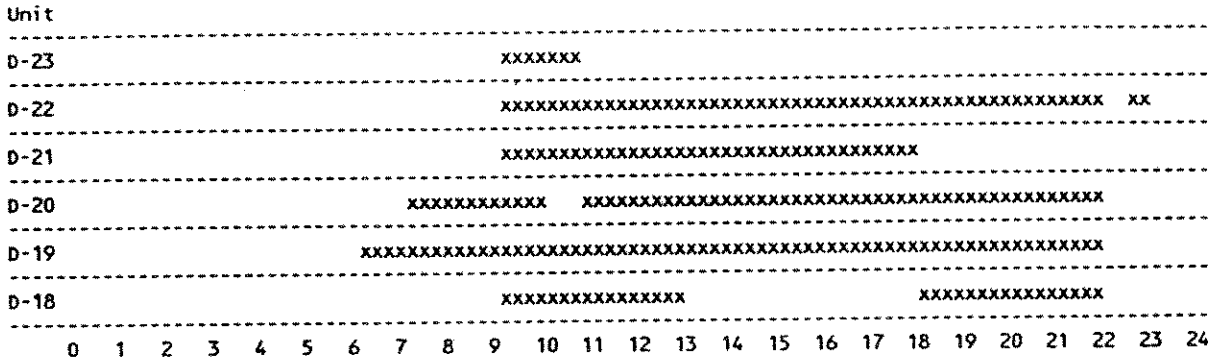
Plant Operations Data for Keahole Generating Station, July 20 through August 21, 1993

KEAHOLE POWER PLANT - DIESEL UNIT OPERATIONAL DATA

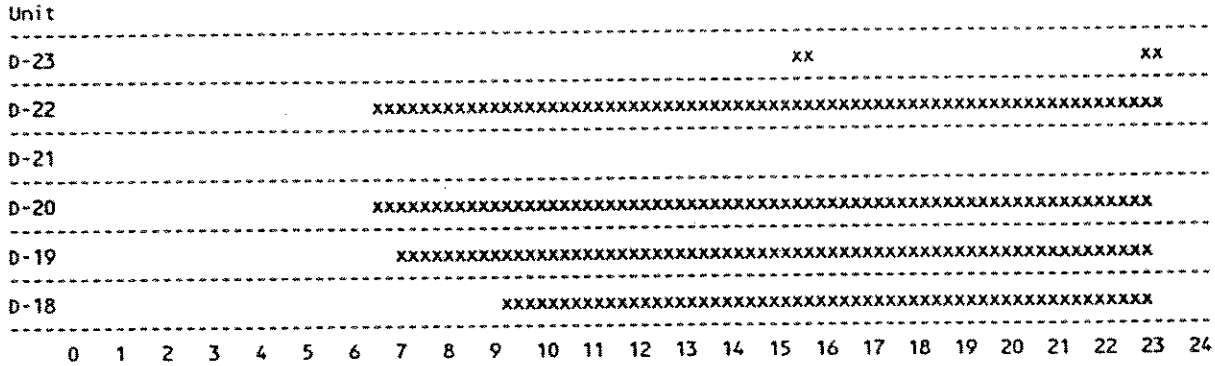
Date: 7-20-93



Date: 7-21-93



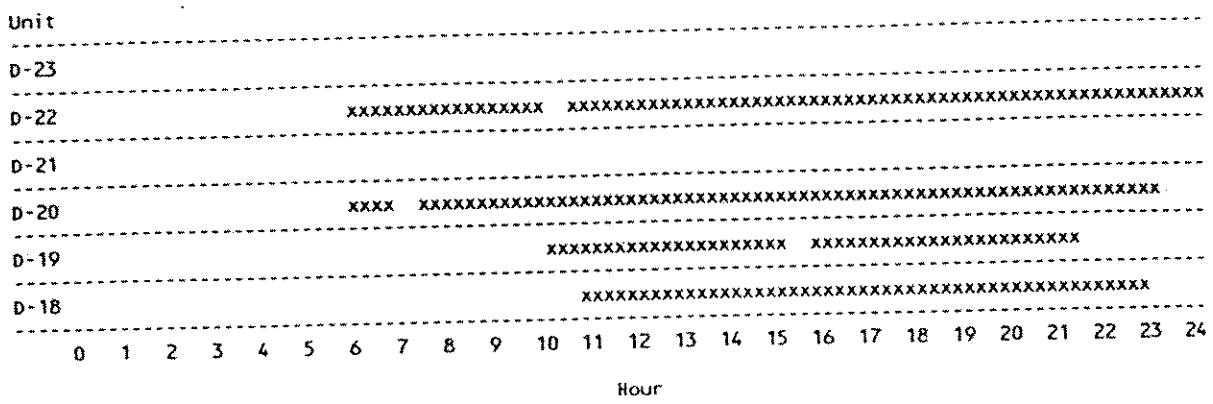
Date: 7-22-93



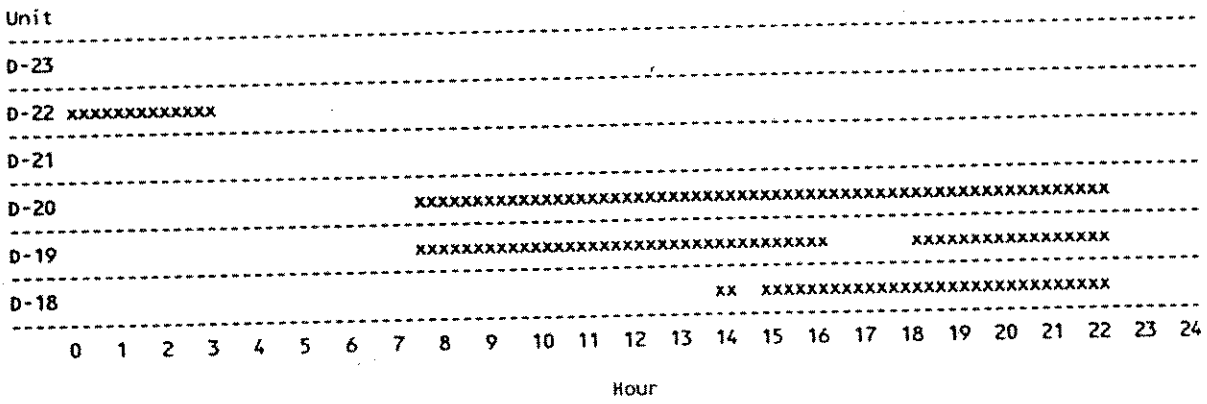
Note: "x" indicates unit operational

KEAHOLE POWER PLANT - DIESEL UNIT OPERATIONAL DATA

Date: 7-23-93



Date: 7-24-93



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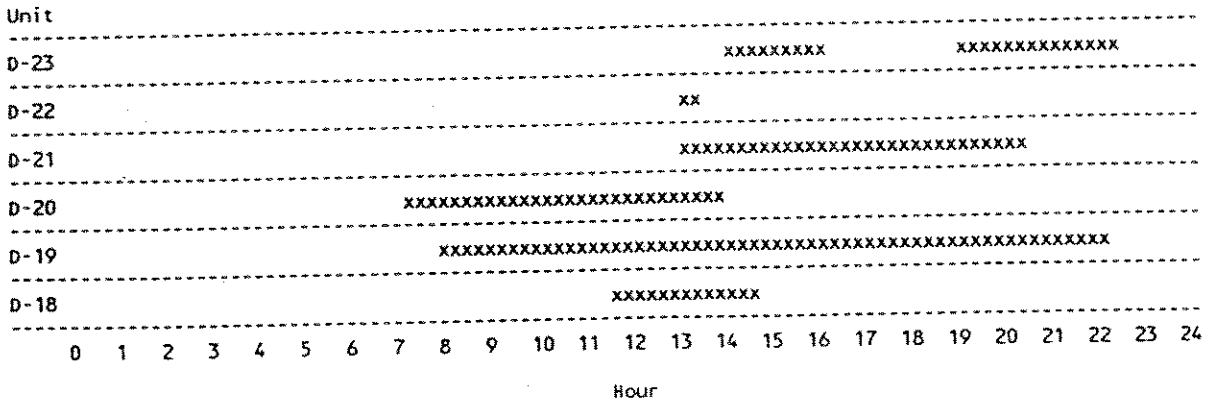

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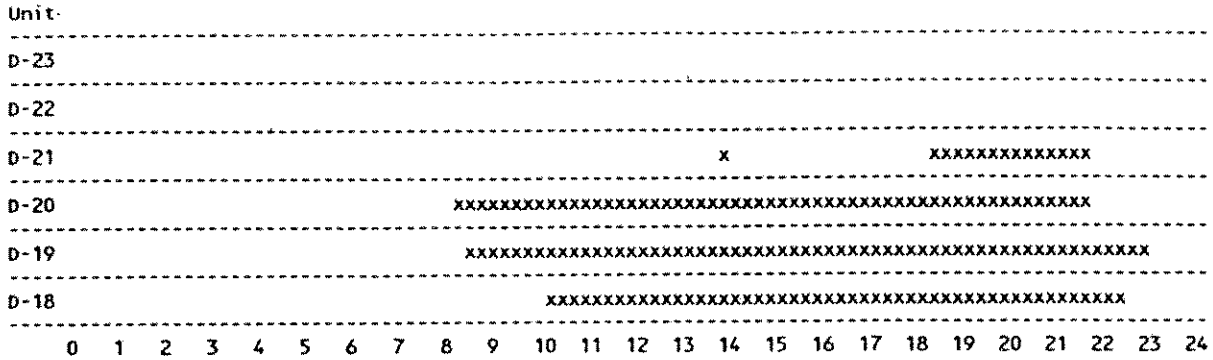

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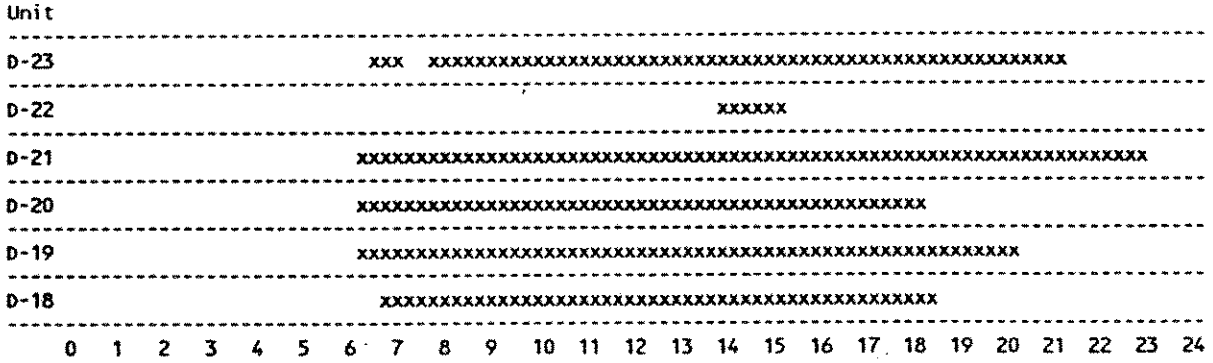

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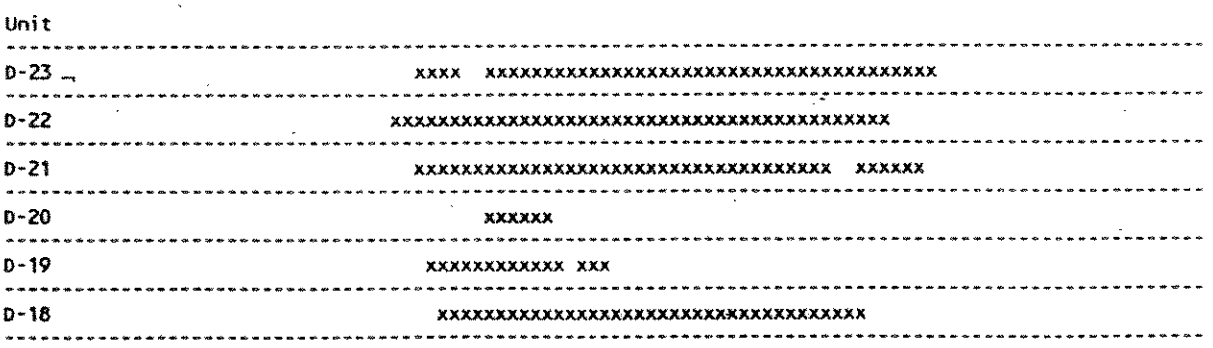

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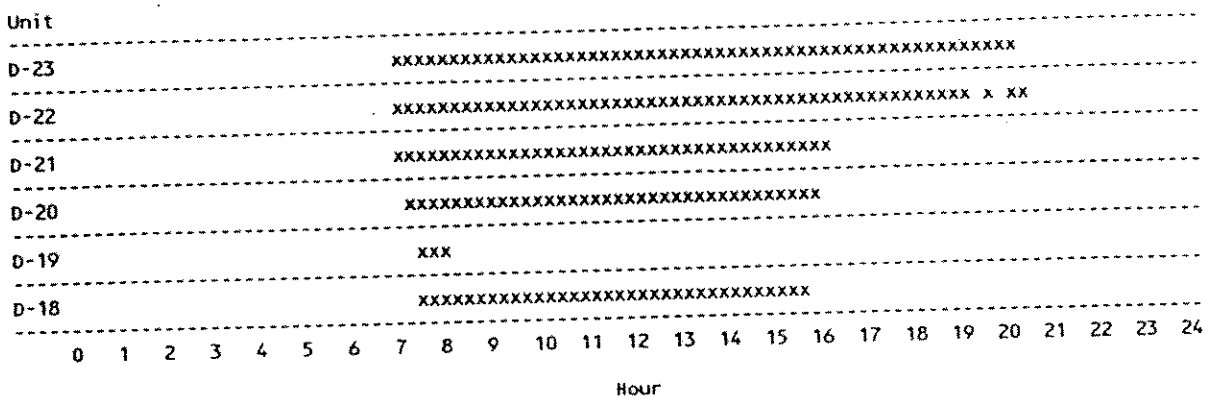

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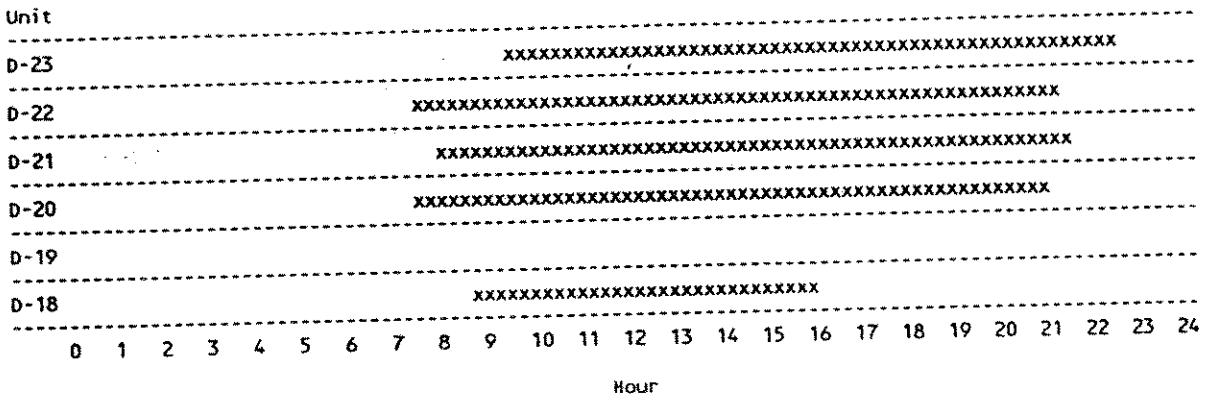

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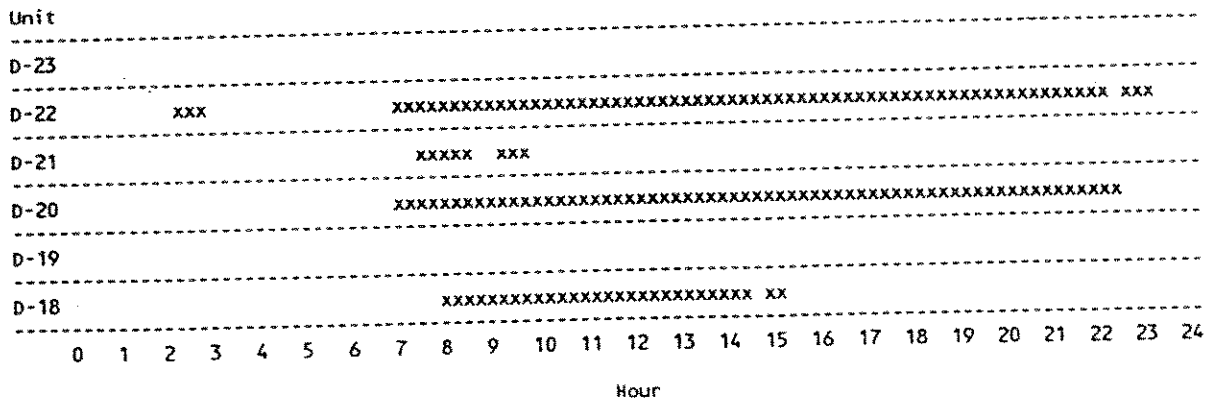

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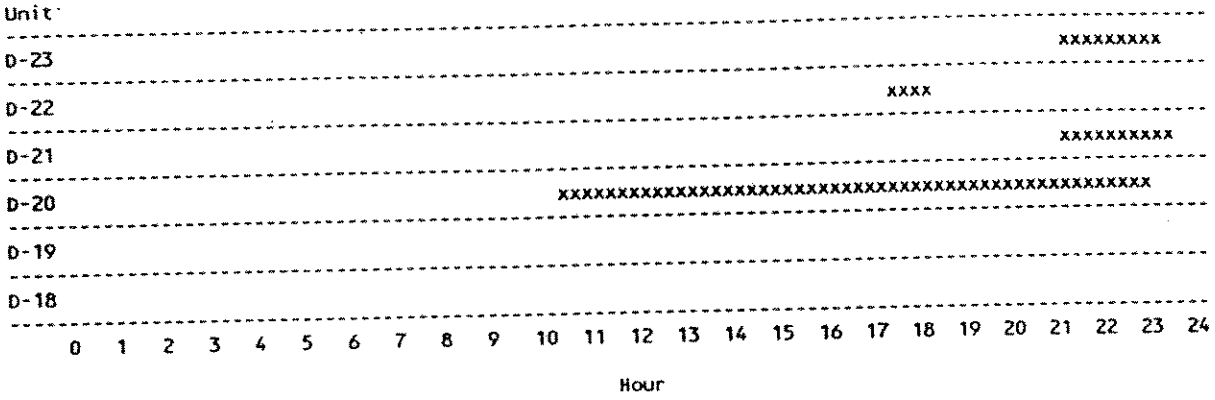

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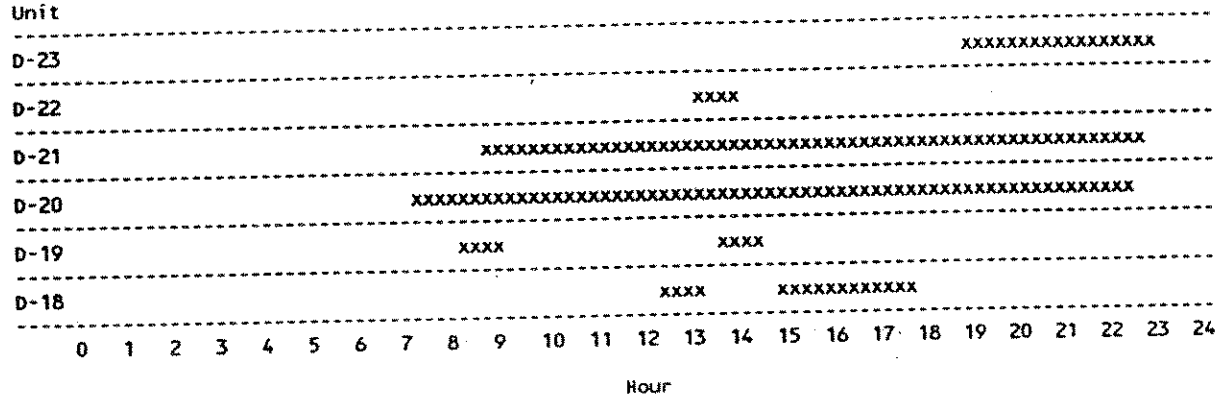

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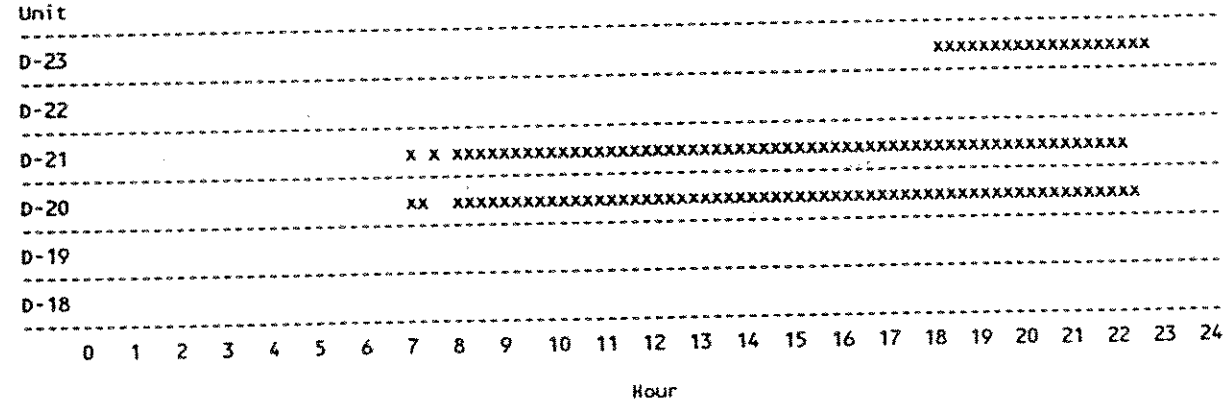

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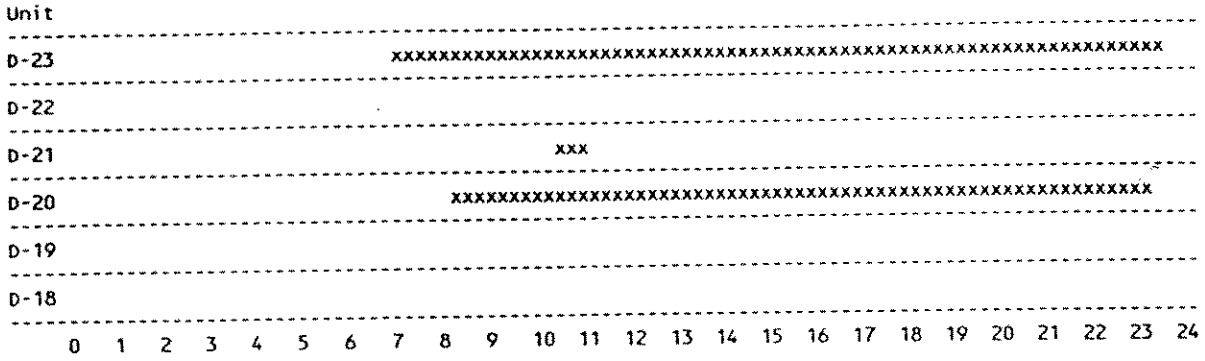

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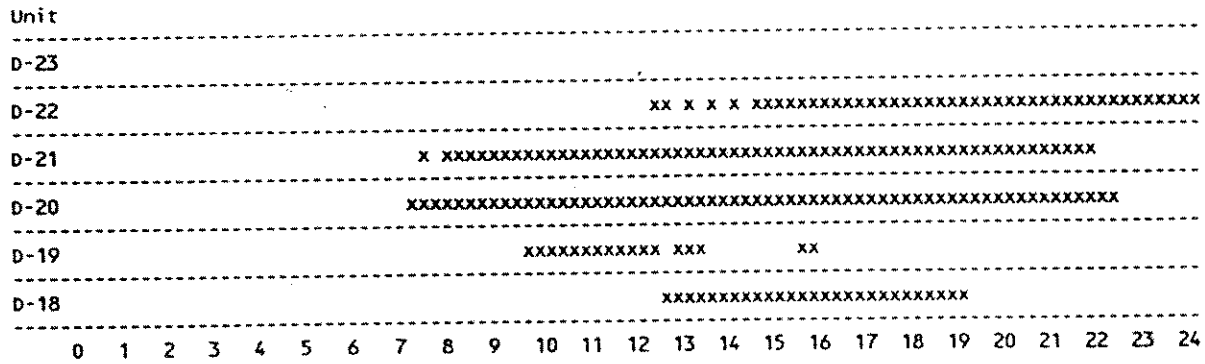

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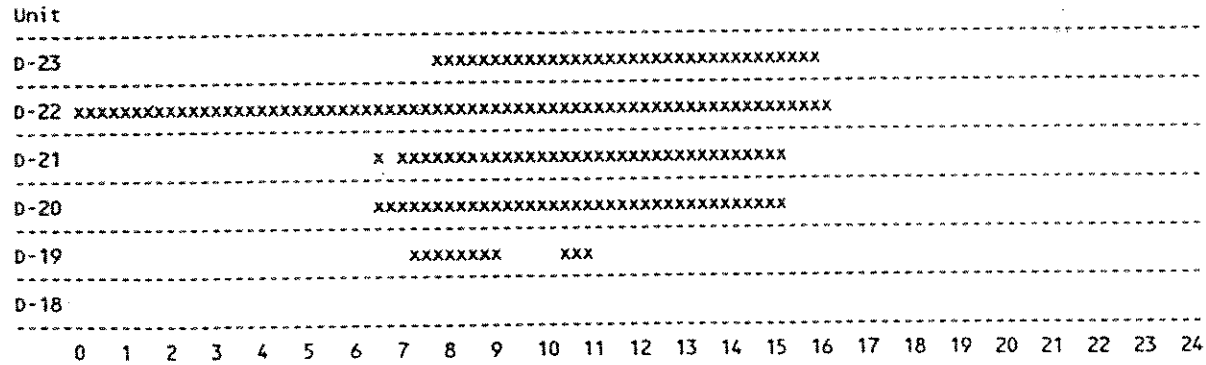

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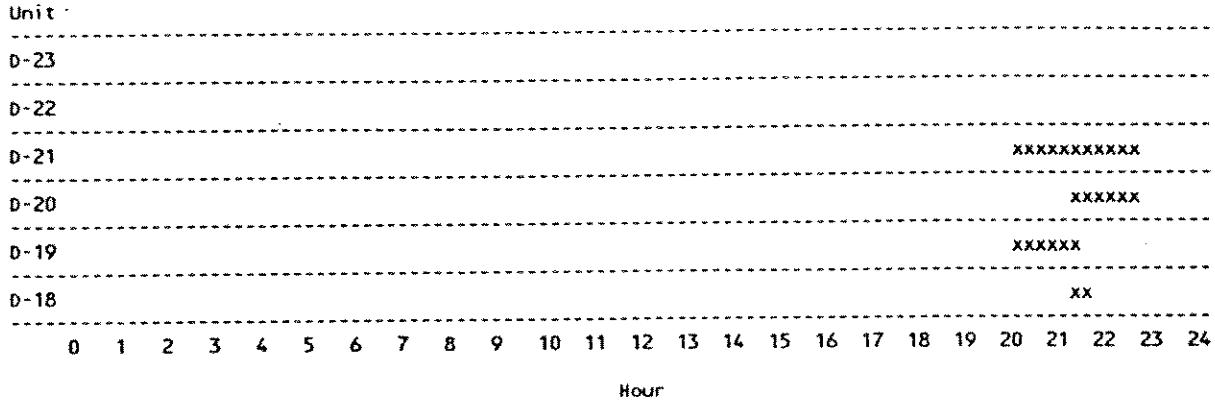

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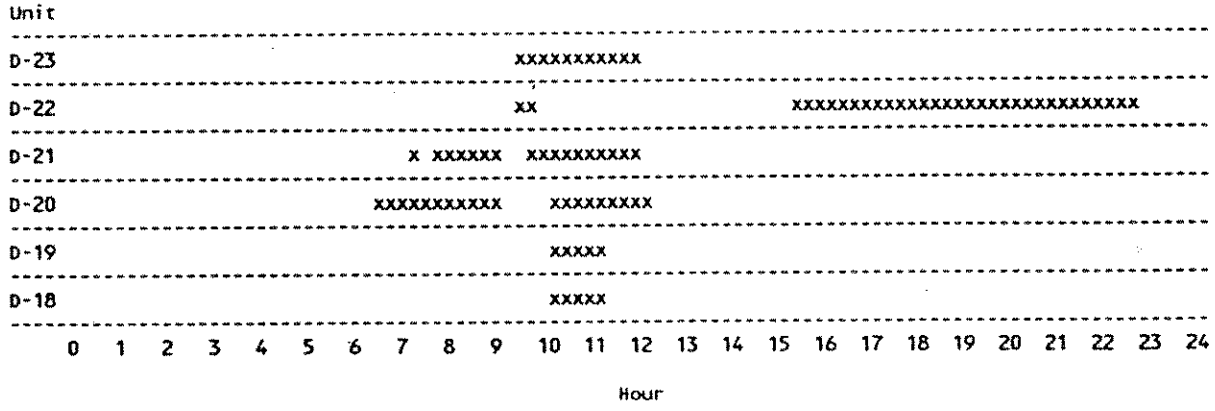

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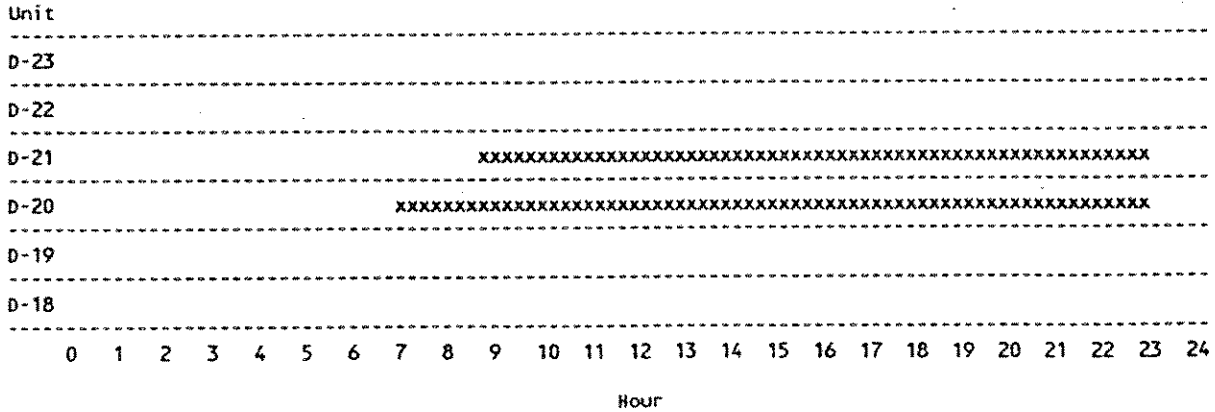

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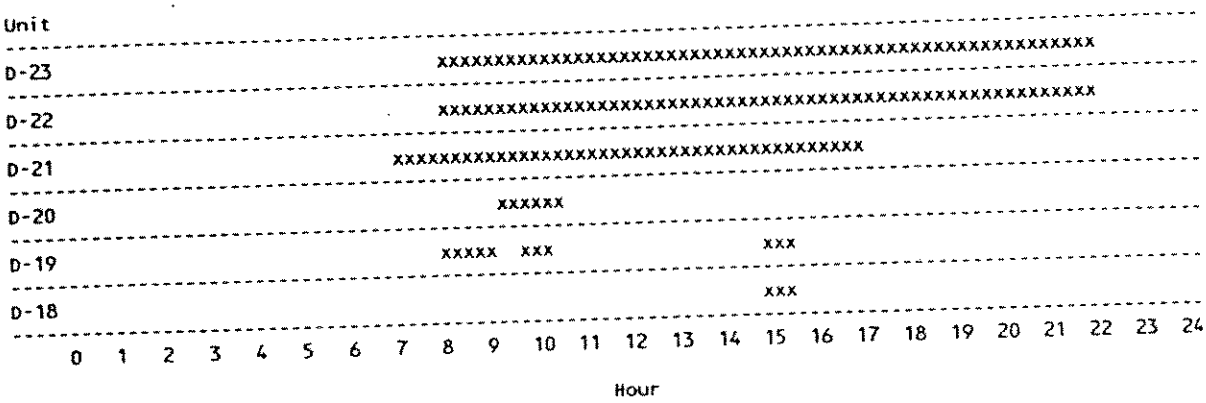

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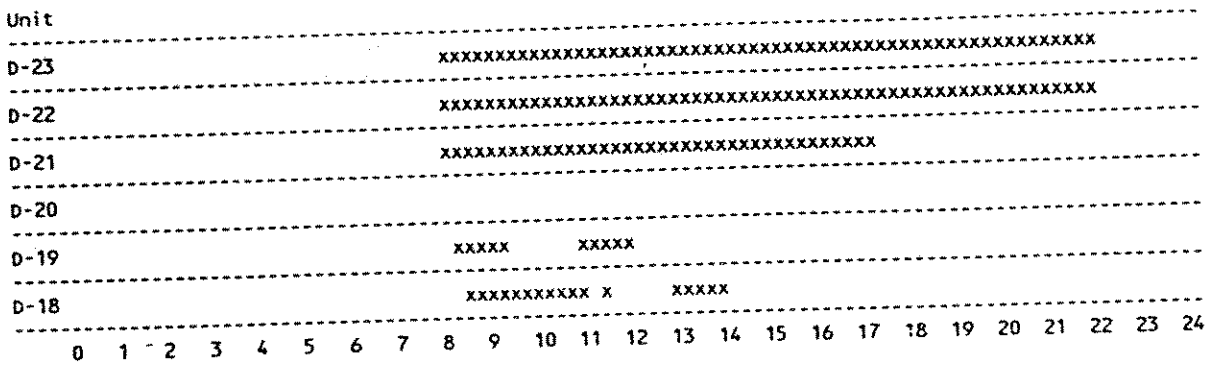

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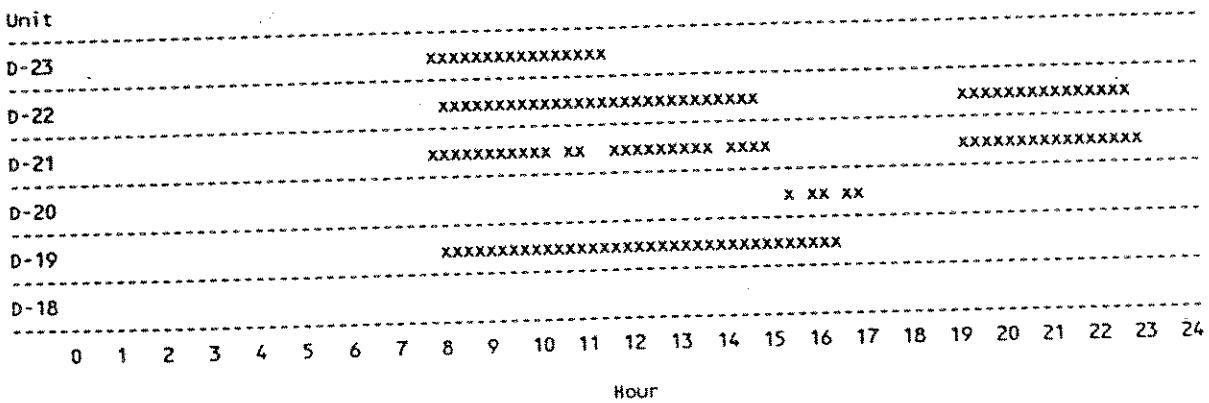

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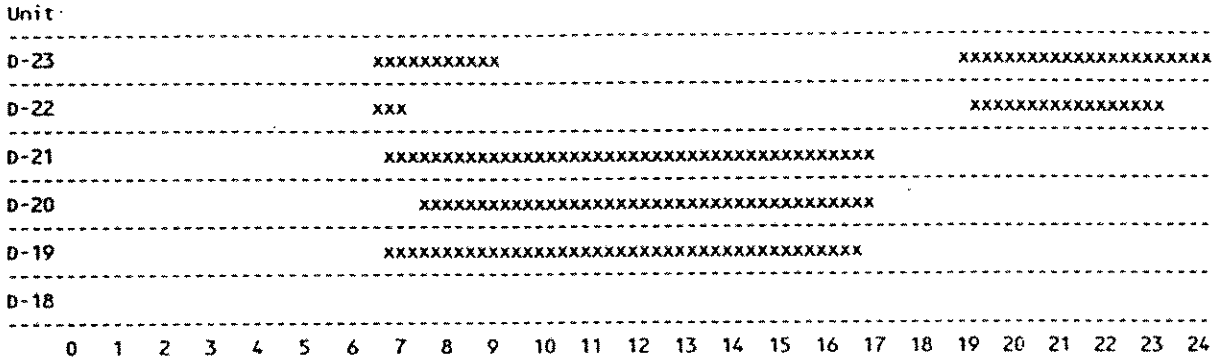

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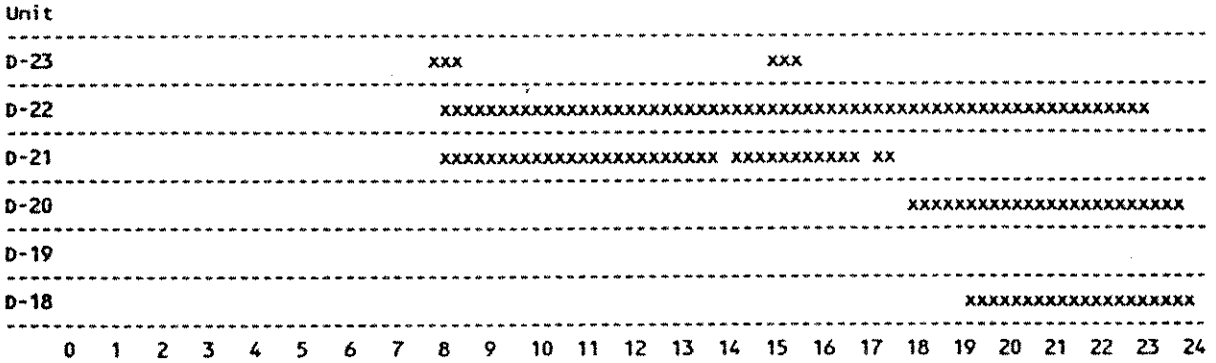

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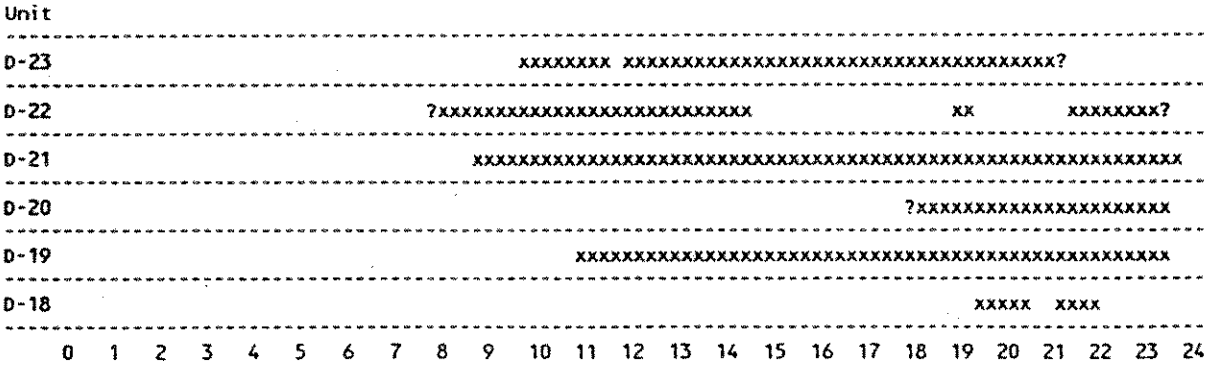

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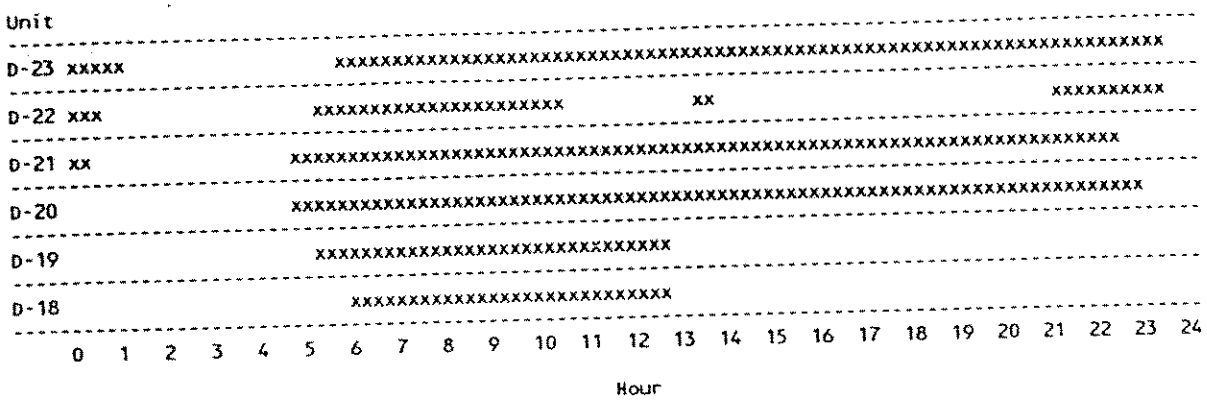

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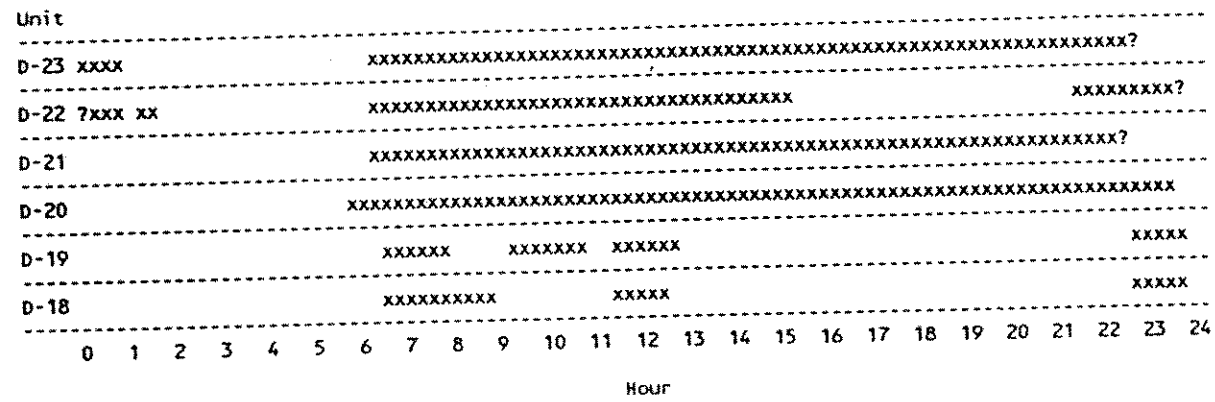

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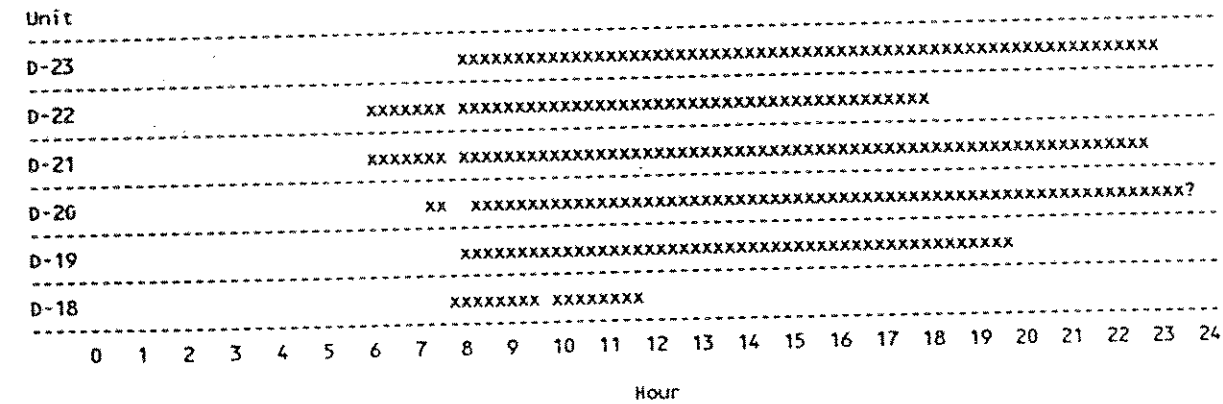

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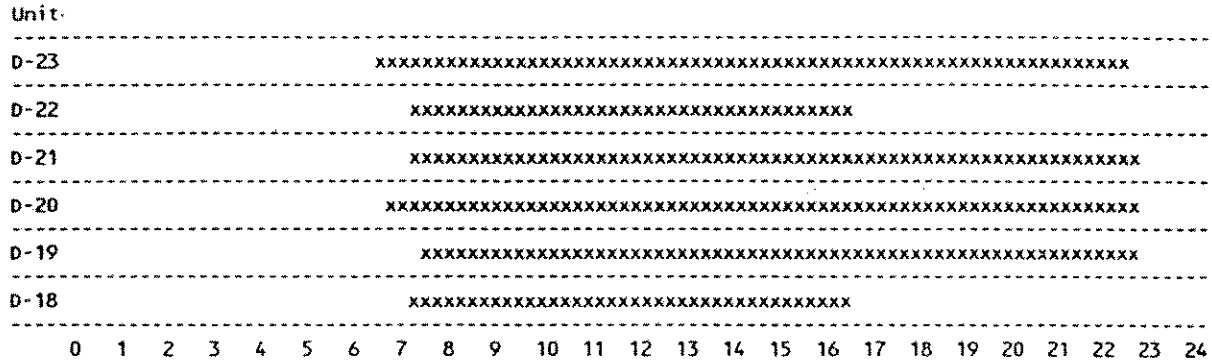

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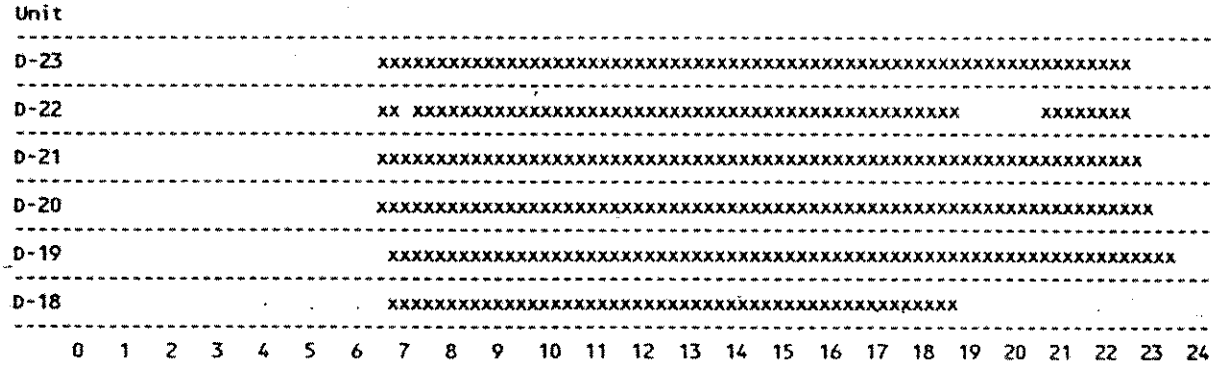

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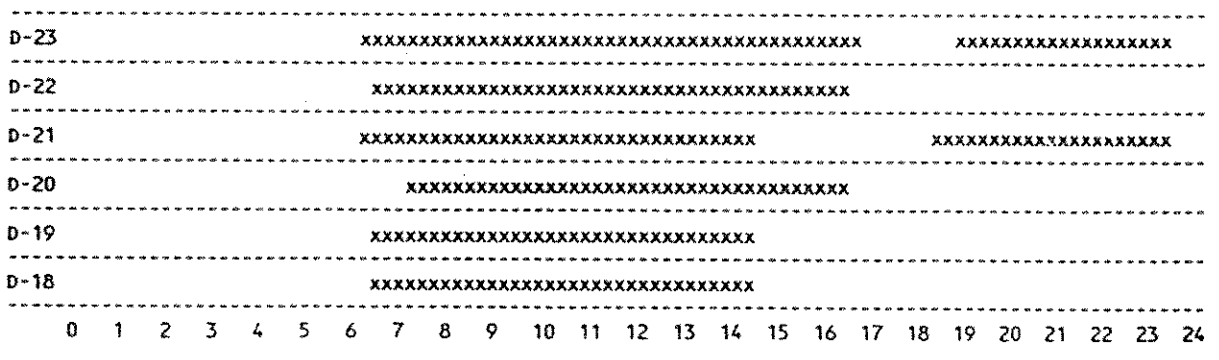

Note: "x" indicates unit operational

Attachment C
Air Quality Study—Acid Aerosol and Ethylene

ATTACHMENT C

AIR QUALITY STUDY
ACID AEROSOL AND ETHYLENE

Kona Orchids, Inc
Keahole, Hawaii

22 September 1993

PREPARED FOR:

ENVIRONMENTAL DEPARTMENT
HAWAIIAN ELECTRIC COMPANY, INC.
HONOLULU, HAWAII

PREPARED BY:

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1481 South King Street, Suite 548
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1. INTRODUCTION

Due to concern about the proposed expansion of the existing Keahole Power Plant on the Island of Hawaii and its potential impacts on adjacent agricultural operations, most notably orchid farms, the Hawaiian Electric Company, Inc. (HECO) commissioned a short-term air sampling program in the area. The plant itself consists of six diesel generators and an oil-fired combustion turbine. The primary concern centered on oxides of nitrogen, acid aerosols, and ethylene, all of which have some association with power plant emissions and all of which have some degree of phytotoxicity.

The owner of one of the nearest orchid farms, Kona Orchids, Inc., offered the use of his property, and sampling equipment was installed and operated during the July - August 1993 timeframe (see Figure 1). HECO itself set up meteorological sensors and a NO/NOx sampler. The results of that effort will be presented in a separate report. It is the purpose of this report to present the results of the acid aerosol and ethylene sampling.

2. METHODS

2.1 Acid Aerosol. Annular denuder technology was used to collect acid aerosol samples in accordance with standard U.S. Environmental Protection Agency methods [1]. The sampling train consisted of a 2.5-micron cutoff cyclone followed by an acid gas absorbing denuder tube, an alkaline gas absorbing tube, and a Teflon filter to collect acidic particles.

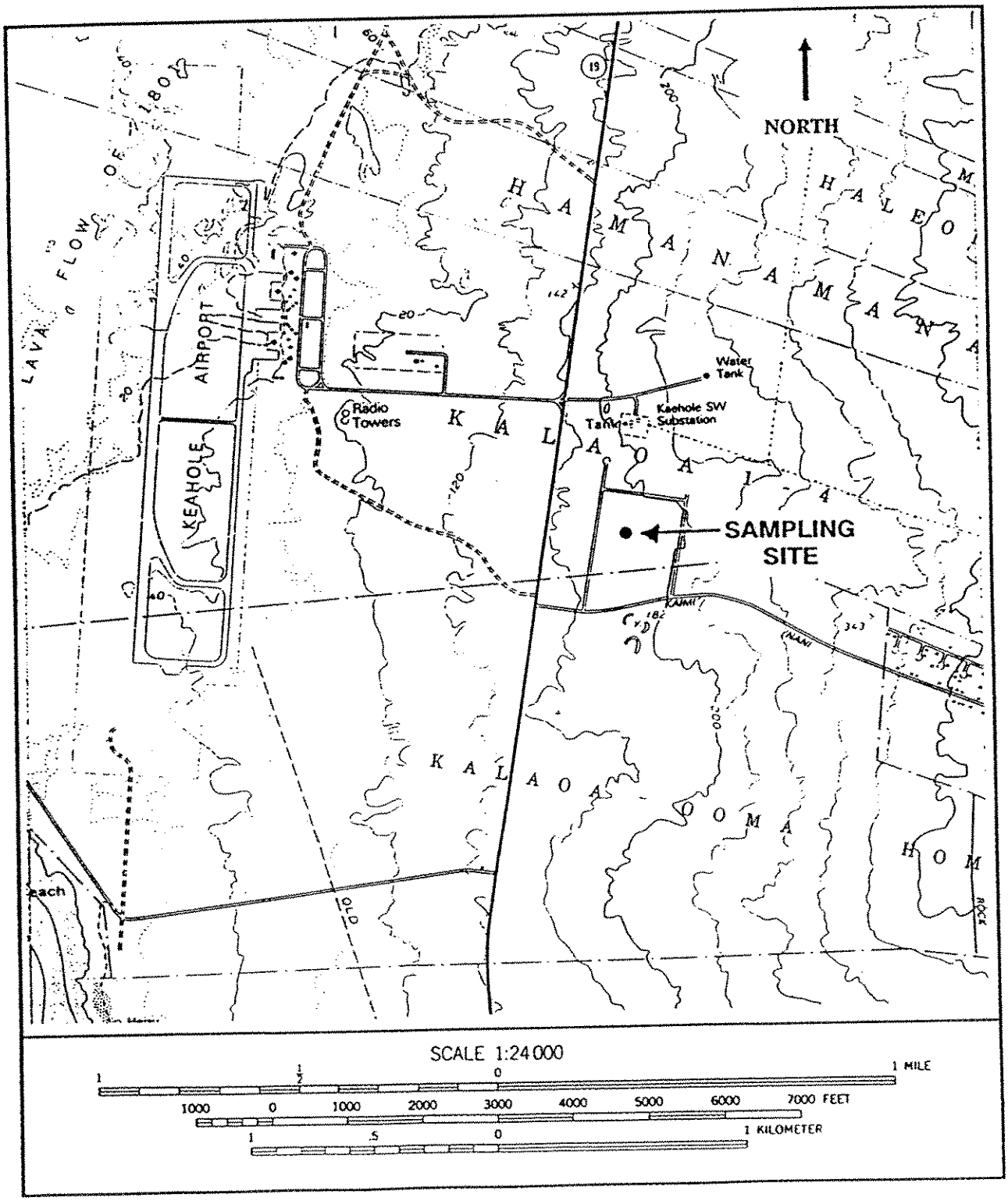
Due to the diurnal onshore/offshore wind pattern in this coastal area, day/night sampling periods were defined as 7:00 a.m. to 7:00 p.m. and 7:00 p.m. to 7:00 a.m., respectively. Thus, 12-hour samples were collected every other day during the 23 July - 22 August 1993 period (with the exception of 16 August due to an approaching hurricane).

Denuder tube extracts were analyzed for the presence of sulfate ($SO_4^=$), nitrate (NO_3^-), and chloride (Cl). Teflon filter extracts were analyzed for pH and sulfate, nitrate, and ammonium (NH_4^+) ions.

2.2 Ethylene. Stainless steel SUMMA canisters were used to collect ethylene in accordance with an EPA-approved standard method [2]. Six 6-hour samples were collected during the 15 - 20 August 1993 period. Based on advice from HECO and the results of the plume impact study [3], a background sample was collected at night (9:00 p.m. - 3:00 a.m.) on 15 August and the remaining five samples

FIGURE 1

SAMPLING SITE LOCATION



were collected during the daytime (7:00 a.m. to 1:00 p.m.) when it was believed plume impaction would be most probable. Upon completion of the 6-day sampling period, canisters were immediately sent to the laboratory for gas chromatographic analysis.

2.3 Sulfur Hexafluoride (SF_6) Tracer. During portions of the ethylene sampling period, the tracer gas SF_6 was released continuously at a rate of 1.7 lb/hr from one of the power plant stacks. If the plume impacted the orchid farm during the sampling, SF_6 would have been collected in a canister and subsequently identified by gas chromatography. See also the B. D. Neal report prepared for Part I of this study [3].

3. RESULTS

3.1 Acid Aerosol. The results of the day/night acid aerosol sampling are summarized in Tables 1 and 2. The complete data set may be found in Appendix A.

SO_2 concentrations were low and comparable to the SO_2 data collected by the State Department of Health in the past [4], i.e., mostly < 5 ug/m^3 with occasional excursions into the 10 - 20 ug/m^3 range. As noted in a recent volcanic air pollluton (VOG) study, oxidation of the large SO_2 emissions from Kilauea Volcano (1,000 - 1,500 T/da) results in little SO_2 being measured in the ambient air downwind [5]. There appeared to be an almost 3-fold difference between daytime and nighttime SO_2 levels and upon statistical analysis (t-test), this proved to be significant ($p < 0.025$).

The higher daytime levels are most likely attributable to the onshore breezes bringing in parcels of VOG-laden air. Statistical analysis of the winds during the day/night 12-hour sampling periods revealed generally southwesterly winds during the day and east-southeasterly winds at night ($p < 0.005$).

HCl levels were negligible with one excursion to 4 ug/m^3 on 8 August. Due to numerous interferents for chloride showing up on the chromatograms, we recommend considering all HCl concentrations as "estimates". Although the mean nighttime level was substantially greater than the daytime value, this difference was not found to be statistically significant.

HNO_3 concentrations were also negligible most of the time, but a few excursions above 5 ug/m^3 occurred during the day and night. While the higher daytime levels might be expected due to photochemical oxidation, the statistical significance did not quite reach the $p = 0.10$ level. A larger sample size might well have

produced "significance."

H_2SO_4 levels were calculated based on measured strong acidity (pH) and $SO_4^=$ concentrations. The mean value is comparable to what has been found at Captain Cook, some 20 miles south of the orchid farm in recent years [6]. The higher mean value found during the day was found to be significant ($p < 0.05$). As with HNO_3, this is

TABLE 1

SUMMARY OF ACID AEROSOL SAMPLING RESULTS (DAYTIME)

Pollutant	Concentrations (ug/m^3)		
	Range	Mean	Std. Dev.
Sulfur dioxide SO_2	0.7 - 24.1	6.1	6.09
Hydrochloric acid HCl	0.0 - 0.4	0.0	0.13
Nitric acid HNO_3	0.0 - 14.2	2.7	4.21
Sulfuric acid H_2SO_4	0.0 - 4.5	1.5	1.20
Ammonium bisulfate $(NH_4)HSO_4$	0.7 - 4.6	1.8	0.88
Ammonium sulfate $(NH_4)_2SO4$	0.8 - 5.3	2.1	1.01

scientifically plausible due to the higher oxidation rates of SO_2 which would occur in the presence of sunlight. It is probably also attributable to the onshore breezes during the day which transport VOG into the area.

The two salts (ammonium bisulfate and ammonium sulfate) produced by the neutralization reaction of H_2SO_4 with atmospheric ammonia (NH_4), were estimated based on the molar quantities of $SO_4^=$ and NH_4^- remaining after the H_2SO_4 was calculated. Their higher mean nighttime concentrations approached significance at the $p = 0.05$ level.

3.2 Ethylene and Sulfur Hexafluoride. The results of the ethylene and SF_6 sampling are summarized in Table 3. Ethylene concentrations were found at essentially background levels, and the absence of SF_6 tends to substantiate this by the apparent lack of plume impact. The slightly elevated Sample No. 5 may have resulted from farm vehicle activity at the site.

TABLE 2

SUMMARY OF ACID AEROSOL SAMPLING RESULTS (NIGHTTIME)

Pollutant	Concentration (ug/m^3)		
	Range	Mean	Std. Dev.
Sulfur dioxide SO_2	0.2 - 5.4	2.3	1.62
Hydrochloric acid HCl	0.0 - 4.5	0.3	1.15
Nitric acid HNO_3	0.0 - 8.0	1.0	2.64
Sulfuric acid H_2SO_4	0.0 - 2.1	0.8	0.68
Ammonium bisulfate $(NH_4)HSO_4$	1.2 - 4.8	2.4	0.91
Ammonium sulfate $(NH_4)_2SO4$	1.4 - 5.6	2.8	1.04

4. CONCLUSIONS

Based on the data collected in this sampling program, one may draw the following conclusions:

- the levels of acid aerosol found (primarily sulfuric acid and its atmospheric neutralization products) were comparable to what is being measured in volcanic air pollution studies at Captain Cook. There was no indication of elevated levels which might be attributable

to power plant operations. Recent health effects research suggests that long-term exposure to acidity at this level may result in increased rates of bronchitis in school-aged children [7]. At this time we have no evidence of phytotoxic effects at the acidity levels measured.

TABLE 3

ETHYLENE AND SF_6 SAMPLING RESULTS

Sample No.	Date	Time	Concentration (ug/m^3)	
			Ethylene	SF_6*
01	15 Aug 93	9 pm - 3 am	0.3	0.0
02	16 Aug 93	7 am - 1 pm	0.5	0.0
03	17 Aug 93	7 am - 1 pm	0.7	0.0
04	18 Aug 93	7 am - 1 pm	0.2	0.0
05	19 Aug 93	7 am - 1 pm	1.3	0.0
06	20 Aug 93	7 am - 1 pm	0.6	0.0

Note: SF_6 was only released at the power plant on 18 and 19 August.

- o significant day/night differences in acid aerosol constituents were found and appeared consistent with local meteorology and what is known about atmospheric chemistry.
- o ethylene levels were found at normal atmospheric background levels and both wind data and SF_6 tracer results indicated no plume impact occurred during the sampling period. There is at least one study showing adverse effects on vegetation at the 1.3 ug/m^3 ethylene level reported here [8].

REFERENCES

1. U. S. Environmental Protection Agency. Determination of the Strong Acidity of Atmospheric Fine-Particles (<2.5 um) Using Annular Denuder Technology, EPA/600/R-93/037, November 1992.

2. TO-14: "Determination of volatile organic compounds (VOCs) in ambient air using SUMMA passivated canister sampling and gas chromatographic analysis in Methods for Determination of Toxic Organic Compounds in Air, W.T. Winberry, N.T. Murphy and R.M. Riggins, Eds., Hayes Data Corporation, New Jersey, 1990, pp. 467-583.

3. Neal, B. D. Plume Impact Study at Keahole Agricultural Park, Keahole, Hawaii, September 15, 1993 (DRAFT).

4. State of Hawaii, Department of Health. Hawaii Air Quality Data For the Period of January 1985 - December 1987.

5. Morrow, J. W., E. J. Morgan, A. N. Furuike, T. A. Peters, and C. R. Badgett-West. Characterization of Volcanic Aerosol in Two Populated Areas on the Island of Hawaii: First Year Findings of a 3-Year Investigation, Paper No. 91-89.2, Air & Waste Managment Association Annual Meeting, Vancouver, 1991.

6. Morrow, J. W. "Volcanic Air Pollution in Captain Cook, Hawaii," presented at the Earthquake, Tsunami, and Volcanic Hazards Seminar sponsored by the Center for the Study of Active Volcanoes, Hilo, 6 August 1992.

7. Speizer, F.E. Studies of Acid Aerosols in Six Cities and in a New Multi-City Investigation: Design Issues, Environ. Health Perspect. 79: 61-67, 1989.

8. Crocker, W., P.W. Zimmerman, and A.E. Hitchcock. Similarities in the Effects of Ethylene and the Plant Auxins. Contribution from Boyce Thompson Institute 7(3): 231-248, July - September 1935 cited in Air Quality Criteria for Hydrocarbons (AP-64), March 1970.

APPENDIX A

ACID AEROSOL DATA

AIR QUALITY STUDY: KONA ORCHIDS, INC. 22 SEP 93

ACID AEROSOL DATA (DAYTIME)

DATE	SO2	HCl	HNO3	H2SO4	(NH4)HSO4	(NH4)2SO4
930723	0.7	0.1	0.2	0.0	0.7	0.8
930725	6.4	0.4	14.2	0.3	1.9	2.1
930727	3.1	0.0	0.0	1.3	0.9	1.0
930729	24.1	0.1	1.5	4.5	1.3	1.5
930731	1.6	0.2	10.8	1.3	1.5	1.7
930802	7.7	0.1	0.5	2.5	1.61.8	
930804	7.7	0.0	0.1	0.3	2.5	2.8
930806	3.2	0.0	0.1	0.7	1.9	2.2
930808	3.2	0.0	0.0	2.8	1.3	1.5
930810	15.4	0.0	4.4	2.1	1.9	2.2
930812	1.8	0.0	1.2	1.0	1.4	1.6
930814	6.9	0.0	0.6	2.5	1.6	1.8
930818	0.7	0.0	1.9	0.0	2.3	2.6
930820	6.8	0.1	1.2	2.1	4.6	5.3
930822	2.0	0.0	4.8	1.3	2.4	2.7
Mean:	6.1	0.0	2.7	1.5	1.8	2.1
Std:	6.09	0.13	4.21	1.20	0.88	1.01
Min:	0.7	0.0	0.0	0.0	0.7	0.8
Max:	24.1	0.4	14.2	4.5	4.6	5.3

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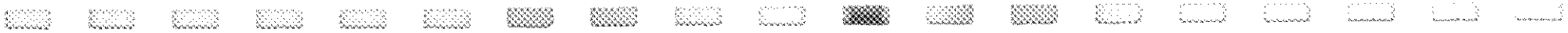
ACID AEROSOL DATA (NIGHTTIME)

DATE	SO2	HCl	HNO3	H2SO4	(NH4)HSO4	(NH4)2SO4
930723	1.1	0.8	0.0	0.0	1.2	1.4
930725	5.4	0.0	0.1	0.0	1.9	2.2
930727	1.5	0.0	0.0	0.3	2.5	2.8
930729	1.9	0.0	0.0	2.1	2.6	2.9
930731	1.2	0.0	0.0	0.0	3.3	3.8
930802	2.4	0.0	0.0	0.0	4.8	5.6
930804	5.2	0.0	6.5	1.7	2.3	2.6
930806	4.1	0.0	0.0	1.7	2.2	2.5
930808	4.6	4.5	0.0	0.7	1.6	1.8
930810	1.5	0.1	8.0	1.4	2.1	2.4
930812	0.9	0.0	2.6	1.0	2.9	3.3
930814	1.5	0.0	1.2	0.7	2.7	3.1
930818	0.2	0.0	0.0	0.7	1.5	1.7
930820	1.0	0.0	0.0	1.3	3.2	3.7
930822	2.6	0.0	0.4	1.0	1.3	1.5
Mean:	2.3	0.3	1.0	0.8	2.4	2.8
Std:	1.62	1.15	2.64	0.68	0.91	1.04
Min:	0.2	0.0	0.0	0.0	1.2	1.4
Max:	5.4	4.5	8.0	2.1	4.8	5.6

Attachment D
Focused Ecological Risk Characterization



ATTACHMENT D

Focused Ecological Risk Characterization

Hawaiian Electric Light Company
Keahole Generating Station Expansion
North Kona District, Hawaii

January 20, 1993

INTRODUCTION

Risk Science Associates has been retained by Hawaiian Electric Company, Inc. to conduct a limited-scope review and evaluation of the potential for ecological impacts from pollutants emitted from a stationary source. This report describes the results of a preliminary Focused Ecological Risk Characterization which was conducted to assess what potential, if any, exists for ethylene emitted from the expanded facility to cause adverse impacts on orchids grown commercially at a location near the generating station.

A focused ecological risk characterization is one tool decision makers can use to determine if any risk to orchids exists due to the presence of pollutants emitted from a facility. An ecological risk assessment does not state that adverse effects will occur to plants and animals found in the area; rather, it describes the chances that adverse effects may occur, no matter how remote the possibility.

In order for a chance to exist that adverse ecological impacts may occur, three conditions must exist simultaneously:

1. a substance possessing some toxicity to orchids must be present

2. there must be a sufficient amount of the substance to pose a potential risk

3. orchids must come into contact with a sufficient amount of the substance

If all three conditions do not exist, no adverse effects will occur.

EXPOSURE ROUTE OF ETHYLENE TO ORCHIDS

Orchids located near the generating station will be exposed to volatile ethylene emitted into the atmosphere from the facility. Ethylene can enter the plant through openings in the leaves called stomata. In normally functioning plants, the opening and closing of stomata regulate the transport of CO_2 and O_2 (necessary for photosynthesis) into and out of the plant by diffusion. Other volatile compounds (such as ethylene) that are found at higher concentrations outside of the leaf can also diffuse into the plant tissue through open stomata.

Exposure to ethylene is regulated by stomatal activity. Factors that result in closure of the stomata (e.g. high temperature) would also reduce the exposure to the plant from gaseous pollutants. Stomatal activity is regulated by the water content of the plant, concentration of gases in the air (e.g. CO_2), temperature and time of day (Raven et al 1986).

PHYTOTOXICITY OF ETHYLENE:

Ethylene is naturally occurring of plant hormone that aids in the control of development, maturation and senescence (aging) of plant tissues (Nichols & Frost 1984). In orchids, ethylene has the following effects (Arditti 1992):

- induces or accelerates senescence in flowers
- produces or destroys (depending on the species) anthocyanin pigments found in the flowers and other parts of the plant.

Ethylene that is produced endogenously within plants is chemically identical to that produced outside the plant; therefore, excessive amounts of ethylene in the atmosphere can accelerate senescence in flowers. To complicate matters further, stress or injury to plants can also stimulate excess production of endogenous ethylene. Such stress can be produced by mechanical perturbation, temperature extremes, water stress, insects, disease, or pollutants (Abeles 1985).

Excess levels of ethylene have been found to have many effects on plant growth and development. In orchids, young blossoms exposed to high levels of exogenous ethylene produce malformed and necrotic sepals (Heck et. al. 1970; Ormrod 1978, Taylor 1984). This condition is termed dry sepal or sepal wilt. Of five different species of orchid exposed to ethylene, *Dendrobium* flowers were the least sensitive species; *Vanda* were the most sensitive (Goh et. al. 1985).

Dendrobium flowers were also found to produce very little endogenous ethylene, with the majority being produced during the bud stage. This lead Goh et. al. (1985) to conclude that applications of exogenous ethylene could be used by the orchid cut-flower trade to force *Dendrobium* buds to open.

CHARACTERIZATION OF RISK:

Because ethylene can produce toxic effects to plants and yet is a naturally occurring plant hormone, it is interesting to note that while high concentrations may be phytotoxic, low concentrations of ethylene are necessary for normal plant development. To assess the probability that ethylene emitted from the proposed expansion of the generating facility at Keahole could potentially cause an adverse effects to the orchids located near the generating facility, concentrations that have been known to cause adverse effects in orchids or other surrogate species were compared to the predicted maximum ground level concentrations at the orchid farms.

Table 1 summarizes the available data on the concentrations of ethylene that result in adverse effects in different species of orchids compared to the predicted maximum ground level concentration (GLC) of ethylene at the orchid farms. As one can see, the predicted maximum GLCs are 2 - 4 orders of magnitude (100-10,000 times) below the concentrations that have been shown to produce dry sepal wilt in orchids (Arditti 1992).

While sensitivity to ethylene varies among species and cultivars of orchids, *Dendrobium* are among the least sensitive orchid species tested. They are also the species of orchid that is cultivated at the orchid farms near Keahole (J. Clary pers. comm.). *Dendrobium* blooms exposed to 3.0 ppm for 40 hrs showed no visible adverse effects (Goh et. al. 1985). The estimated 40 hr exposure at the orchid farms based on the 1 hr GLC (0.00012 ppm multiplied by 40 hrs = 0.004 ppm) is 3 orders of magnitude (1,000 times) less.

SUMMARY & CONCLUSIONS

As stated in the introduction, an adverse impact on orchids may occur if they are exposed to a phytotoxic compound at a concentration high enough to produce toxic effects. The orchids occurring near the Keahole generating station will be exposed to extremely low concentrations of ethylene produced from the facility (as low as 2 nanograms/m^3 on an

annual average). While ethylene is a naturally occurring plant hormone, it has also been known to produce dry sepal wilt in orchid blossoms. However, because such minute quantities of ethylene will be emitted from the proposed expansion of the Keahole generating station, it is highly unlikely that exposure to this concentration will adversely effect *Dendrobium* orchids found near the facility.

Respectfully submitted,

Jennifer Holder, PhD

Alvin Greenberg, PhD

Table 1: Maximum Ground Level Concentrations of Ethylene Compared to Known Effects Levels

Exposure Scenario		units	Maximum ground level concentration: 1 hr average	3 hr average	8 hr average	24 hr average	40 hr exposure	Annual average	Response
Concentration at the Orchid Farms*		ug/m3	0.14	0.12	0.08	0.04		0.002	
		ppm	0.00012**	0.0001**	0.00007**	0.000035**		0.0000017**	
Experimental									
	Orchid Species								
	Cattelya (?)	ppm			0.004-0.1	0.002-0.02			sepal wilt in orchids †
	Vanda 'Miss Joaquim'	ppm					3		petals, sepals and perianth lost color††
	Dendrobium	ppm					3		no visible effect††
	Cymbidium 'Angelica'	ppm					3		intensification of pink color, and yellowing of petals and sepals††
	Cymbidium 'King Arthur'	ppm					3		more intense response than that shown by Cymbidium 'Angelica' ††
	Paphiopedilum	ppm					3		loss of green color, yellowing and flower deterioration††

*= predicted concentrations with proposed expansion of power plant
** = calculated value; 1 ppm=(ug/m3)(24.5)/(1000)(MW)
† = Arditti 1992
††=Goh et. al. 1983

References

Abeles, F. (1985) Sources of ethylene of horticultural. In: Ethylene and Plant Development. Eds. J.A. Roberts & G. A. Tucker. Butterworths London pp.287-296

Arditti, J. (1992) Fundamentals of Orchid Biology. Wiley & Sons, New York.

Heck W.H., R.H. Daines & I.J. Hindawi (1970) Other Phytotoxic Pollutants. In: Recognition of Air Pollution Injury to Plants: A Pictorial Atlas. Eds. J.S. Jacobson & A.C. Hill. Air Pollution Control Association. Pittsburg Pennsylvania. pp. F1-F11.

Goh, C.J., A.H. Halevy, R. Engel & A.M. Kofranek (1985) Ethylene evolution and sensitivity in cut orchid flowers. Scientia Horticulturae 26:57-67.

Nichols, R. & C.E. Frost (1984) Post-harvest effects of ethylene on ornamental plants. In: Ethylene & Plant Development. Eds: J.A. Roberts & G. A. Tucker. Butterworths London pp. 343-351.

Ormrod, D.P. (1978) Pollution in Horticulture. Elsevier Scientific Publishing Company.

Raven P.H., R.F. Evert & S. E. Eichorn (1986) Biology of Plants 4th ed. Worth Publishers Inc. New York. pp. 755.

Taylor, O.C. (1984) Organismal Responses of Higher Plants to Atmospheric Pollutants: Photochemical and Other. In: Air Pollution & Plant Life. Eds. M. Treshow. Wiley & Sons. Chichester.

Attachment E
Focused Ecological Risk Characterization

ATTACHMENT E

Focused Ecological Risk Characterization

Hawaiian Electric Light Company
Keahole Generating Station Expansion
North Kona District, Hawaii

January 20, 1993

INTRODUCTION

Risk Science Associates has been retained by Hawaiian Electric Company, Inc. to conduct a limited-scope review and evaluation of the potential for ecological impacts from pollutants emitted from a stationary source. This report describes the results of a preliminary Focused Ecological Risk Characterization which was conducted to assess what potential, if any, exists for certain specified pollutants emitted from the expanded facility to cause adverse impacts on orchids grown commercially at a location near the generating station. The pollutants specified were limited to oxides of sulfur (SO_x) and oxides of nitrogen (NO_x).

A focused ecological risk characterization is one tool decision makers can use to determine if any risk to orchids exists due to the presence of pollutants emitted from a facility. An ecological risk assessment does not state that adverse effects will occur to plants and animals found in the area; rather, it describes the chances that adverse effects may occur, no matter how remote the possibility.

In order for a chance to exist that adverse ecological impacts may occur, three conditions must exist simultaneously:

1. a substance possessing some toxicity to orchids must be present

2. there must be a sufficient amount of the substance to pose a potential risk

3. orchids must come into contact with a sufficient amount of the substance

If all three conditions do not exist, no adverse effects would occur.

EXPOSURE ROUTE OF SO_2 AND NOX TO ORCHIDS

Orchids located near the generating station will be exposed to volatile SO_2 and NO_x emitted into the atmosphere from the facility. These volatile compounds can enter the plant through openings in the leaves called stomata. In normally functioning plants, the opening and closing of stomata regulate the transport of CO_2 and O_2 (necessary for photosynthesis) into and out of the plant by diffusion. Other volatile compounds (such as SO_2 and NO_x) that are found at higher concentrations outside of the leaf can also diffuse into the plant tissue through open stomata.

Exposure to volatile compounds is regulated by stomatal activity. Factors that result in closure of the stomata (e.g. high temperature) would also reduce the exposure to the plant from gaseous pollutants. Stomatal activity is regulated by the water content of the plant, concentration of gases in the air (e.g. CO_2), temperature and time of day (Raven et al 1986).

PHYTOTOXICITY OF SO_2 AND NOX

Once gaseous pollutants enter the plant, they dissolve in water found on the cell surfaces within the leaves. In water, SO_2 becomes H_2SO_4 and NO_x becomes HNO_3. Both of these compounds are acidic and change the cellular pH of the plant tissues, thus affecting the permeability of membranes. This interrupts photosynthesis, respiration and biosynthesis. At higher concentrations, cell membranes and cell walls are disrupted and visible injuries such as chlorosis and necrosis of the leaves form (Malhotra & Khan 1984).

Sulfur Dioxide:

Plants exposed to SO_2 exhibit both visible and invisible injuries depending on the exposure. At low concentrations, SO_2 can affect several different components of the photosynthetic process thus reducing plant productivity. At higher concentrations, visible injuries appear; these include interveinal chlorosis, leaf necrosis and reduced growth (Saxe 1989).

The majority of studies on the phytotoxic effects of SO_2 have focused on plant parts other than flowers. It is not known how, or if, leaf necrosis or reductions in plant growth effect flowering. A few studies have shown, however, that in species other than orchids, SO_2 inhibits pollen tube growth within flowers after pollination. This can result in a

reduction in seed yield (Bonte 1982). Exposure to SO2 has also been shown to depress flower bud development in sunflowers, *Helianthus annus* (Miller 1988).

Nitrogen Oxides:

NO_x includes nitric oxide (NO) as well as nitrogen dioxide (NO_2). While both can be deposited on plants, NO_2 is more water soluble and thus more likely to be absorbed by the plant (Saxe 1989). At higher levels, yellow and brown patches occur on leaves and marginal necrosis occurs (Ormrod 1986). Like SO_2, exposure to NO_x affects photosynthesis and respiration in plants at concentrations that do not produce visible injuries ((Malhotra & Khan 1984; Saxe 1989). While NO_x can cause toxic effects in plants, they are especially damaging when in association with SO_2.

Exposure to Combination of SO_2 & NO_x:

Plants exposed to mixtures of SO_2 and NO_x exhibit both additive and synergistic responses (Runeckles 1984; Saxe 1989). Reported effects include foliar injury and reductions in growth. Experimental work on the phytotoxic effects of mixtures of these compounds have concentrated on monocot grasses and some dicots; the effects of these gases on orchid growth, flower production and morphology have not been evaluated to date.

CHARACTERIZATION OF RISK

Although SO_2 and NO_x can produce toxic effects to plants, sulfur and nitrogen are essential plant nutrients. Thus, while higher concentrations may be phytotoxic, low concentrations of these compounds could conceivably benefit some plants (Ormrod 1986). To assess the probability that SO_2 and NO_x could potentially cause an adverse effects to the orchids located near the generating facility, concentrations that have been known to cause adverse effects in orchids or other surrogate species were compared to the predicted maximum ground level concentrations at the orchid farms.

There has been extensive work on the effects of SO_2 and NO_x and combinations of these two pollutants to plants. The majority of these studies have focused on visible injuries to plant parts (mainly leaves) and in reductions in plant growth and crop yield. Few studies have focused on the effect of air pollutants on flowering (which is, of course, of interest to the cut-flower trade). While there may be a link between foliar damage and flower production in some plant species, this has not been studied in

orchids. There has also been scant work on the effects of these pollutants on actual flower structures. Only a couple of studies were found that had direct bearing on orchids or flowers. Table 1 summarizes this data and compares it to the maximum ground level concentration (GLC) of SO_2 and NO_x estimated at the orchid farms.

The first study investigated the effect of SO_2 (and SO_2 + ozone) to orchids. In that study, concentrations of 1.2 ppm for 6 hrs resulted in no visible effects to epiphytic orchids (Nyman et. al. 1990). Using the general toxicological guidance that duration multiplied by the concentration is a constant, then the experimental dose applied in this study would be equivalent to an exposure of 3.6 ppm for 3 hrs. The 3 hr average maximum predicted GLC at the orchid farms for SO_2 is 0.04 ppm. This is 2 orders of magnitude (almost a 100 times) less than the modelled no effect level.

The second study looked at the effect of SO_2 on the development of sun flower blossoms (Miller 1988). As in the above study, if duration multiplied by the concentration is a constant, then the experimental dose applied to these sun flowers would be equivalent to an exposure to a GLC of 28 ppm for 3 hrs. This is 700 times less than the modelled minimum effect level.

Based on the above studies, it seems highly unlikely that SO_2 and Nox emitted from the proposed expansion of the generating facility would adversely effect the orchids found nearby. However, a variety of factors lead to uncertainty in this analysis. First, orchids will be exposed to a combination of both NO_x and SO_2. Based on other studies, it is known that these compounds interact synergestically. Thus studies that focus just on the effects of SO_2 may underestimate adverse effects that would occur when plants are exposed to mixtures of compounds. Secondly, neither of these studies directly addresses the potential adverse effects of exposure to orchid flowers. Because different plant species and cultivars exhibit a wide range of sensitivities to pollutants (Ormrod 1986), it is difficult to quantify potential risk with data from only two studies.

SUMMARY AND CONCLUSIONS

As stated in the introduction, an adverse impact on orchids may occur if they are exposed to a phytotoxic compound at a concentration high enough to produce toxic effects. The orchids occurring near the Keahole generating station will be exposed to slightly elevated concentrations of SO_2 and NO_x produced from the facility. While sulfur and nitrogen are

plant nutrients, SO_2 and NO_x when dissolved in water produce acidic compounds that interfer with normal plant metabolism. While the available data provide some support that the levels of SO_2 and NO_x emitted from the generating station are unlikely to cause adverse effects to plants found there, uncertainty based on this data is high. This is due to the paucity of work on the potential effects of SO_2 and NO_x on orchids in particular, and flowers in general. Based on this, a more rigorous assessment of risk would serve to reduce this uncertainty and would produce a stronger characterization of risk. Such a rigorous assessment would include:

1) an in-depth review of the phyto-toxicological literature

2) the selection of appropriate surrogate species and endpoints

3) a comparison of this rigorously reviewed data with predicted GLCs at the orchid farms.

Respectfully submitted,

Jennifer Holder, PhD

Alvin Greenberg, PhD

References

Bonte J. (1982) Effects of air pollution on flowering and fruiting. In: Effects of Gaseous Air Pollutants in Agriculture and Horticulture. Eds Unsworth, M.H. & D. P. Ormrod. Butterworth Scientific London pp 207-224.

Malhotra S.S. & A.A. Khan (1984) Biochemical and physiological Impact of major pollutants. In: Air Pollution & Plant Life. Eds. M. Treshow. Wiley & Sons. Chichester.

Miller, J.E. (1988) Effects on photosynthesis, carbon allocation, and plant growth. In: Assessment of Crop Loss From Air Pollutants. Eds. W.W. Heck, A. C. Taylor & D. T. Tingey. Elvesier Applied Press. London pp. 287-314.

Nyman, L.P., D.B. Benzing, P.J. Temple & J. Arditti (1990) Effects of ozone and sulfur dioxide on two epiphytic orchids. Environ. & Exper. Bot. 30 (2): 207-213.

Ormrod, D.P. (1986) Gaseous Air POllution and Horticultural Crop Production. In: Horticultural Reviews. Vol. 8. ed. J. Jarick.

Raven P.H., R.F. Evert & S. E. Eichorn (1986) Biology of Plants 4th ed. Worth Publishers Inc. New York. pp. 755.

Runeckles, V.C. (1984) Impact of Air Pollutant Combinations on Plants. In: Air Pollution & Plant Life. Eds. M. Treshow. Wiley & Sons. Chichester.

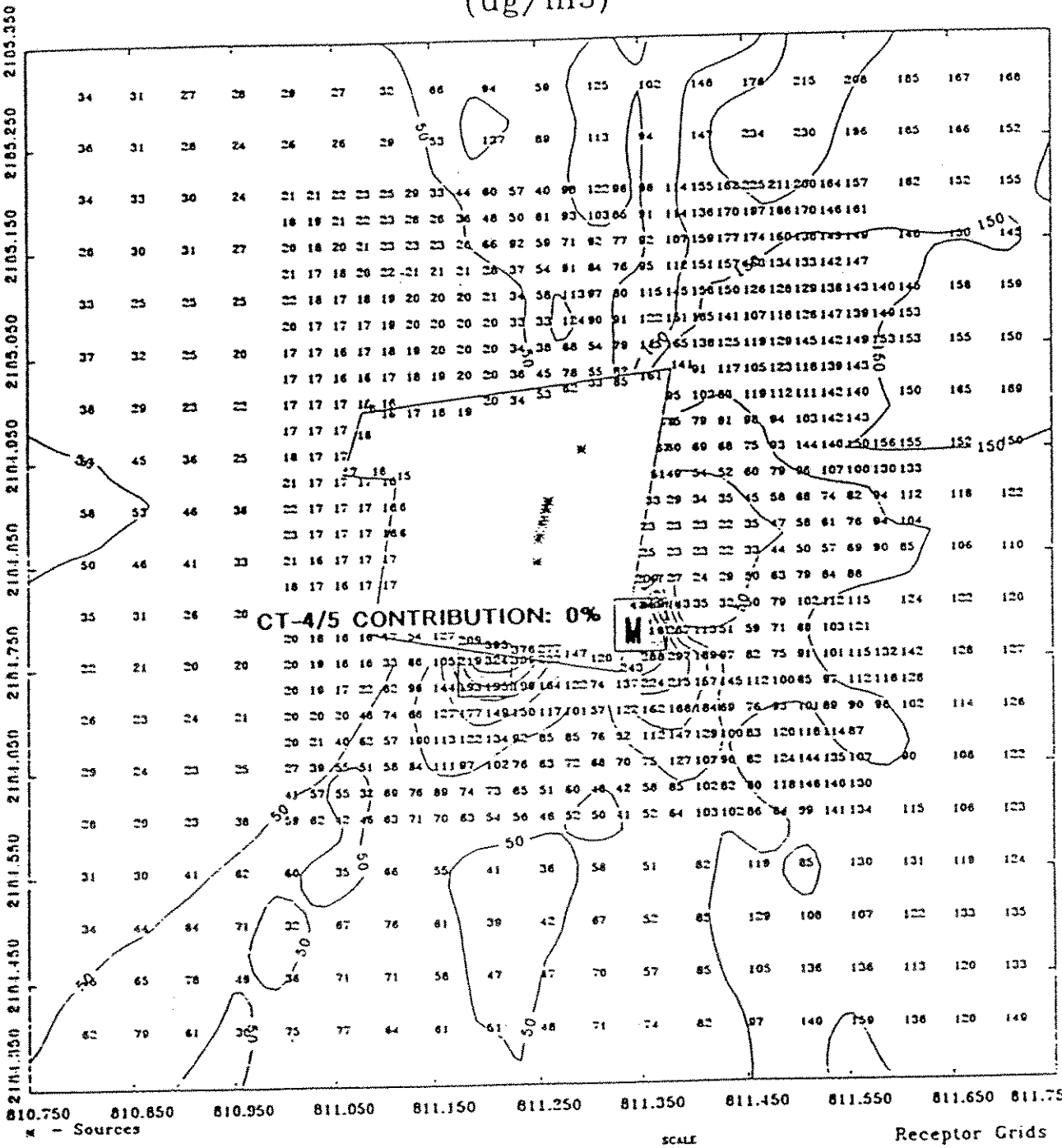
Saxe, H. (1989) Air Pollution. Primary Plant Physiological Responses, and Diagnostic Tools. PhD Thesis. The Royal Veterinary & Agricultural University, Denmark.

Table 1: Maximum Ground Level Concentrations of SO2 Compared to Known Effects

Exposure Scenario	units	Maximum ground level concentration: 3 hr average	6 hr exposure	24 hr average	Annual average	24 hr exposure for 5 weeks	Endpoint
Concentration at the Orchid Farm							
	ug/m3	102.86*		29.8*	1.58*		
	ppm	0.04**		0.01**	0.0006**		
Experimental							
2 species of epiphytic orchid †	ppm		1.2				No observable visible effects on plant structure, flowering was not evaluated
Helianthus annus (sunflower)††	ppm					0.1 per day for 5 weeks	depression of flower bud development and stem elongation

* = predicted concentrations with proposed expansion of power plant
** = calculated value; 1 ppm=(ug/m3)(24.5)/(1000)(MW)
†=Nyman et.al. 1990
††=Miller 1988

2nd Highest 3-Hr SO2 Ambient Concentration (ug/m3)



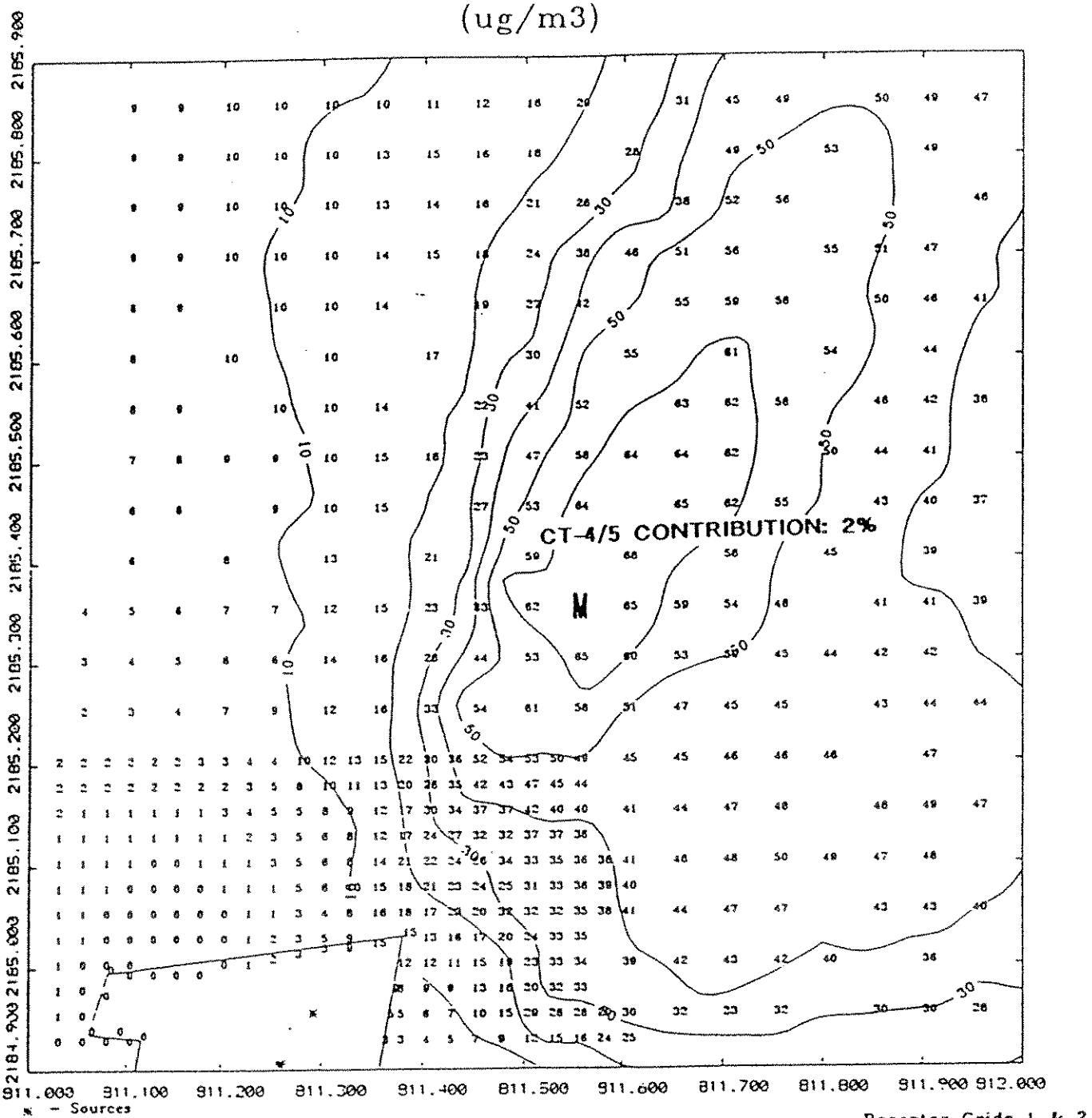
* - Sources

M - Maximum Concentration
(446.8810 ug/m3)

Receptor Grids 1 & 2

Shaded areas are receptor grids 3 & 5

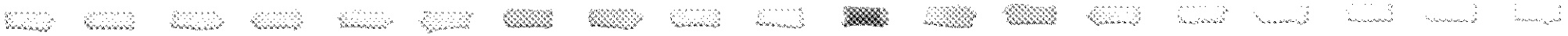
Annual Average NOx Ambient Concentration (ug/m3)



* - Sources

M - Maximum Concentration
(68.1417 ug/m3)

Receptor Grids 1 & 2



Attachment F
Focused Ecological Risk Characterization

ATTACHMENT F

Focused Ecological Risk Characterization

Hawaiian Electric Light Company
Keahole Generating Station Expansion
North Kona District, Hawaii

October 29, 1993

INTRODUCTION

Risk Science Associates has been retained by Hawaiian Electric Company, Inc. to conduct a limited-scope review and evaluation of the potential for ecological impacts from pollutants emitted from a stationary source. This report describes the results of a preliminary Focused Ecological Risk Characterization which was conducted to assess what potential exists, if any, for H_2SO_4 mist emitted from the expanded facility to cause adverse impacts on plant species grown commercially at a location near the generating station.

A focused ecological risk characterization is one tool decision makers can use to determine if any risk to plant species exists due to the presence of pollutants emitted from a facility. An ecological risk assessment does not state that adverse effects will occur to plants found in the area; rather, it describes the chances that adverse effects may occur, no matter how remote the possibility.

In order for a chance to exist that adverse ecological impacts may occur, three conditions must exist simultaneously:

1. a substance possessing some toxicity to plant species must be present

2. there must be a sufficient amount of the substance to pose a potential risk

3. plants must come into contact with a sufficient amount of the substance

If all three conditions do not exist, no adverse effects would occur.

POTENTIALLY EXPOSED PLANT RECEPTORS

Due to the diversity of different commercially grown plant species found near Keahole Generating Facility and the paucity of toxicity data for specific plant species, an assessment of potential impacts of H_2SO_4 mist to 3 generic plant categories is presented in this report. The categories are as follows:

- **foliage:** includes any landscape species that are grown for their foliage.
- **flowers:** includes orchids (*Dendrobium* sp.), poinsettia (*Euphorbia* sp.), Naupaka (*Scaveola* sp.) and lei flowers such as Ilima (*Sida* sp.), Pikake (*Jasminum* sp.) and Plumeria (*Plumeria* sp.)
- **fruit & nuts:** this includes coffee (*Coffea* sp.), various citrus fruits, papaya (*Carica* sp.), mango (*Mangifera* sp.), coconut (*Cocos* sp.) and macademia nut (*Macademia* sp.)

EXPOSURE ROUTE OF H_2SO_4 MIST TO COMMERCIALLY GROWN PLANTS

Commercially grown plants located near the generating station will be exposed to H_2SO_4 mist emitted into the atmosphere from the facility. In contrast to gaseous air pollutants (e.g. SOx and NOx) which enter plants through their stomata producing internal injury, H_2SO_4 mist injures the surface of the plant first. Only continual exposure and damage to the surface will result in injury to internal plant tissues (Evans et. al. 1977).

PHYTOTOXICITY OF H_2SO_4 MIST

H_2SO_4 mist produces adverse effects to plants due to the presence of free hydrogen ions and not the presence of sulfate (which is an essential nutrient to plants; Jacobson 1984). This is true for acidic precipitation in general because other common inorganic ions found in precipitation does not produce adverse effects in plants unless the pH of the solution is also altered (Jacobson 1980). Because it is the free hydrogen ion concentration found in solution that is responsible for injurious effects to plants,

H_2SO_4 mist will be considered a subcategory of the more general stressor, acid precipitation; therefore, in this report, H_2SO_4 mist will be used interchangeably with the term acid precipitation.

The severity of adverse effects to plants by exposure to acid precipitation depends on a number of important including (Jacobson 1984; Musselman & Sterrett 1988):

- chemical characteristics of the solution: e.g. chemical composition and concentration of hydrogen ions.

- physical characteristics: e.g. the number, mass and size distribution of droplets. These parameters can influence the settling velocity, mass transfer rates, capacity to wet surfaces and the efficiency of capture by plant surfaces (e.g. intercept fraction). The rate of acidic deposition and the duration of the exposure event are also important elements.

- biotic characteristics: e.g. the sensitivity of a particular plant species or cultivar, the stage of development of the plant and characteristics of the leaf surface.

The particle size of the precipitation droplets is particularly important. Table 1 relates particle size to the deposition process and deposition velocity. Understanding these processes are important because the size of the acid droplet and the way that it is deposited on the leaf surface affects the dose of hydrogen ions that a plant receives. For example, aerosols of H_2SO_4 do not cause foliar lesions unless water is added to the leaf (Jacobson 1984), while acidic fog, mist and rain can cause foliar lesions and abscission of leaves.

Table 1: Physical Properties Related to Particle Size
(From Jacobson 1984)

Physical Form	Particle diameter μm	Deposition Process	Deposition Velocity cm/s
aerosol	0.01-10	diffusion, impaction	<0.2
fog/clouds	1-3	impaction	1-3
mist	30-300	impaction, sedimentation	3-50
rain	300-3000	sedimentation	50-800

The majority of plant physiology research on acid precipitation has focused on injury to foliage. The following discussion will attempt to summarize the available research; however, while it emphasizes how injury occurs to the plant leaf, the general mechanism of injury may also apply to other plant structures such as flowers, fruits and nuts. The severity of the response to H_2SO_4 mist to other plant structures will depend on their sensitivity. For example, the hard shells of nuts are likely to be less sensitive to H_2SO_4 mist than flower petals.

The primary site of action for acidic precipitation is the epidermis of the plant. Generally, foliar injury is located near vascular tissue and trichomes (an outgrowth of the epidermis such as hair or scales) on the leaf surface. The ability of acid precipitation to adversely affect plants depends on leaf characteristics. Species with very waxy cuticles are generally less sensitive to injury (Berg 1987). Plants also have the capacity to buffer acidic solutions placed on their leaves; this is effective in neutralizing the acid (Musselman 1988). Species also differ in their buffering ability (Adams & Hutchinson 1984).

Initial injury consists of lesions which progressively deteriorate through the leaf producing necrotic spotting (Evans et. al. 1977). There is also a concomitant increase in the leaching of minerals from injured leaves (Wood & Bormann1975; Keever & Jacobson 1983). As more and more leaf area becomes necrotic, the productivity of the plant decreases. This is manifested in severely injured plants by decreased growth, reduced yields and delayed maturity (Musselman & Sterrett 1988).

Depending on where the acidic precipitation accumulates and dries, the lesions on the leaf can produce varied secondary results. For example, in soybean, lesions on the margins of leaves undergoing rapid expansion produced severe curling of the leaf (Evans & Curry 1979).

The severity of the effect of foliar lesions on other aspects of the plant (e.g. reductions in growth) is also influenced by the age and life-history stage of the plant when exposed. Young plants and developing leaves are more susceptible to damage than are mature ones (Haines et al 1980). Young plants that are rapidly developing may have reduced growth when leaf surfaces are injured. Fruit and

seeds may compete for reduced photosynthate from injured leaves to the detriment of new root and leaf development (Jacobson 1984)

CHARACTERIZATION OF RISK

Numerous studies have demonstrated that acidic precipitation can produce injury to plant leaves if the pH is sufficiently low (see Amthor 1984 for a review). As stated above, the extent of foliar injury is not only related to the number of free hydrogen ions available in the precipitation, but also on the species of plant exposed. For example, broad-leaved trees are more sensitive than conifers and the foliage of broadleaved herbaceous plants are more sensitive than the foliage of woody herbaceous plants (Evans & Curry 1979). Dicots are generally more sensitive than monocots, and within dicots the most sensitive crop species in descending order are root, leaf, cole and tuber crops than forage, grain and fruit crops (Lee et. al. 1981).

The potential risk of commercially grown plant species found near Kaehole generating facility is difficult to quantify because very little is known about acid precipitation in the tropics (McDowell, 1988); the greatest emphasis in acid precipitation research has been on temperate agricultural crops and forest species that are likely to be exposed to low pH rainfall in the northern hemisphere. Table 2 and the following sections will attempt to summarize available research on the effects of acid precipitation on the three main plant categories of interest: foliage, flowers and fruits & nuts.

Foliage:

The majority of research on acid precipitation has focused on its effect to leaf surfaces or foliage. Generally, leaf necrosis can be induced by precipitation of a pH below 3; severe necrosis is seen at levels below 2 (Musselman & Sterrett 1988).

Flowers:

Because flowers are composed of tender, fleshy structures and have a low buffering capacity, they are expected to be extremely sensitive to acidic precipitation (McCool et. al. 1990). Flower injury was observed in zinnias (*Zinnia elegans*), chrysanthemums (*Chysanthemum* sp.) and carnation (*Dianthus caryophyllus*) at pH below 4.0 when exposed to single exposures of acidic fog (McCool et. al. 1990); foliar injury also occurred in zinnia foliage at a pH of 4.0 (Keever & Jacobson 1983).

Fruit & Nuts:

Acid rain can affect the development of fruit as well as its marketability (Forsline et. al. 1983). In apples (*Malus domestica*), lesions were reported on fruit exposed to acidic precipitation of a pH of 3 (Proctor 1983). In grapes, vines exposed to a pH of 2.5 had significantly less percent soluble solids at harvest than control fruit (Forsline et. al. 1983).

Valencia orange trees (*Citrus sinensis L. cv. Valencia*) were exposed to acidic fog . While some foliar necrosis was observed in plants exposed to fog of pH 3.2, the greatest damage occurred to plants exposed to fog of pH 1.6. After 12 exposures to fog at pH 1.6 there was a significant reduction in the weight of leaves and the growth rate of the orange plant (Musselman & Sterrett 1988); however, there was no discussion of how this affected the quality of the fruit or yield.

Seed quantity and seed quality were reduced in soybean crops exposed to acid rain of a pH <4 . The decrease in seed yield was due to a decrease in the number of mature seed pods and not in number of seeds/pod or the mass of individual seeds. It was not known whether the decrease in mature pods was due to a decrease in soybean flower pollination , a decrease in pod retention or inadequate development of young pods (Evans et. al. 1981).

While the limited available studies show that there may be an effect on fruit when exposed to acidic precipitation, it remains unclear whether this is economically important. In grapes, there was a decrease in pollen germination in plants exposed to solutions of pH of 3.25, however, there wasn't always a corresponding decrease in fruit set. Even if there was, most vines need to be thinned of fruit anyway (Forsline et. al. 1983). In apples, exposure to acid precipitation below a pH of 3 injured flowers. However, apple trees need only about 10% of the flowers to set fruit; thus, adverse economic effects may be undetectable (Proctor et. al. 1983).

References

Adams, C. M. & T.C. Hutchinson (1984) A comparison of the ability of leaf surfaces of three species to neutralize acidic rain drops. New Phytologist. 97:463-478.

Amthor, J.S. (1984) Does acid rain directly influence plant growth? Some comments and observations. Environ. Pollut. Ser. A. 36:1-6.

Berg, V.S. (1987) Plant cuticle as a barrier to acid rain penetration. In: Effects of Atmospheric Pollutants on Forests, Wetlands and Agricultural Ecosystems. Eds. T.C. Hutchinson & K.M. Meema. Nato ASI Series Vol G1 6.

Evans, L. S., N.F. Gmur & F. Da Costa (1977) Leaf surface and histological pertubations of leaves of *Phaseolus vulgaris* and *Helianthus annuus* after exposure to simulated acid rain. Amer. J. Bot. 64(7):903-913.

Evans, L.S., K.F. Lewin, C.A. Conway & M. J. Patti (1981) Seed yields (quantity and quality) of field grown soybeans exposed to simulated acidic rain. New. Phytol. 89: 459-470

Evans, L.S. & T.M. Curry (1979) Differential responses of plant foliage to simulated acid rain. Amer. J. Bot. 66(8) 953-962

Forsline P.L., R.C. Musselman, R.J. Dee & W.J. Kender (1983) Effects of acid rain on grapevines. Am. J. Enol. Vitic. 34(1):17-22.

Haines, B., M. Stefani & F. Hendrix (1980) Acid rain: threshold of leaf damage in eight plant species from a southern Appalachian forest succession. Water, Air and Soil Pollut. 14:403-403.

Jacobson, J.S. (1980) Experimental studies on the phytotoxicity of acidic precipitation: the United States experience. In: Effects of acid precipitation on terrestrial ecosystems. eds. T.C. Hutchinson & M. Havas. Plenum Press N.Y.

Jacobson, J.S. (1984) Effects of acidic aerosol, fog, mist and rain on crops and trees. Phil. Trans. R. Soc. Lond. B 305: 327-338

Keever, G.J. & J.S. Jacobson (1983) Simulated acid rain effects on zinnia as influenced by available nutrients. J. Amer. Hort. Sci. 108(1):80-83.

Lee, J.J., G.E. Neely, S.C. Perrigan & L.C. Grothaus (1981) Effect of simulated sulfuric acid rain on yield, growth and foliar injury of several crops. Env. & Exp. Bot. 21(2):171-185.

McCool, P.M. & R.C. Musselman (1990) Injury of three ornamental flower crops from simulated acidic fog. Plant Disease 74(4):310-312.

McDowell, W.H. (1988) Potential effects of acid deposition on tropical terrestrial ecosystems In: Acidification in Tropical Countries SCOPE 36. eds. H. Rodhe, R. Herrerra. Wiley & Sons

Musselman R.C. (1988) Acid neutralizing capacity of leaves exposed to acidic fog. Environ. & Exper. Bot. 28(1):27-32.

Musselman R.C & J.L. Sterrett (1988) Sensitivity of plants to acidic fog. J. Environ. Qual. 17(2):329-333.

Proctor, J.T. (1983) Effect of simulated sulfuric acid rain on apple tree foliage, nutrient content, yield and fruit quality. Environ. Exp. Bot. 23(2):167-174.

Wood, T. & F.H. Boorman (1974) The effects of an artificial acid mist upon the growth of Betula alleghaniensis Britt. Environ. Pollut. 7: 259-268.

Wood, T. & F.H. Boorman (1975) Increase in foliar leaching caused by acidification of an artificial mist. Ambio. 4: 169-171.

Table 2: Selected Toxicological Studies on the Phytotoxicity of Acid Precipitation

Species	Compound	Maximum pH level producing injury	Particle Diameter	Toxocological Endpoint	Reference
Seedless Vascular Plants					
Bracken Fern	"		"	after 10 rainfalls of 20 min. 18% of the surface area of young fronds were injured	Evans & Curry 1979
Pteridium aquilinum		2.5			
Seed Vascular Plants					
Monocot					
Spiderwort (Tradescantia sp.)	Simulated sulfate acid rain	2.3	0.2 mm	After 16 rainfalls of 20 min each between 2.3 and 5% of the leaf area showed injury. Hypertrophy of mesophyll cells was also found	Evans & Curry 1979
Dicot					
Pin Oak (Quercus palustris)	Simulated sulfate acid rain	2.5	0.2 mm	Insensitive to foliar injury	Evans & Curry 1979

Table 2: Selected Toxicological Studies on the Phytotoxicity of Acid Precipitation

Species	Compound	Maximum pH level producing injury	Particle Diameter	Toxocological Endpoint	Reference
Soybean(Glycine Max)	Simulated sulfate acid rain	2.9	0.2 mm	After 6 20 min daily exposure about 7% of the leaf surface showed lesions	Evans & Curry 1979
Bean (Phaseolis vulgaris)	Simulated sulfate acid rain	3.1	0.2 mm	Foliar damage	Evans et al 1977
Sunflower (Helianthus annuus)	Simulated sulfate acid rain	3.1	0.2 mm	Foliar damage	Evans et al 1977
Yello Birch Seedlings (Betula alleghaniensis)	sulfuric acid mist	3	25- 100 µm	Foliar tissue damage and reduction in plant growth after 11 weeks of treatment	Wood & Boorman 1974
Radish (Raphanus sativus)	sulfuric acid mist	2.5	?	Reduced leaf area and dry weight after 7 applications of acid rain (in total 4 cm of precipitation)	Harcourt & Farrar 1980
Corn pollen (Zea mays)	acid precipitation	4.5	?	Reduced corn pollen germination in a liquid medium	Zhang & Craker 1991

Table 2: Selected Toxicological Studies on the Phytotoxicity of Acid Precipitation

Species	Compound	Maximum pH level producing injury	Particle Diameter	Toxocological Endpoint	Reference
Mountain birch pollen (Betula pubescens ssp. tortuosa)		4	?	Reduction in percent pollen germination in the laboratory	Neuvonen et. al. 1991
Mountain birch pollen (Betula pubescens ssp. tortuosa)		4.6	?	Reduction of pollen tube length in the laboratory	Neuvonen et. al. 1991
Apple seedlings (Malus hupehensis)	simulated acid rain	2.75		Growth reduction and foliar injury	Forsline et. al. 1983
Mature apple trees (Malus domestica)	simulated sulfuric acid rain	3	0.3 mm	Visible foliar damage	Proctor 1983
Valencia orange (Citrus sinensis L. cv. Valencia)	simulated acidic fog	3.2	20 μ	trace of foliar necrosis	Musselman & Sterrett 1988
Flowers					
Apple flowers (Malus domestica)	simulated sulfuric acid rain	3	0.3 mm	injury to petals. induction of brown necrotic areas and red lesions	Proctor 1983

Table 2: Selected Toxicological Studies on the Phytotoxicity of Acid Precipitation

Species	Compound	Maximum pH level producing injury	Particle Diameter	Toxocological Endpoint	Reference
Zinnia flowers (Zinnia elegans)	simulated acid fog	4	40 µm	flower injury	McCool et.al.1990
Carnation and crysanthemum flowers (Dianthus caryophyllus & Chrsanthemum sp.)	simulated acid fog	3.5	40 µm	flower injury	McCool et.al.1990
Zinnia (Zinnia elegans)	simulated acid rain	2.8	1.02 mm	flower injury when exposed 30 min/day twice a week for 6 weeks	Keever & Jacobson 1983
Fruit					
Apples (Malus domestica)	simulated sulfuric acid rain	3	0.3 mm	Reduced fruit quality	Proctor 1983
Apples (Malus domestica)		2		blemishes on fruit, premature ripening and fruit drop	
Soybean (Glycine max)		4		decreased seed yield	Evans et. al. 1981
Soybean (Glycine max)		<3		decreased seed quality	Evans et. al. 1981

SUMMARY OF HELCO'S DEMAND FORECASTING METHODOLOGY

HELCO forecasts electrical demand by estimating future peak demand and kilowatt hour sales from several different "viewpoints" or perspectives. Final forecasts are selected by the Forecast and Planning Committee (FPC) and can be corroborated by more than one analytical method. Although mathematical trending of historical kilowatt-hour sales data is one form of analysis used in the forecasting process, HELCO does not depend solely on mathematical trending to forecast the future. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place. Following is a description of the demand forecasting methodology.

Short-Term Peak Demand Forecasting

Generally, historical monthly morning and evening peak data are used in the short-term peak demand forecasts (e.g., for 1993-98). These forecasts are derived by multiplying the forecasted annual peaks by a morning monthly peak factor and an evening monthly peak factor. These factors are derived from actual monthly morning and evening peaks averaged over the most current 5 years. The system peak forecasts are then analyzed in relation to the energy sales forecasts and the projected load factor, which is the ratio of the average hours of operation to the total annual hours available.

Another major portion of the short-term forecasted increase in demand can be directly attributed to large-scale construction projects currently under way. Such large-scale projects reflect the increasing competition among discount retailers for larger market shares and are not necessarily dependent on tourism or population increases. These projects, all scheduled to come on-line in 1993 and 1994, include:

Kealakehe Sewer Treatment Plant and Pump Station	2,000 kVA
COSTCO Pacific Distribution Center	1,500 kVA
Keauhou Shopping Center Phase 2	2,000 kVA
Safeway/ACE/Ben Franklin	1,500 kVA
Lanihau Center Phase 2	4,000 kVA
K-Mart/Queen Liliuokalani Trust	3,000 kVA
Mauna Kea Prince Hotel	2,000 kVA
Royal Vista Golf Course Irrigation Pumps	3,000 kVA

Short-Term Sales Forecasting

Short-term energy sales forecasting at HELCO is performed through analyses of the marketplace: rate schedule analyses, system analyses, market analyses, economic analyses, and customer service analyses. Each of these analyses is described below.

- Rate schedule analyses consider a spectrum of mathematical analyses of the patterns and trends in the number of customers and kilowatt-hour sales to the individual rate schedules using linear, Box-Jenkins and exponential models, econometric analysis, and other traditional curve-fitting methods.

- System analyses use a number of mathematical analyses and trending techniques of the patterns and trends in total system kilowatt-hours (kWh).

- Market analyses are based on survey analyses of the market conditions influencing the different rate schedules, with special emphasis on customer-by-customer accounting of loads in Large Power Rate Schedule P. Also considered are influences on Residential Schedule R, including new construction outlook, resort development, and government-supported or -sponsored housing.

- Economic analyses include judgmental analyses and considerations of the potential for future economic growth in the HELCO service area, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- Customer service analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month.

The inputs into these analyses are diverse and include such items as personal income, visitor count, population growth, national and state economic conditions, new construction, inflation factors, oil prices, conservation measures, and weather patterns.

Long-Term Sales Forecasting

The long-term sales forecasts for HELCO's electricity sales are the result of econometric equations, developed by HELCO, that relate historical patterns of energy usage to independent economic and weather variables. Care is taken to ensure that as many county-specific data as possible are used, rather than state-wide information. Sources for historical economic data include:

- Department of Business, Economic Development and Tourism's (DBEDT) State Data Book
- DBEDT's Quarterly Statistical and Economic Reports
- County of Hawaii's Department of Research and Development Data Book
- Bank of Hawaii's Annual Report
- Updated data from the Hawaii Visitors Bureau
- National Oceanic and Atmospheric Administration's (NOAA) weather data summaries from the State Department of Land and Natural Resources

The econometric models are validated using statistical tests for:

- Residual autocorrelation (Durbin-Watson Test)
- The goodness of fit (coefficient of determination or R-Squared Value)
- Statistical significance of the independent variables (t-Test)
- Heteroskedasticity of the residuals
- Multicollinearity of the independent variables

In addition, the reasonableness of the relationship between the independent and dependent variables for each model is evaluated.

The results of these models are reasonable predictors of long-term trends. The econometric models are not, however, responsive to rapid changes in the short-term conditions; for this reason, they are not used for the short-term forecasts.

On the other hand, the customer and market analyses described above examine the short term very carefully and are more likely to account for the near-term conditions that drive electricity sales. A combination of the short-term detailed analyses and the long-term econometric model has shown itself to be a reasonable method for projecting sales over a 20-year period. This is generally done by applying the rates of growth resulting from the econometric models to the short-term analyses forecasts.

Effects of Conservation

Potential effects of customer conservation and Demand-Side Management (DSM) activities are also factored into the forecasting process. The extent that customers have practiced load shifting and conservation in the past would be reflected in the historical database. For example, the FPC included 700 kW and 300 megawatt-hour (MWh) peak demand and energy forecast adjustments, respectively, beginning with the 1993 forecasts, for the impact of HELCO's Pilot Commercial Lighting Program. As other DSM programs move from the planning to implementation stage, the forecasts will be adjusted to account for the estimated demand and energy savings. However, the precise levels of future conservation and reduction in usage due to DSM programs are difficult to predict because a consumer's personal conservation rate is affected by a number of other factors that are difficult to reliably forecast. These factors include:

- Actions of city, state, federal, and foreign governments
- Oil prices, which affect electricity prices
- Overall inflation
- Economic factors
- Weather variables

- Public acceptance of new energy-efficient appliances
- Public willingness to make lifestyle choices that encourage conservation

Economic and Population Inputs Used

Economic conditions and their possible influences on forecasted demand are regularly reviewed during deliberation on the forecasts for each rate schedule. The figures contained within Table 1-1 in the Revised Draft EIS were adopted by the HELCO Forecast and Planning Committee in March 1993 and reflect economic and population data up to that time. Concerns regarding the extent and duration of the state-wide economic slump, the drop in Big Island tourism, the eventual closing of Hamakua Sugar, the slowdown of Hilo Coast Processing Company, and the slowdown of new construction were all factored into the methodology. The minutes of the March 1993 FPC meeting follow this summary. As a result of the state-wide recession and the downturn in new construction, HELCO's near-term kWh sales growth was projected at lower levels than the previous year's projections.

General population growth is but one element of the overall model, and the population figures used in the HELCO models are provided by HELCO. County population estimates included in the 1989 General Plan and the State Department of Business, Economic Development and Tourism population projections Series M-K, developed in 1988, were not used to project the short-term peak demand for 1993 to 1998. For demand forecasts from 1998 to 2010, HELCO used the most recent population and tourism data available and the recommended modifications to the individually metered residential accounts developed by the Consumer Advocate's Office, which were incorporated into HELCO's Integrated Resource Planning proposal. The following table shows the population and visitor census projections used in developing the demand projections shown in Table 1-1 of the Revised Draft EIS.

Population and Visitor Census Projections		
	1992 Base and Projections	
Year	Population	Visitors
1992	129,610	14,718
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874
Source: HELCO Long Term Sales & Peak Forecast March 1993, page 3-65.		

The forecasting of system peak demand is more complex than the forecasting of kilowatt-hour sales. In general, peak loads are much more sensitive to changes in weather patterns than to changes in visitor arrivals or population changes. This was evidenced during the prolonged hot and humid weather on Oahu in September 1993. During this period, new high-peak demands were placed on Hawaiian Electric Company, Inc. (HECO) generating equipment, independent of any sudden increases in population or tourism. In addition, the peak demand is much more sensitive to the timing of a major project, such as a hotel, or large commercial use, than is the overall kWh sales forecast. For example, a 2-MW hotel that starts operating in December would contribute only one month of kWh sales, annualized over the entire year. However, the full 2 MW of electrical demand on the system peak would need to be met.

Accuracy of Forecasts

Historically, the FPC's recommendations have been reasonably close to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast. In 1989, the system peak of 130.4 MW was 1.6 MW below the forecast. In 1992, the recorded peak of 150.2 MW was 0.8 MW below the forecast.

The FPC's projection of future growth is frequently revised. In the 1987 forecast, an increase in system peak of 4 MW per year was projected on the basis of slightly pessimistic economic and visitor industry climates. In 1988, this forecast was revised to a 5-MW-per-year increase to reflect improved economic conditions. In 1989 and 1990, the strong influence of Japanese visitors and developers led to forecasts being revised upward to as much as a 9-MW-per-year increase. By 1991, the softened economy, lingering effects of the Persian Gulf War, and the beginning of a downturn in visitor arrivals led to a revision in the 5-year projected growth to only 5.8 MW. Current demand through November 1993 has been approximately 5 MW below the projected 157 MW.

Table 1-1 in the Revised Draft EIS reflects the following growth: 1993, 8 MW; 1994, 6 MW; 1995, 6 MW; 1996, 7 MW; 1997 and 1998, 7 MW. Possible reductions in demand, due to the adoption and implementation of the DSM programs contained in HELCO's proposed Integrated Resource Plan before the Public Utilities Commission (PUC), are incorporated in these forecasts. Some of the specific assumptions in the various HELCO schedules that compose these forecasts include:

- Persistence in the national economic recession
- Dropping of visitor arrivals in second half of 1993
- Further softening in resort condominium sales
- Decline in multi-family construction
- Sliding of 1994 proposed projects into 1995 and 1996
- Impact of Commercial Lighting Program
- Similar weather patterns

Alternative Scenarios

In addition to the demand forecasts presented in Table 1-1 of the Revised Draft EIS, HELCO has also examined alternative scenarios that explore the impact of other events on the peak demand. One such scenario is the possible impact of the Model Energy Code as reflected in the latest update of the Hawaii Building Energy Efficiency Standard developed in 1992 for the Energy Division of DBEDT.

The scope of the Energy Efficiency Standard encompasses the design of new residential and nonresidential construction as well as major renovations. DBEDT estimates the impact of the proposed building standards on electricity demand in the year 2010 for the State of Hawaii to be a cumulative savings of 114 MW and 404 gigawatt-hours (gWh). The breakdown of the savings is estimated to be 51 percent from nonresidential, 8 percent from nonresidential renovations, and 41 percent from the residential sector. Based on the percentage of total state electricity consumption, the cumulative savings for the Island of Hawaii in the year 2010 are estimated at 10.3 MW and 36.6 gWh. This assumes that Hawaii County's electricity reductions are 7.2 percent of total state savings in nonresidential, 7.2 percent from nonresidential renovations, and 11.8 percent from the residential sector.

The adoption of the Energy Efficiency Standard for Hawaii County requires legislative action on the part of the Hawaii County Council. Currently, an advisory committee is reviewing the Model Energy Code for submittal to the Hawaii County Council. Adoption of the new standards is anticipated by 1995. Following adoption of the standards in their final form, HELCO will factor into its demand forecasts any estimated energy reductions that may result.

Summary

In summary, the peak demand forecasts contained in Table 1-1 reflect conservative, rather than optimistic, assumptions about the level of visitor arrivals and general economic growth for Hawaii County. Population projections are only one of the elements of the overall forecasting model; other elements include such items as weather patterns, conservation efforts, and projects under construction. These projections are frequently reevaluated to maintain accuracy and adequateness of HELCO's planning efforts. State Series M-K and County General Plan population projections are not used in the HELCO demand forecasts reflected in Table 1-1. Short-term projections are based mainly on the historical peak demand data and on the ongoing construction projects for those developments advanced enough in the planning process to be considered "certain." Long-term projections from 1998 to 2010 use population projections developed by the Consumer Advocate's Office for use in the Integrated Resource Planning process. Appropriate changes have been made to Section 3.3.3 of the Revised Final EIS. This discussion and a summary of the March 1993 Forecast and Planning Committee Meeting have been included in Section 9 of the Revised Final EIS.

HAWAII ELECTRIC LIGHT CO., INC.

FORECAST PLANNING COMMITTEE MEETING

SUMMARY OF MARCH 1, 1993 MEETING

PROCEDURE

The HELCO Forecast Planning Committee (FPC) met on March 1, 1993 to develop a Sales and Peak Forecast for the years 1993 through 1998. A number of forecasts for individual rate schedules over the 1993 to 1995 period were presented by members of the FPC. Among the forecast recommendations reviewed were those derived from (1) Marketing Analyses (2) Customer Service analyses (3) Econometric modeling and (4) Consumer Advocate projections on Schedule R Use Per Customer. This forecast was prepared for evaluation by the HELCO Integrated Resource Planning Advisory Group as shown in Table 1.

Table 2A displays the adopted forecasts for 1993 and 1994 by individual rate schedules as well as the adopted forecasts of total KWH sales, peak and KWH sales load factor for the years 1992-1998. Table 2B shows the adopted 20 year forecast of syste peak demand from 1993 through 2013. The adopted forecasts of the average number of customers by rate schedules for the years 1993-1998 appears in Section 3, Table 3.

Table 4 compares 1992 recorded billed KWH sales to the individual rate schedule forecasts adopted at the last FPC meeting held on April 1, 1992.

ECONOMIC INDICATORS

Early predictions by several local economists indicated that 1993 was to have been a better year than 1992. These were more recently changed to a forecast of no growth due to the national and regional recession that negatively impacts the visitor industry growth.

A weak National economy and reduced Federal spending have clouded the hopes of an improved economic picture for Hawaii. Statewide, the visitor industry was negatively affected by national coverage of Hurricane Iniki which devastated Kauai on September 12, 1992. The bulk of the Kauai visitor bookings were absorbed by other neighbor island tourist destinations and resulted in an immediate but temporary economic benefit to the Big Island. The downturn in the Japan economy and its recessionary effects on travel and spending have caused further visitor industry concern relating to Eastbound visitor arrivals. California's economic woes have affected the number of Westbound tourists, motivating the Hawaii Visitors Bureau to consider added promotional efforts. Further impeding the Hawaii visitor industry are the recent cutbacks in the number of domestic flights and reductions in promotional advertising by several major carriers.

Near-term economic projections for Hawaii vary from optimism by the State DBED&T, to more cautionary outlooks by visitor destination promotional groups in Hawaii.

Concerns regarding the extent and duration of the current state-wide economic slump were expressed by individual members of

the HELCO FPC. Discussion then moved to concerns regarding the economic forecasts at the local level and related impacts to HELCO and the Big Island. Foremost on FPC members' minds was the eventual closing of Hamakua Sugar at the end of March, the winding down of the Hilo Coast Processing Company and its likely negative impact on Ka'u Sugar Company operations. With Hamakua Sugar closing, many displaced wage earners will suddenly be thrust into the Hawaii island job-seeking marketplace where unemployment was currently at 7.7% for February 1993. As another indicator of employment difficulties on the Big Island, many Big Island construction workers are now commuting to the neighbor islands for employment.

As a result of the statewide recession and the slowdown in new construction, HELCO's near-term KWH sales growth is projected to be weakened. The overall slowdown of construction activity in Kona, continued economic stability in Hilo and Puna as reflected by an increase in housing construction, and moderate growth in the Waimea area were additional considerations also factored into near-term sales projections.

DISCUSSION OF SALES AND CUSTOMER FORECASTS BY RATES

Schedule R, Residential Service

1992 Recorded Billed KWH Sales

Recorded billed KWH sales for 1992 of 299.7 GWH indicated a gain of 10.0 GWH (Hilo +5.1 GWH, Kona +1.7 GWH, Waimea +3.2 GWH, or a 3.5% increase over 1991 recorded billed KWH sales of 289.7 GWH. For 1992, the recorded billed KWH sales were 3.1 GWH below

the adopted residential Middle Moderate Econometric Model forecast. Growth for the Hilo district was noted to be largely due to more "ohana" type dwellings. The Puna district also reflected this same trend in addition to a steady level of owner/builder home construction. It was felt that a saturation level of home construction in Kona was realized in 1992, as indicated by the large amount of "For Sale" signs posted in many neighborhoods.

1992 Customers and Use Per Customer

The 1992 recorded average number of 45,260 customers reflected a 4.4% growth over 1991 recorded average customer numbers and was only 83 customers lower than the 1992 adopted forecast provided by Customer Service.

The average annual use per customer recorded for 1992 was 6,626 KWH or 52 KWH below the adopted forecast and 54 KWH less than the 6,794 KWH recorded in 1991. The slight decrease in use per customer was most likely due to (1) heightened energy awareness and some conservation practices, (2) reduced visitor occupancy in resort condominiums, and (3) more rental vacancies.

1993-1994 KWH Sales Forecast

The continuing national economic recession and the slowdown in new construction indicates that the current level of slowed growth will persist for a number of years. Only a few multi-family housing projects are expected to come on line as sales of resort type condominiums have slowed to a trickle. Advance bookings for Big Island hotels appear to be stable for the first 6 months of 1993, and then appear to drop off for the

second half of the year. This drop-off will also affect the resort condominium rental market.

The FPC discussion further noted that an influx of residents to Hilo from Honolulu in the next 3-5 years is possible. The opportunity to sell high on Oahu and buy "cheap" in Hilo as well as Hilo's desirable local flavor could attract an increasing customer base in the Hilo service area.

For 1993 and 1994, the Customer Service Department's projections of 309.7 GWH for 1993 and 320.7 GWH for 1994 were presented and discussed in detail. The accuracy of this short-term forecasting method is based on close observation and tracking of its daily operations. Market Analyses offered 310.7 GWH and 320.9 GWH for 1993 and 1994 respectively. This year the FPC reviewed a recommended forecast for the residential sector from the Consumer Advocate's Office (used in HELCO's Integrated Resource Planning advisory group discussion). Math modeling forecasts were reviewed prior to this meeting but it was felt that these forecasts were not able to adjust for the dramatic slowing of the local economy and were deemed as inappropriate choices. After brief discussion of the merits of each of the forecasts presented, the FPC agreed to accept Customer Services' forecast of 309.7 GWH and 320.7 GWH for 1993 and 1994 respectively. This was combined with the Consumer Advocate's forecast for the years 1995 through 2010 for long term projection purposes.

1993-1994 Customers and Use Per Customer

There were 45,260 average residential customers recorded for 1992. The increase of 1,917 customers over 1991 represents a 4.4% increase. Lower numbers of new customers are anticipated for the near future. To adjust for this projected reduction, the forecasted numbers for 1993 of 46,810 and for 1994 of 48,460 were reduced by 100 customers for each year and presented to the FPC. The FPC approved 46,710 for 1993, and 48,360 for 1994 as the best choices for numbers of residential customers.

The derived projections of 553 KWH per customer per month in 1993, and 553 KWH per customer per month in 1994 represent a levelized projection in use per customer for 1993 and 1994. The derived forecast of 6,630 KWH per year for 1993 represents a small increase of 9 KWH (-62 KWH in 1992) from the 6,621 KWH recorded in 1992.

Schedule G, General Service

1992 Recorded Billed KWH Sales

Recorded billed KWH sales for 1992 of 240.7 GWH indicates a gain of 26.2 GWH (Hilo 16.6 GWH; Kona 5.2 GWH; Waimea 4.4 GWH), or a 12.2% increase over 1991 recorded billed KWH sales of 214.5 GWH. The recorded billed KWH sales of 240.7 GWH was 6.2 GWH above the Customer Service revised forecast of 234.5 GWH. In comparing the 1992 recorded Schedule G growth by service area to the forecasted figures, it can be shown that the growth for Hilo was underestimated, and overestimated for the Kona and Waimea areas. Hilo Schedule G sales were forecasted at 8.5 GWH, however 16.6 GWH was attained. Kona's were forecasted at 6.0 GWH and 5.2

GWH was realized. Waimea's were forecasted at 5.5 GWH and 4.4 GWH was recorded. Transfers in rate schedules from Schedule P to J accounted for a portion of the jump in Schedule G loads. Increases in pumping loads were also noted as 1992 was generally a drier year, especially during the first half of the year in the Hilo and Puna districts.

1992 Customers and Use Per Customer

The 1992 recorded average number of customers of 8,307 was 259 customers more than the recorded figures in 1991 but 121 customers less than the forecasted Customer Service projections (not including residential construction customers using temporary power service). The 1992 recorded growth of 259 customers represents a 3.2% increase over 1991.

The average monthly use per customer of 2,414 KWH per month was 193 KWH more per month than the 1991 average of 2,221 KWH.

1993-1994 KWH Sales Forecast

Customer Service's adjusted (for slower economic growth) forecast of 256.2 GWH in 1993 and 273.2 GWH in 1994 was recommended for this Rate Schedule. Customer Service's close scrutiny of customer activity has been responsible for recognizing and adapting forecasts to large customer adjustments and new developments in this rate schedule.

The FPC then reviewed the Engineering Department's listing of proposed projects. The reliability of the proposed load connection completion dates was discussed. No new shopping centers in Hilo were noted and a Food Fair supermarket for Pahoa has been deferred.

Consolidation of loads, and load transfers from H/K rates to Schedule G are anticipated due to the new Schedule H rates which took effect October 9, 1992. Schedule G growth for 1993 is expected to be about 6.0 GWH for Hilo, 5.5 GWH for Kona, and 5.0 GWH for Waimea.

It appears that many of the projects currently identified for completion in 1994 will slide into 1995 or 1996. These include the Keahole Airport improvements, Liliuokalani Trust lands in Kailua, the Kealakehe golf course, and Lands of Ka'u (district in Kona). The Customer Service adjusted forecasts of 256.2 GWH in 1993 and 273.2 GWH in 1994 were adopted by the FPC. These numbers reflect a slowdown in the economic growth projections.

1993-1994 Customers and Use Per Customer

The FPC adopted Customer Service's projections of 8,567 and 8,837 customers for 1993 and 1994 respectively. The FPC agreed that Customer Service's adjusted numbers were the best choices for the short-term future.

The calculated 1993 average monthly use per customer of 2,492 KWH is 78 KWH per customer per month more than in 1992. The derived forecast for 1994 of 2,576 KWH per customer per month reflects an increase of 84 KWH per customer per month.

Schedule G is not a homogeneous rate as it incorporates a vast mix of customers and applications from small residential temporary construction power, to shopping centers, to service buildings, to sugar processing companies for use when their mills are down for over-haul, and to water pumping which can vary with

weather and other temporary conditions. DSM considerations were assumed to impact this rate by -1.0 GWH in 1993 in light of the excellent response by HELCO customers to the Commercial Pilot Lighting Program.

Schedule H, Heating, Cooking and Heat Pumps

1992 Recorded Billed KWH Sales

Recorded billed KWH sales for 1992 of 47.9 GWH indicated a growth of 0.8 GWH or a 1.7% increase over 1991 sales. Recorded billed KWH sales were only 0.1 GWH above the adopted Econometric forecast.

1992 Customers and Use Per Customer

The 1992 recorded average number of 785 Schedule H customers was 5 below the forecast. The historical decline in numbers of Schedule H customers and the potential for meter combinations of older existing commercial businesses continues to impact this rate. This impact is expected to continue in light of the October 9, 1992 revised rate schedule H, which does not allow air conditioning and refrigeration loads to be tied-in to new customer billing accounts.

1993-1994 KWH Sales Forecast

Customer Service's forecast was the only forecast offered. Sales of 47.6 GWH in 1993 and 46.8 GWH in 1994 were projected. This rate is anticipated to be eventually phased out as it is currently applicable only to commercial cooking, heating and heat pumps.

1993-1994 Customers and Use Per Customer

Schedule H continues to show a decline in the numbers of customers. The Customer Service projections of 761 customers in 1993, and 726 in 1994 were adopted. Calculated use per customer is 5212 KWH per month or 62,549 KWH per year in 1993, and 5372 KWH per month or 64,462 KWH per year in 1994.

Schedule P, Large Power

1992 Recorded Billed KWH Sales

Recorded billed KWH sales for 1992 of 196.4 GWH indicated a gain of 0.5 GWH or a 0.3% increase over 1991 recorded billed KWH sales of 195.9 GWH. Of the 0.5 GWH gain realized in 1992, 3.2 GWH was attributed to new loads but was offset by hotel adjustments, other adjustments, and total individual adjustments. Summaries of the major load additions and adjustments were reviewed in detail. Recorded KWH sales for this Rate Schedule was 4.1 GWH above the adopted Marketing Forecast for 1992. Reasons for the deviation are (1) increased consumption at hotels due to more tourists in the last quarter of the year because of Hurricane Iniki, (2) a small increase on supermarket accounts due to warmer weather, and (3) a one year delay in achieving a forecasted 1.5 GWH reduction projected with HELCO's Pilot Commerical Lighting Program. This is a result of nation-wide shortages of the new energy efficient lighting products.

1992 Customers and Use Per Customer

For 1992, 59 Customers were recorded, 3 below forecast. Financial problems plagued Ocean Farms from establishing its own service location and it continued as a sub-tenant to the Keahole

Airport account while in receivership. Other Schedule P customers transferred to Schedule J, which account for a portion of the forecast deviation.

1993-1994 KWH Sales Forecast

Two Customer Service and two Marketing forecasts for Schedule P were presented to the FPC. Customer Service presented its original forecast of 199.4 GWH in 1993 and 204.4 GWH in 1994, and its adjusted forecast of 193.9 GWH in 1993 and 193.4 GWH in 1994. Marketing's forecast was 197.3 GWH in 1993, and 208.4 GWH in 1994. The adjusted Marketing forecast is 195.3 GWH in 1993 and 206.4 GWH.

Marketing's original forecast of 197.3 GWH for 1993 was prepared by projecting Schedule P KWH sales on an individual account basis through analyses of customer usage. Personal interviews with customers and reviews of tneir past performance continues to form the basis for Marketing's Schedule P forecasts. Projected KWH sales for each customer were forecasted. The forecast estimates for 1993 and 1994 identify the KWH sales by districts, type of load change and type of business. Data was carefully reviewed.

It was earlier agreed that the Pilot Commercial Lighting Program impact to rate schedule P would be -2.0 GWH in 1993. In discussion, it was noted that the DSM Pilot Commercial Lighting Program impacts had not entered into Marketing's individual customer forecast, but some consideration to DSM was entered into the Customer Service forecast. Although delayed by product availability, the anticipated target goal of 700 KW demand

reduction and 3.0 GWH sales reduction was to be considered in the short-term forecast. (1.0 GWH was deducted from the Adjusted Customer Service forecast Rate Schedule G.) The Adjusted Marketing Forecast of 195.3 GWH in 1993 (includes -2.0 GWH for the DSM Pilot Commercial Lighting Program), represents a -1.1 GWH change, or a 0.6% reduction from the 1992 KWH sales of 196.4 GWH.

Major loads expected in 1993 are carry-over new loads from Waikoloa Pumps and the Department of Water Supply. New project loads for the HELCO system are two new County of Hawaii sewage treatment facilities, one in Hilo and the other at Kealakehe, Kona. A private sewage treatment plant at Keauhou Kona is anticipated to come on line by mid-year.

The Adjusted Marketing forecast for 1994 of 206.4 GWH represents a 11.1 GWH gain or a 5.7% increase. The 350 room Hapuna Beach Prince Hotel, and Liberty House-Lanihau Shopping Center are major 1994 projects.

The FPC adopted the Adjusted Marketing projections of 195.3 GWH in 1993 and 206.4 GWH in 1994 as reasonable in light of the supporting data offered.

1993-1994 Customers

Fifty-nine Schedule P customers were forecasted by Marketing for 1993 and sixty-five for 1994. This was adopted by the FPC.

Schedule F, Street Lights

1992 Recorded Billed KWH Sales

Recorded billed KWH sales for 1992 were 3.3 GWH, the same as in 1991. The County of Hawaii continues its program to convert to more efficient low pressure sodium street lights and adds new

fixtures to their system each year. (The County Government accounts for 95% of the load for this rate schedule.)

1992 Customers

There were fifty-one average customers in 1992, twenty-two more than in 1991.

1993-1994 KWH Sales Forecast

The declining KWH sales trend bottomed out in 1989 as the County slowed its nearly complete re-lamping program. The gradual conversion has stabilized this rate schedule. A new method of counting these County accounts has increased the numbers of customers. The Committee agreed to accept 3.4 GWH as reasonable for both 1993 and 1994.

1993-1994 Customers

Sixty-three customers are forecasted for 1993, a gain of twelve customers over 1992 (mostly due to the method of counting County of Hawaii customers). An additional twelve customers are projected for 1994.

TOTAL SALES

1993-1994 SALES

As shown on Table 2A, the sum of the KWH sales in the individual rate schedules for 1993 totals 812.2 GWH. This represents an increase of 24.2 GWH, or 3.1%, over 1992 recorded KWH sales. In relation to current economic conditions, sales growth at this level appears to be low but reasonable. For 1994, the total KWH Sales Forecast amounted to 850.5 GWH, which

represents an increase of 38.3 GWH, or 4.7% more than the 1993 forecast. The FPC adopted the total KWH sales forecasts of 812.2 GWH for 1993 and 850.5 GWH for 1994.

1995-1998 TOTAL KWH SALES

Marketing and Customer Service provided short-term forecasts and had no formal total KWH sales forecasts beyond 1995 since they do not have sufficient information for this period. For 1995, it was decided to derive the Total KWH sales projection based on forecasts of the individual rate schedules ("R" 331.3 GWH, "G" 291.2 GWH, "H" 45.5 GWH, "P" 213.3 GWH, and "F" 3.5 GWH). This method of forecasting total sales produced 884.8 GWH for 1995. The gain of 34.3 GWH or 4.0% growth appeared reasonable.

For 1996, 1997 and 1998, a gain in total KWH sales of 33.6 GWH, 31.3 GWH and 38.4 GWH, respectively, appear to be reasonable as compared to the gain in KWH sales by individual rate schedules and service areas from 1992 to 1995. For Rate Schedule R, the increase was based on a slower completion of new homes. For Rate Schedule G, the increase was based on expected moderate economic growth. For Rate Schedule P, an increase of 6.9 GWH in 1995 was based on individual customer gains and two new stores---JC Penney and Liberty House.

SYSTEM PEAK AND SALES LOAD FACTOR

Forecasts of system peak demand and sales load factor were projected for the years 1993-1998 as shown in Table 2A.

Recorded peaks and growth trends of recent years were reviewed. The FPC's recommendations have been reasonably close

to the recorded system peaks. In 1988, the recorded system peak of 126.3 MW was 2.3 MW above the 1988 forecast and in 1989, the system peak of 130.4 MW was 1.6 MW below the 1989 forecast. In 1990, the recorded system peak of 140.3 MW was 1.3 MW above the 1990 forecast, and in 1991, the recorded system peak of 145.4 MW was 0.4 MW above the 1991 forecast. For 1992, the recorded peak of 150.2 MW was 0.8 below the 1992 forecast. In past FPC meetings, it was noted that 4.5 MW of the 10.3 MW increase in 1988's system peak was attributed to the then fully occupied Hyatt Regency Hotel at Waikoloa which opened in September 1988.

The FPC's projection of future growth has changed significantly in the past few years. In the 1987 forecast, an increase in system peak of 4 MW per year was considered good. This 1987 five-year forecast was based on slightly pessimistic economic and visitor industry climates. In the 1988 forecast, an increase in system peak of 5 MW per year was derived on the basis of moderate economic conditions. In the 1989 forecast, increases of 6 to 7 MW per year in the system peak were projected based on the strong influence of Japanese visitors and developers. In the 1990 forecast, gains of 7 to 9 MW per year were anticipated due to the accelerated development of new resorts and commercial projects in West Hawaii, strong residential new construction, favorable overall, island-wide economic conditions, and a balance between visitor, resident and government needs, interactions and interventions. In 1991, the softened growth rate was due to a slowing of new construction, economic uncertainty brought about by a national recession and effects of the Persian Gulf war,

customer pricing reactions to higher energy costs and energy conservation awareness. In 1992, the FPC forecasted a gain of 5.6 MW, however, 4.8 MW was realized due to the slowing of the local economy. A forecast of 157.0 MW was adopted for 1993 as reasonable. The 157.0 MW forecast for 1993 is 1.0 MW less than the 1993 Forecasted Peak adopted a year earlier on April 1, 1992.

For 1993, 1994, 1995, 1996, 1997, and 1998, gains of 6.8 MW, 8 MW, 6 MW, 6 MW, 7 MW, and 7 MW were decided as reasonable based on previous discussions on the growth in the individual rate schedules, economic factors, the completion of resort hotels (with 1994 being the key year) and the peak-load impact of the Commercial Lighting Pilot DSM Program. Resort development is expected to slow thereafter. The FPC continues to go on record that unforeseen conditions could affect peak forecasts from year to year by a plus 2 MW to minus 1 MW deviation band. This means that peak projections could be slightly on the lower side in a two to three year time frame during periods of favorable economic conditions and vice versa during periods of economic slow downs.

The FPC projected a twenty year forecast to set generation requirement objectives for proper long-range planning. The projections were based on long-range Econometric Modeling with growth extended out at a slightly declining rate as shown in Table 2B.

At the conclusion of the meeting, the FPC concurred that it was reasonable to prepare for integrated resource planning and demand-side management impacts that will become a large component of the forecasting process for long-range load planning.

The resulting sales load factors for 1992-1997 as shown in Table 2A were calculated, reviewed and adopted by the FPC.

HAWAII ELECTRIC LIGHT COMPANY, INC.
Table 1
Summary of Forecasts Presented

			Marketing Analys	Customer Service	Combined CS w/ CA	Adopted Forecast
"R"	Sales (GWH)	1993	310.7	309.7	309.7*	309.7
		1994	320.9	320.7	320.7*	320.7
	Customers	1993		46,710*		46,710
		1994		48,360*		48,360
				Origl Revsd Adjstd		
"G"	Sales (GWH)	1993		264.2 257.2 256.2*		256.2
		1994		290.2 274.2 273.2*		273.2
	Customers	1993		8,567*		8,567
		1994		8,837*		8,837
"H"	Sales (GWH)	1993		47.6*		47.6
		1994		46.8*		46.8
	Customers	1993		761*		761
		1994		726*		726
			Marketing		Cust Service	
			Origl Revsd Adjstd		Origl Revsd	
"P"	Sales (GWH)	1993	197.3 197.3 195.3*		199.4 193.9	195.3
		1994	204.6 208.4 206.4*		204.4 193.4	206.4
	Customers	1993	59*			59
		1994	65*			65
				Cust Service		
"F"	Sales (GWH)	1993		3.4*		3.4
		1994		3.4*		3.4
	Customers	1993		63*		63
		1994		75*		75
	Total Sales	**1993**				**812.2**
		1994				**850.5**
	Customers	**1993**				**56,160**
		1994				**58,063**

* selected model

HAWAII ELECTRIC LIGHT COMPANY, INC.
TABLE 2A
FORECAST OF SALES, PEAK & SLF
1993-1998
March 1, 1993

At its meeting of March 1, 1993, the HELCO Forecast Planning Committee adopted the following forecasts of KWH Sales, Peak Demand and Sales Load Factor for 1993-1998.

Rate	GWH 1992(R)	GWH 1993(F)	GWH Incr	% Incr	GWH 1994(F)	GWH Incr	% Incr
R	299.7	309.7	10.0	3.3	320.7	11.0	3.6
G	240.7	256.2	15.5	6.4	273.2	17.0	6.6
H	47.9	47.6	(0.3)	(0.6)	46.8	(0.8)	(1.7)
P	196.4	195.3	(1.1)	(0.6)	206.4	11.1	5.7
F	3.3	3.4	0.1	3.0	3.4	0.0	0.0
Total	788.0	812.2	24.2	3.1	850.5	38.3	4.7

Year	GWH Sales	GWH Incr	% Incr	Peak (MW)	MW Incr	% Incr	SLF	Incr
1992	788.0	37.5	5.0	150.2	4.8	3.3	59.9	0.7
1993	812.2	24.2	3.1	157.0	6.8	4.5	59.1	(0.8)
1994	850.5	38.3	4.7	165.0	8.0	5.1	58.8	(0.3)
1995	884.8	34.3	4.0	171.0	6.0	3.6	59.1	0.3
1996	918.4	33.6	3.8	177.0	6.0	3.5	59.2	0.1
1997	949.7	31.3	3.4	184.0	7.0	4.0	58.9	(0.3)
1998	988.1	38.4	4.0	191.0	7.0	3.8	59.1	0.2

*1992 Billed GWH sales

FORECAST PLANNING COMMITTEE:

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Rick von Gnechten

William J. Stormont

(excused)
Rankin A. Curtis

HAWAII ELECTRIC LIGHT COMPANY, INC.
TABLE 2B
FORECAST OF SALES, PEAK & SLF 1993-1998
March 1, 1993

At its meeting of March 1, 1993, the HELCO Forecast Planning Committee adopted the following forecasts of System Peak Demand for 1993-2013.

Year	Peak (MW)	MW Incr	% Incr
1985	102.4	5.4	5.6
1986	108.6	6.2	6.1
1987	116.0	7.4	6.8
1988	126.3	10.3	8.9
1989	130.4	4.1	3.2
1990	140.3	9.9	7.6
1991	145.4	5.1	3.6
1992	150.2	4.8	3.3
Forecast			
1993	157.0	6.8	4.5
1994	165.0	8.0	5.1
1995	171.0	6.0	3.6
1996	177.0	6.0	3.5
1997	184.0	7.0	4.0
1998	191.0	7.0	3.8
1999	199.0	8.0	4.2
2000	207.0	8.0	4.0
2001	215.0	8.0	3.9
2002	224.0	9.0	4.2
2003	233.0	9.0	4.0
2004	242.0	9.0	3.9
2005	251.0	9.0	3.7
2006	261.0	10.0	4.0
2007	271.0	10.0	3.8
2008	283.0	12.0	4.4
2009	295.0	12.0	4.2
2010	308.0	13.0	4.4
2011	321.0	13.0	4.2
2012	334.0	13.0	4.0
2013	348.0	14.0	4.2

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HAWAII ELECTRIC LIGHT COMPANY, INC.
Table 3
1993-1998 Forecasted Numbers of Customers

	1993 Forecast	1994 Forecast	1995 Forecast	1996 Forecast	1997 Forecast	1998 Forecast
Customers						
R	46,710	48,360	50,235	51,454	52,703	53,981
G	8,567	8,837	9,177	9,450	9,739	10,028
H	761	726	694	662	630	598
P	59	65	68	70	72	74
F	63	75	87	99	111	123
Total	56,160	58,063	60,261	61,735	63,255	64,804
Customer Increase						
R	1,450	1,650	1,875	1,219	1,249	1,278
G	260	270	340	273	289	289
H	(24)	(35)	(32)	(32)	(32)	(32)
P	0	6	3	2	2	2
F	12	12	12	12	12	12
Total	1,698	1,903	2,198	1,474	1,520	1,549
% Increase	3.1%	3.4%	3.8%	2.4%	2.5%	2.4%

Section 10
Bibliography

Black & Veatch. *Supply-Side Resource Option Portfolio Development, Final Report.* July 1993.

Bruner, Phillip L. *Survey of the Avifauna and Feral Mammals at Keahole, North Kona, Hawaii.* July 1992.

CH2M HILL. *Assessment of Potential Property Value Impacts.* November 1992a.

_____. *Groundwater Impacts for the Proposed Expansion of Keahole Generating Station.* November 1992b.

_____. *West Hawaii Site Study.* August 1988.

Char & Associates. *Botanical Survey, Keahole Generating Station Expansion, North Kona District, Island of Hawaii.* July 1992.

Cooper, H. H., Jr. and Jacob, C. E. "A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Wellfield History." *Transactions, American Geophysical Union.* Vol. 27, No. 4. 1946.

County of Hawaii. *Keahole to Kailua Development Plan.* 1991.

_____. *The General Plan.* November 1989.

County of Hawaii, Department of Water Supply. *Hawaii County Water Use and Development Plan, Plan Revision Draft.* For the Commission on Water Resource Management, Department of Land and Natural Resources, State of Hawaii. December 1991.

_____. *Water System Standards, Volume I.* 1985.

Dames & Moore. "Technical Evaluation of Seawater Return Flow and Wastewater Disposal Systems at NELH/HOST Park." Appendix C in High Technology Development Corporation. *Final Environmental Impact Statement, Development Plan for the Hawaii Ocean Science and Technology Park and Expansion of the Natural Energy Laboratory of Hawaii, Keahole, North Kona, Hawaii.* 1985.

Drever, J. I. *The Geochemistry of Natural Waters.* Prentice Hall, Englewood Cliffs, New Jersey. Second edition. 1988.

Federal Emergency Management Agency. Flood Insurance Rate Maps. Hawaii County, Hawaii. 1988.

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Review and Reevaluation of Groundwater Conditions in the Pearl Harbor Groundwater Control Area, Oahu, Hawaii*. 1988.

_____. *Water Resources Protection Plan, Volumes I and II*. June 1990.

State of Hawaii, Department of Land and Natural Resources, Division of Water and Land Development. *Summary of Drilling Log and Pumping Test for Kalaoa Well 12-11, North Kona, Hawaii*. November 1968. Circular C48. Job No. 17-HW-20. Exploratory Drilling. November 1968.

State of Hawaii, Marine Mining Program. *A Baseline Study of Ground Water Geochemistry in the Kawaihae and Hilo Areas of the Island of Hawaii*. Department of Planning and Economic Development. 1986.

State of Hawaii, Office of State Planning. *Hawaii State Plan*. 1991.

_____. *West Hawaii Regional Plan*. 1989.

Strack, O. D. L. "A Single-Potential Solution for Regional Interface Problems in Coastal Aquifers." *Water Resource Research*. Vol. 12, No. 6. Pp. 1165-1174. 1976.

The Traffic Management Consultant. *Traffic Impact Analysis Report for the Proposed Keahole Generating Station*. August 1992.

The Traverse Group, Inc. *Draft EIS, High Technology Development Corporation Development Plan for the Hawaii Ocean Science and Technology Park and Expansion of the Natural Energy Laboratory of Hawaii*. July 1985.

U.S. Department of Commerce, Bureau of the Census. *U.S. Census Report*. 1990.

U.S. Department of Transportation. *Manual on Uniform Traffic Control Devices for Streets and Highways*.

U.S. Geological Survey. *Chemical Quality of Groundwater in Hawaii*. Report R48. Prepared in cooperation with the Division of Water and Land Development, the Department of Land and Natural Resources, and the State of Hawaii. May 1973.

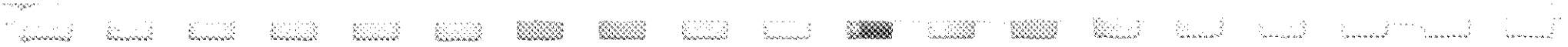
_____. *Hydrology and Sediment Transport, Moanalua Valley, Oahu, Hawaii*. Water Resources Investigations Report 84-4156. 1984.

_____. *Hydrology of the Leeward Aquifers, Southeast Oahu, Hawaii*. Water Resources Investigations Report 85-4270. 1986.

University of Hawaii. *Water Balance of the Pearl Harbor Honolulu Basin, Hawaii, 1946-1985.* WRCC Technical Report 151. 1983.

University of Hawaii, Water Resources Center. *Groundwater Recharge and Coastal Discharge for the Northwest Coast of the Island of Hawaii: A Computerized Water Budget Approach.* Honolulu, Hawaii. July 1977.

Water Resource Associates. *Geology and Groundwater Resources, Proposed Keahole Power Plant, North Kona, Hawaii.* August 1992.

Waterloo Center for Groundwater Research. *Migration and Remediation of Dissolved Organic Contaminants in Groundwater.* Short Course, Chicago, Illinois, February 24-27, 1992. 1992.

Y. Ebisu & Associates. *Acoustic Study of Potential Noise Impacts Associated with the Proposed Expansion of the Keahole Generating Station, Kona, Hawaii.* November 1992.