JOHN WAIHEE
GOVERNOR
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

HOALIKU L. DRAKE
CHAIRMAN
HAWAIIAN HOMES COMMISSION

November 29, 1993

Mr. Brian J.J. Choy, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Choy:

SUBJECT: Final Environmental Assessment (EA) for Kawaihae Cogeneration Plant, Kawaihae, Hawaii

The Department of Hawaiian Home Lands (DHHL) has reviewed the Final Environmental Assessment (EA) and comment letters for the proposed project. The EA has identified all areas of potential impacts and proposed mitigative measures. A negative declaration determination has been made based on the following reasons:

The proposed project with mitigative measures in place will:

- not involve a loss or destruction of any natural or cultural resources throughout the project development;
- not curtail the range of beneficial uses of the environment;
- not conflict with the State's long-term goals. The project is compatible with the surrounding industrial land use of the harbor and with the DHHL's master plan designating the area as industrial use;
- not substantially affect the economic or social welfare of the community or state;
- not substantially affect public health;

KAWAIHAE COGENERATION PLANT

FINAL ENVIRONMENTAL ASSESSMENT

VOLUME I

For

Kawaihae Cogeneration Partners
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

December 1993

VOLUME I

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VOLUME II

EXHIBITS

EXHIBITS

KAWAIHAE COGENERATION PLANT
DRAFT ENVIRONMENTAL ASSESSMENT

I. GENERAL INFORMATION / PROJECT SUMMARY

PROJECT	Kawaihae Cogeneration Plant
APPLICANT	Kawaihae Cogeneration Partners 1001 Bishop Street, Suite 1520 Honolulu, Hawaii 96813
APPROVING AGENCY	Department of Hawaiian Home Lands
LAND OWNER	Department of Hawaiian Home Lands
LOCATION/AREA	Kawaihae, South Kohala, Island of Hawaii
TAX MAP KEY	Zone 6, Section 1, Portions of Plats 1 and 2
STATE LAND USE DESIGNATION	Agricultural and Urban

II. STATEMENT OF OBJECTIVE

The objective of the proposed project is to develop a cogeneration power plant and appurtenant desalination facilities which will provide up to 58 megawatts (MW) of electrical power to the Big Island and up to 2.6 millon gallons of potable water to the local area. The proposed project will have significant benefits to island residents, as well as the Department of Hawaiian Home Lands and Hawaiian beneficiaries. Electric power consumers on the Big Island will benefit from the additional capacity and increased reliability. The Department of Hawaiian Home Lands will have a source of water needed for its Ten-Year Master Plan and significant revenues.

Kawaihae Cogeneration Partners (KCP) is a limited partnership between Ola La'a, Inc. and Kaimana Energy I, Inc. whose purpose is development and operation of the proposed cogeneration facility at Kawaihae. Ola La'a is wholly owned by Waimana Enterprises, Inc., a native Hawaiian owned corporation. Kaimana Energy I, Inc. is wholly owned by Diamond Energy, Inc., a Delaware Corporation.

The project is located on land owned by the State of Hawaii Department of Hawaiian Home Lands (DHHL) which is designated for industrial use in DHHL's Kawaihae Ten-Year Master Plan. The DHHL Ten-Year Master Plan Environmental Impact Statement (EIS), which was accepted in March 1993, addresses the impacts of developing over 2,000 acres, for a variety of land uses, including the 122-acre industrial area where the proposed project is located. The EIS addressed the general impacts associated with development of the power plant being proposed. This Environmental Assessment (EA) expands upon those impacts addressed in the EIS by addressing the specific impacts of KCP's cogeneration power plant project. The DHHL Kawaihae Ten-Year Master Plan EIS is provided in Appendix D.

This Environmental Assessment was prepared to fulfill the requirements of Chapter 343 of the Hawaii Revised Statutes (HRS). Any proposed action using State lands automatically triggers Chapter 343's environmental review process.

III. PROJECT DESCRIPTION

A. PROJECT LOCATION

The proposed project area is located in Kawaihae, South Kohala district of West Hawaii. (Exhibit III-1). Waimana Enterprises, Inc. has completed a lease agreement with the State Department of Hawaiian Home Lands (DHHL) for 40 acres of DHHL's 10,000-acre property in Kawaihae. The construction of the proposed power plant and ancillary facilities will encompass less than fifteen acres of land within the 40-acre leased area.

Possible use of the remainder of the parcel for additional power generation has not been sufficiently quantified to enable the applicant to assess those impacts. The need, type and location of all future power plants is subject to Hawaii Electric Light Company, Inc.'s (HELCO) Integrated Resource Planning which considers conservation measures, technological advances, and economic growth. Therefore, only the impacts of the proposed 58 MW power plant and ancillary facilities are assessed. Any future developments will be subject to all applicable regulations and permitting processes.

The 40-acre "leased area" will be within the 122-acre area designated for industrial use on DHHL's Kawaihae Ten-Year Master Plan.[1] (Exhibits III-2 and III-3). The location of the 40-acre leased area and the 15-acre construction site is shown on Exhibit III-3. For purposes of evaluating the potential impacts of the proposed project, via the State's environmental review process (Chapter 343, HRS), the entire 40-acre leased area is identified as the "study area" and is hereby referred to as such. This EA will address the existing conditions and potential impacts of the proposed development within the entire "study area."

The study area is identified as portions of Tax Map Key 6-1, plats 1 and 2, and is located mauka of Kawaihae Road, directly across from Kawaihae Harbor. (Exhibit III-4).

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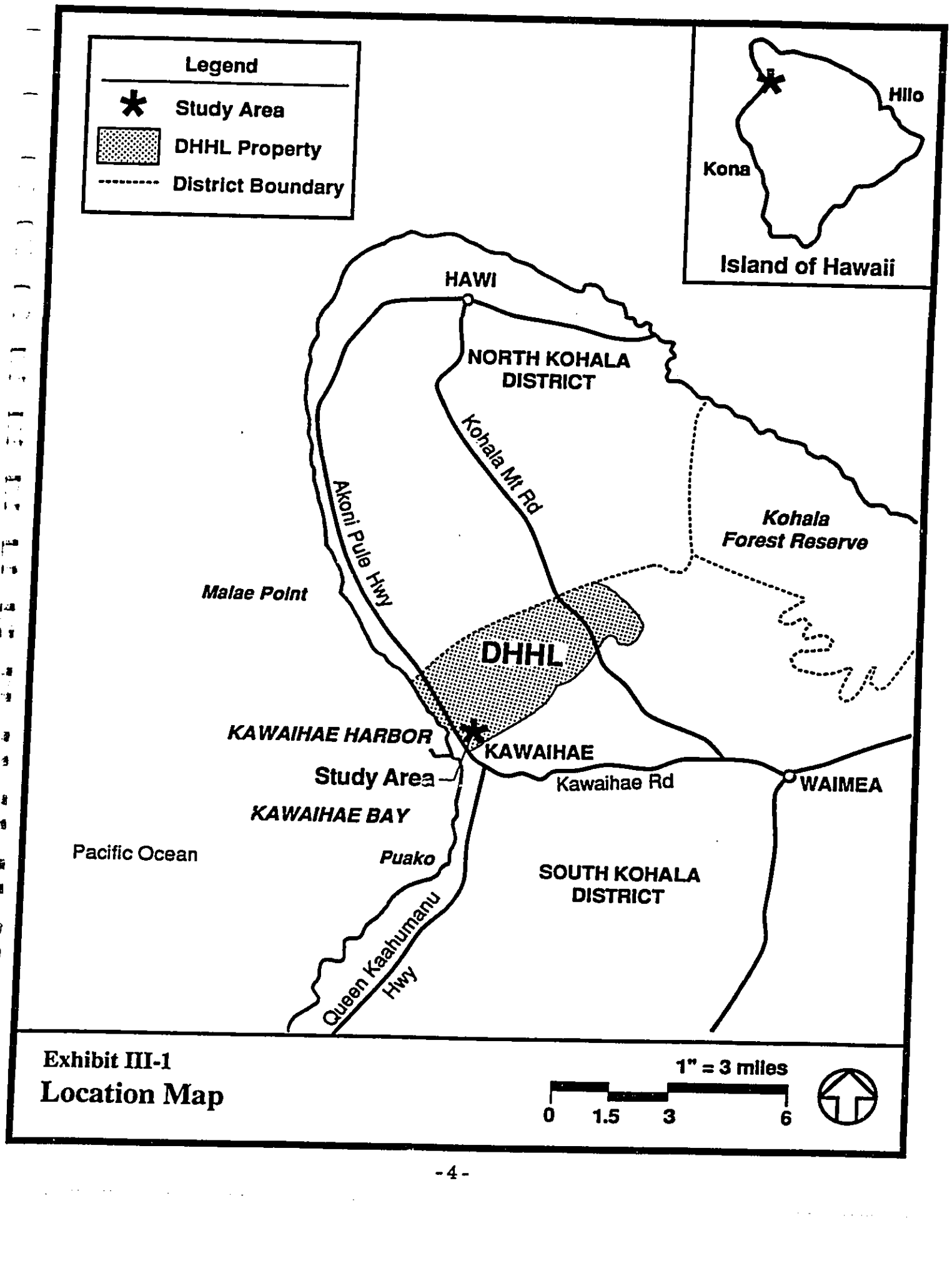
[1]R.M. Towill Corporation, Final Environmental Impact Statement, Kawaihae Ten Year Master Plan, December 1992.


Legend
Study Area
DHHL Property
District Boundary
Hilo
Kona
Island of Hawaii
HAWI
NORTH KOHALA DISTRICT
Kohala Mt Rd
Akoni Pule Hwy
Kohala Forest Reserve
Malae Point
DHHL
KAWAIHAE HARBOR
KAWAIHAE
Study Area
Kawaihae Rd
WAIMEA
KAWAIHAE BAY
Pacific Ocean
Puako
SOUTH KOHALA DISTRICT
Queen Kaahumanu Hwy
Exhibit III-1
Location Map
1" = 3 miles
0
1.5
3
6

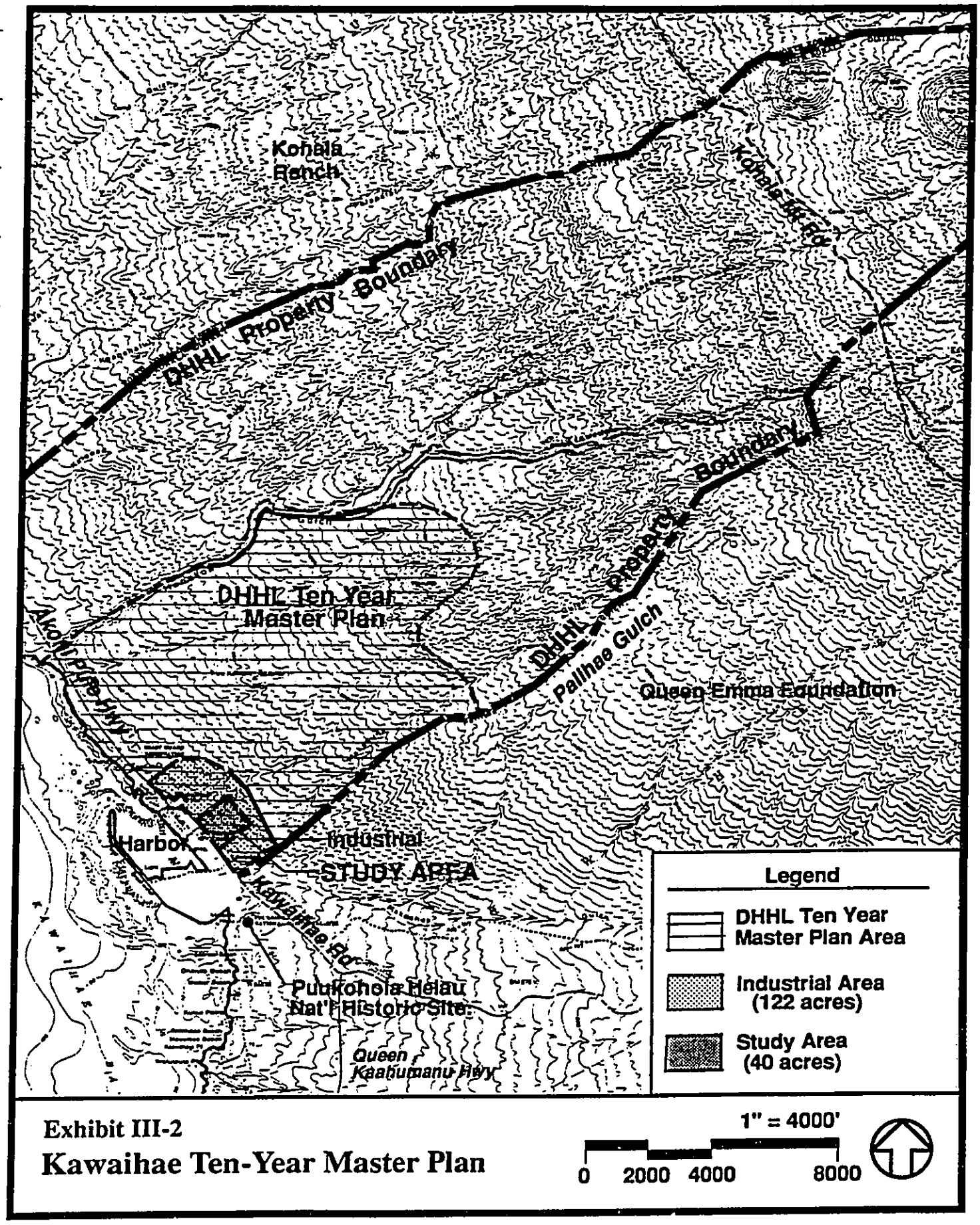


Exhibit III-2

Kawaihae Ten-Year Master Plan

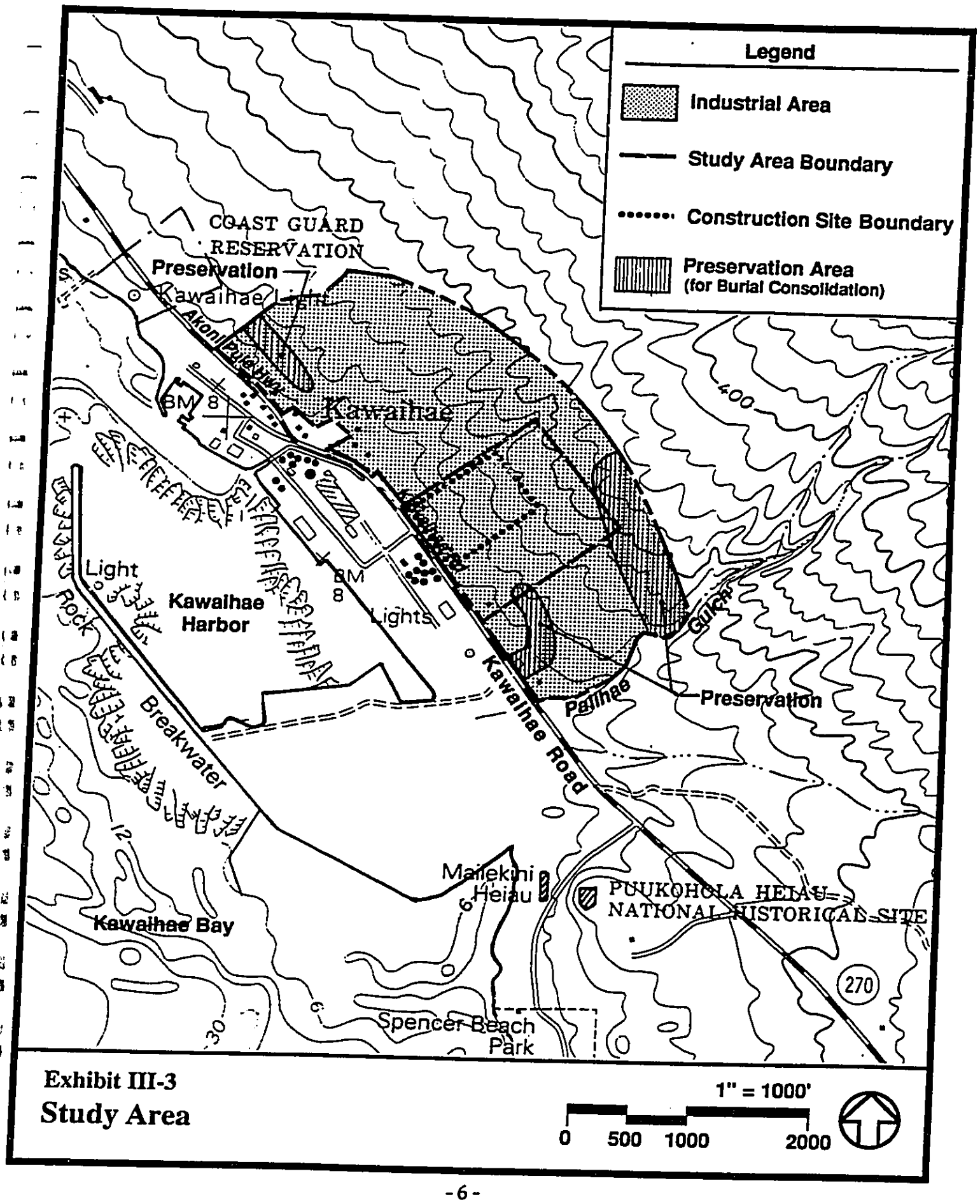


Exhibit III-3
Study Area

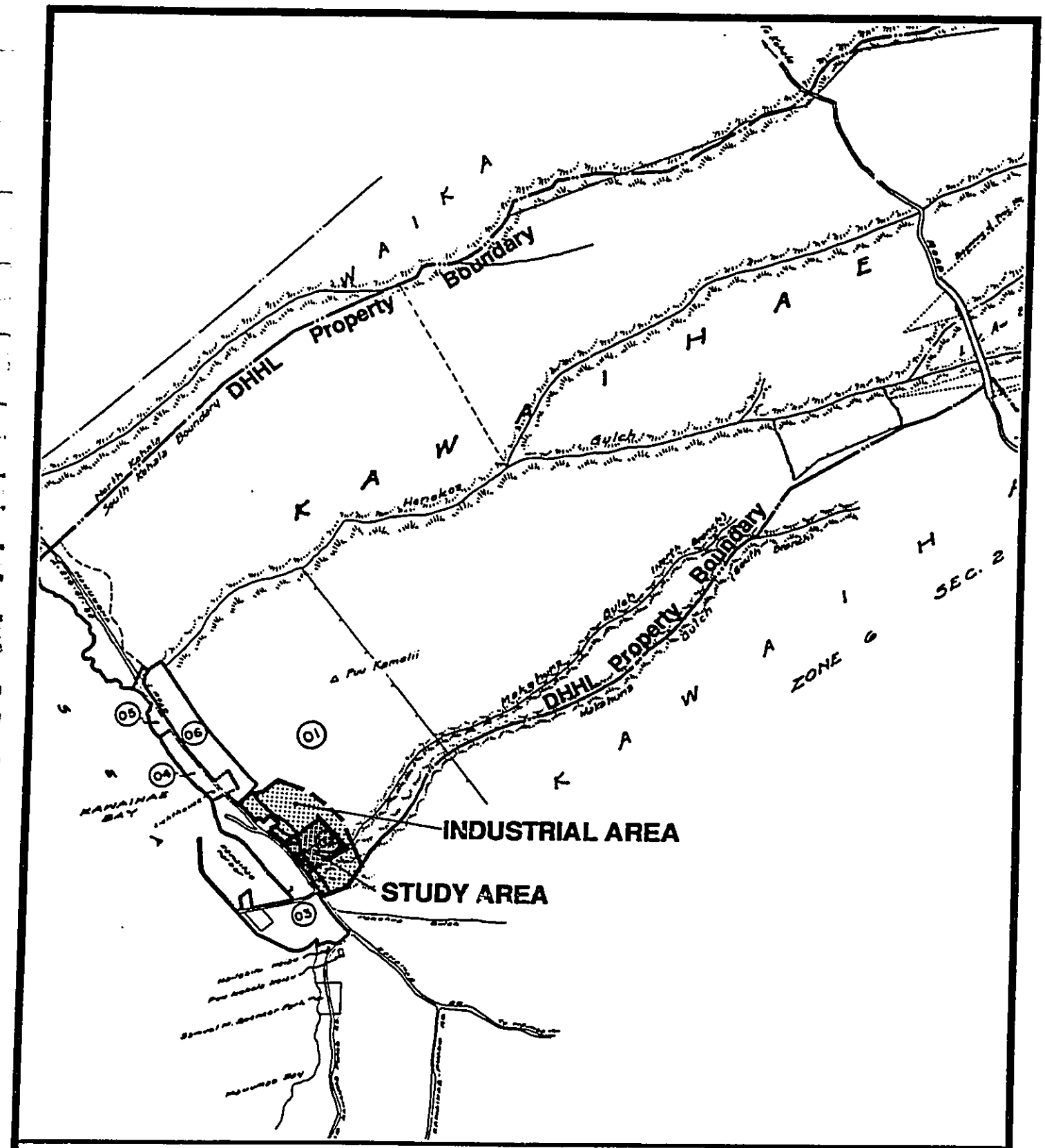


Exhibit III-4

TMK Map: Zone 6 Sec. 1

1" = 4000'

0 2000 4000 8000

B. PROJECT FACILITIES

General Description

Kawaihae Cogeneration Partners (KCP) is proposing to develop, construct, and operate a 58 megawatt (MW) Qualifying Facility (QF) power plant on the west side of the island of Hawaii, in Kawaihae. The plant is a cogeneration facility because it will simultaneously produce two forms of energy: electric power and heat, where the heat is used for industrial or commercial purposes. The net electrical power generated by the facility will be sold to HELCO and distributed to customers through the utility's existing power transmission grid. The facility will use waste heat from gas turbine exhaust to generate steam and, in turn, sell between 10,000 and 95,000 pounds per hour of steam to a desalination plant. Hence, the power plant will be treated as a cogeneration "qualifying facility" as defined by the Public Utilities Regulatory Act of 1978 (PURPA) and Hawaii Administrative Rules, Title 6, Chapter 74. The desalination plant is being designed as an integral part of the power plant although it may be owned and operated independently of the power plant. KCP will assure the desalination plant will be properly operated and maintained.

The power plant will be a dual-train combined cycle (DTCC) plant consisting of two combustion turbine generators (CTG), two heat recovery steam generators (HRSG), and one steam turbine generator (STG). (Exhibit III-5). The DTCC unit has been identified by HELCO as the most appropriate type of unit to meet HELCO's immediate system needs and is being proposed for the expansion at their Keahole power plant.[2] HELCO determined that the DTCC is the most cost effective type of unit based on the requirements for capital, operation and maintenance, and fuel. Providing 58 MW by utilizing combustion turbines operating in a dual-train mode (or two CTGs), rather than a single large CT, minimizes the impact on the island's power distribution system should there be a loss of a single generating unit, thereby providing greater system reliability.

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[2]Hawaii Electric Light Company, Inc., Draft EIS, Keahole Generating Station Expansion, December 1992.

In addition to the generating facility, major features of the KCP design include a control house, office, warehouse and shop, transmission switching station (substation), pipeline, fuel oil storage tanks, exhaust stack, condenser, centrifugal refrigeration units, cooling tower, water supply wells, reinjection well(s), treated-water storage tank, reverse osmosis units, condensate polisher (mixed bed demineralizer), wastewater storage tank, septic system, and miscellaneous ancillary features. The project "General Arrangement" plan is shown on Exhibit III-6.

A brief description of the plant components is presented in the following sections. All design data presented are preliminary and will be subject to possible change during the course of detailed engineering design.

1. Power Generation

At the heart of the planned cogeneration facility are the combustion turbine generators (CTG), heat recovery steam generators (HRSG) and steam turbine generator (STG). The simple combustion turbine engine consists of three components: a compressor, a combustor, and a turbine, which is coupled to a generator. Efficiency of a simple-cycle combustion-turbine plant is increased by feeding the hot exhaust gas from the combustion turbine into a heat recovery steam generator (HRSG) to utilize the waste heat. The waste heat generates steam, converting the plant type to a combined cycle plant. In the HRSG, the hot gas passes over heat exchanger tubes. Heat from the exhaust gas is transferred to water flowing in the tubes, generating steam. Steam at two pressure levels is generated in the HRSGs. The superheater section of the HRSG provides superheated, high-pressure steam to the steam turbine generator, and additional power is produced with essentially no additional consumption of fuel. Low-pressure steam is used primarily for feedwater deaeration with excess steam inducted into the STG.

Power generated by the project will be at 13.8 kilovolt (kV).

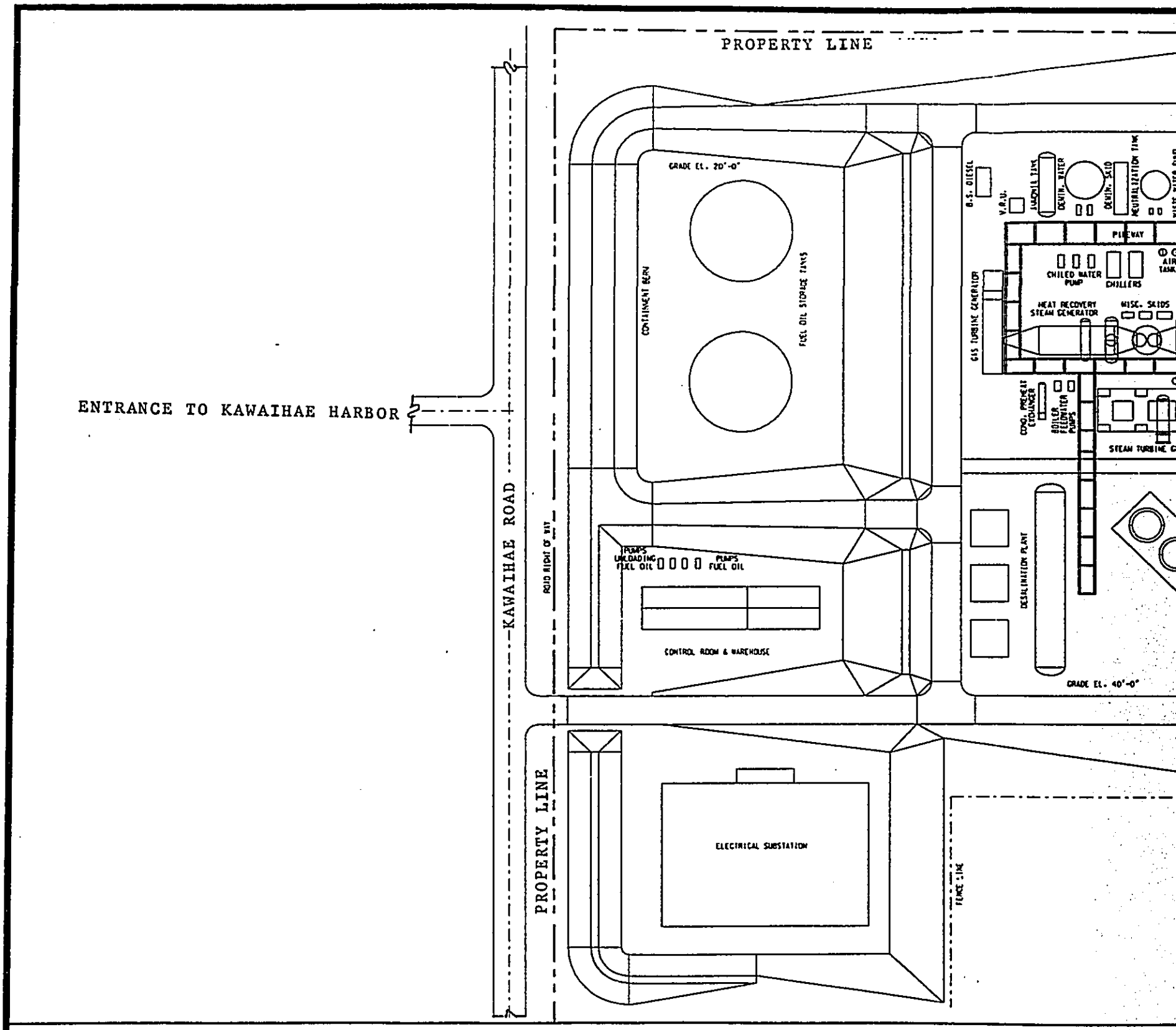
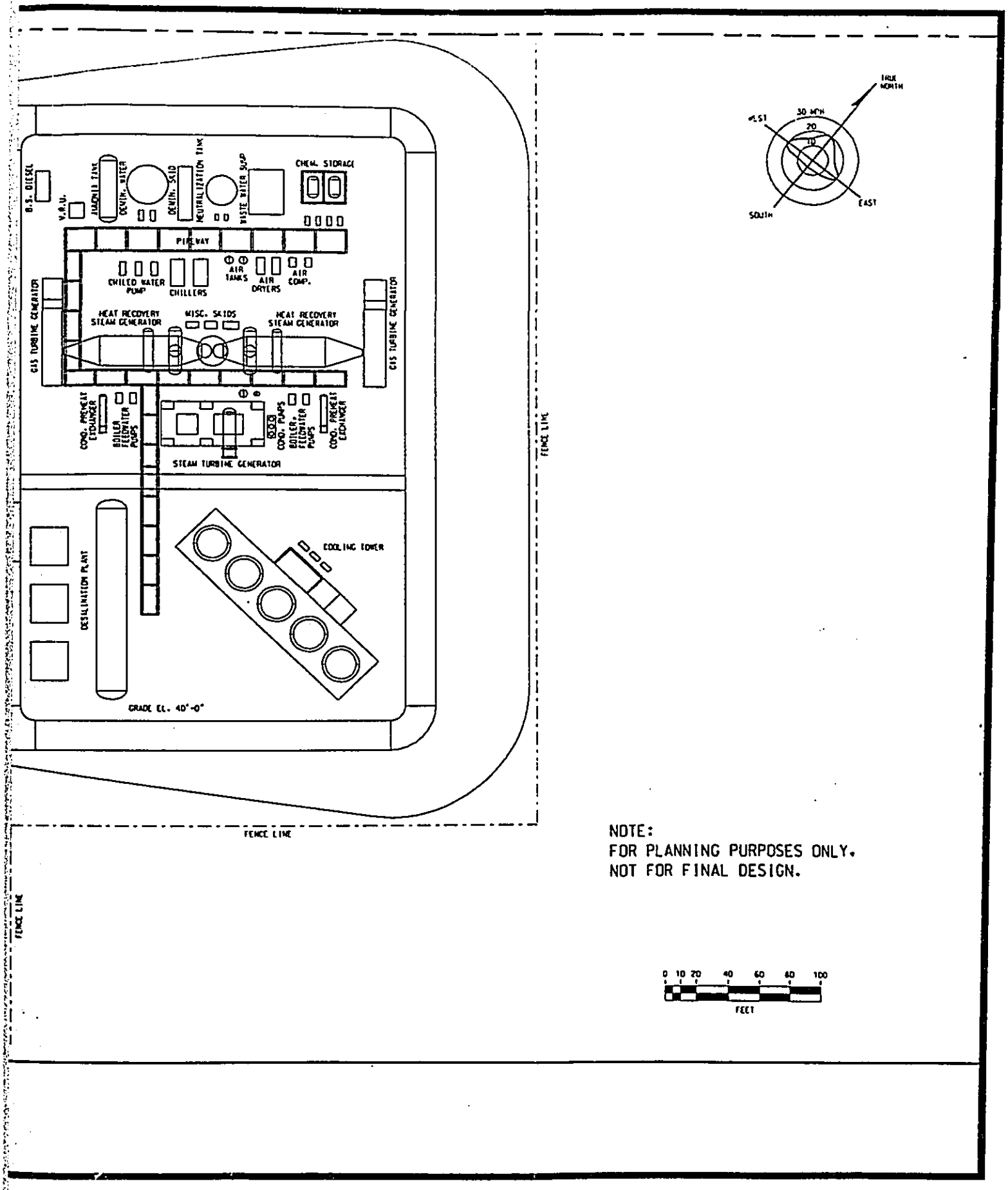


Exhibit III-6
General Arrangement of Project Features


B.S. DIESEL
V.R.U.
DEMIN. WATER
DEMIN. SKID
NEUTRALIZATION TANK
WASTE WATER SUMP
CHEM. STORAGE
PIPEWAY
CHILLED WATER PUMP
CHILLERS
AIR TANKS
AIR DRYERS
AIR COMP.
GAS TURBINE GENERATOR
HEAT RECOVERY STEAM GENERATOR
MISC. SKIDS
HEAT RECOVERY STEAM GENERATOR
GAS TURBINE GENERATOR
COND. PRECOAT EXCHANGER
BOILER FEEDWATER PUMPS
COND. PUMPS
BOILER FEEDWATER PUMPS
COND. PRECOAT EXCHANGER
STEAM TURBINE GENERATOR
DESALINATION PLANT
COOLING TOWER
GRADE EL. 40'-0"
FENCE LINE
FENCE LINE
TRUE NORTH
WEST
30 MPH
20
10
SOUTH
EAST
NOTE:
FOR PLANNING PURPOSES ONLY.
NOT FOR FINAL DESIGN.
0 10 20 40 60 80 100
FEET

Process steam for export to the desalination plant is extracted from the STG through a controlled extraction port. The STG is equipped with a full flow steam bypass. During start-up and under abnormal operation conditions, up to 100% of the superheated high pressure steam can be bypassed directly to the condenser. A desuperheater is provided to condition the bypass steam prior to entering the condenser.

In addition to the STG and HRSGs, the other major components in the steam cycle are the condenser, deaerator, and feedwater system. (Exhibit III-7). The low pressure, low temperature steam from the STG is returned to a liquid state by cooling in the condenser using water from the cooling tower. At the condenser, the extremely pure water used in the steam side of the system is kept separate from the saline cooling water flow. Condensate from the condenser flows to the deaerator before entering the feedwater system which feeds the water to the HRSG. The deaerator uses low pressure steam from the HRSG to mechanically remove non-condensable gases (primarily air) from condensate before it is returned to the HRSG.

The exhaust gases leaving the HRSG are released via a single 100 foot - dual vent exhaust stack, having a diameter of eighteen to twenty feet.

The CTGs, and STG will be housed in pre-engineered metal frame structures similar to those used at HELCO's existing power plants. Other equipment may be enclosed for noise mitigation.

2. <u>Water Systems</u>

The plant will use water of three quality levels: raw water, desalinated water, and potable water. (Exhibit III-8). Raw water will be extracted from on-site ground water supply wells and used by the desalination plant, the power plant's water treatment system, and the power plant's cooling system. Two wells will supply all the raw water need for full

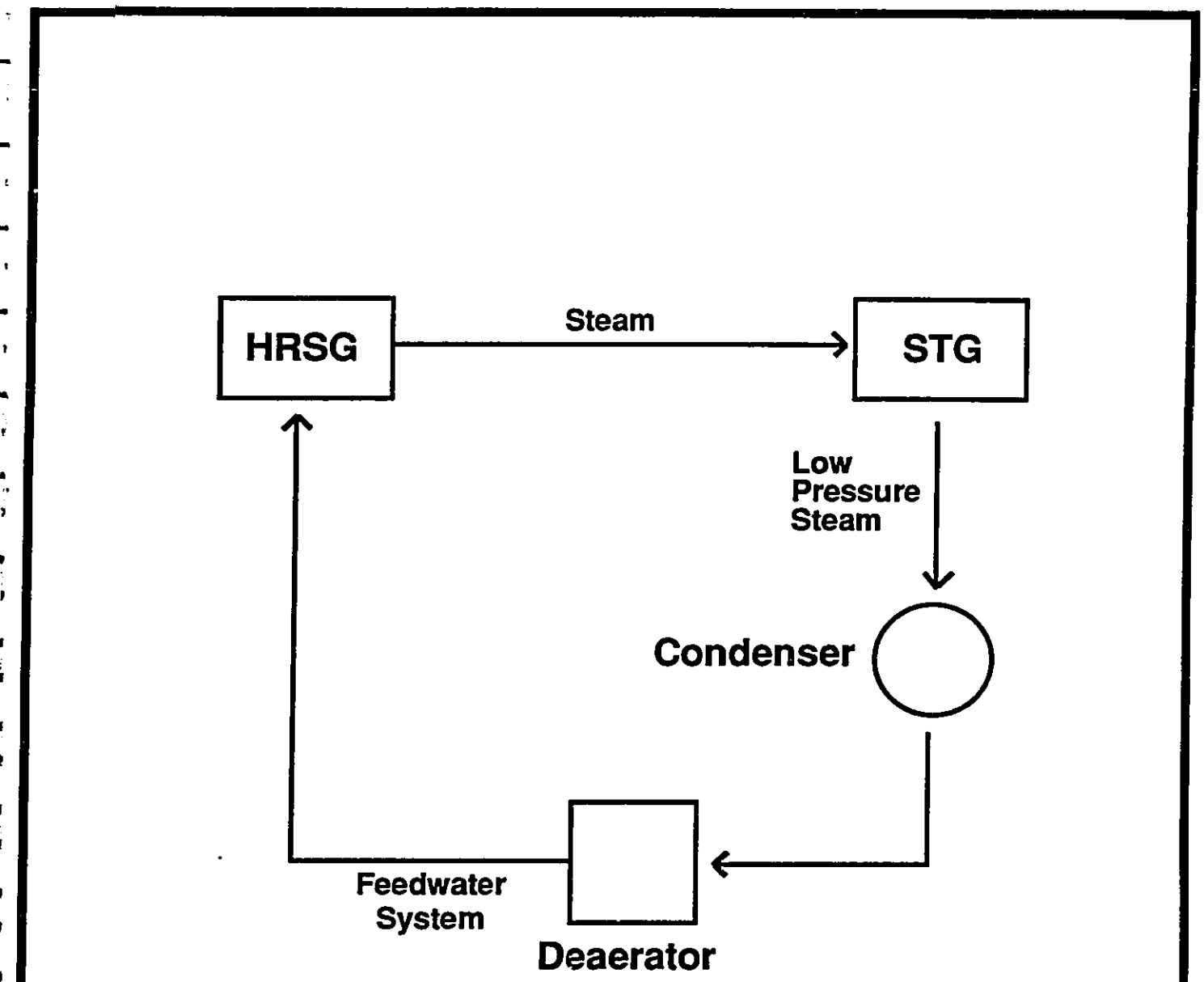


Diagram represents a single train.

Exhibit III-7
Steam Cycle

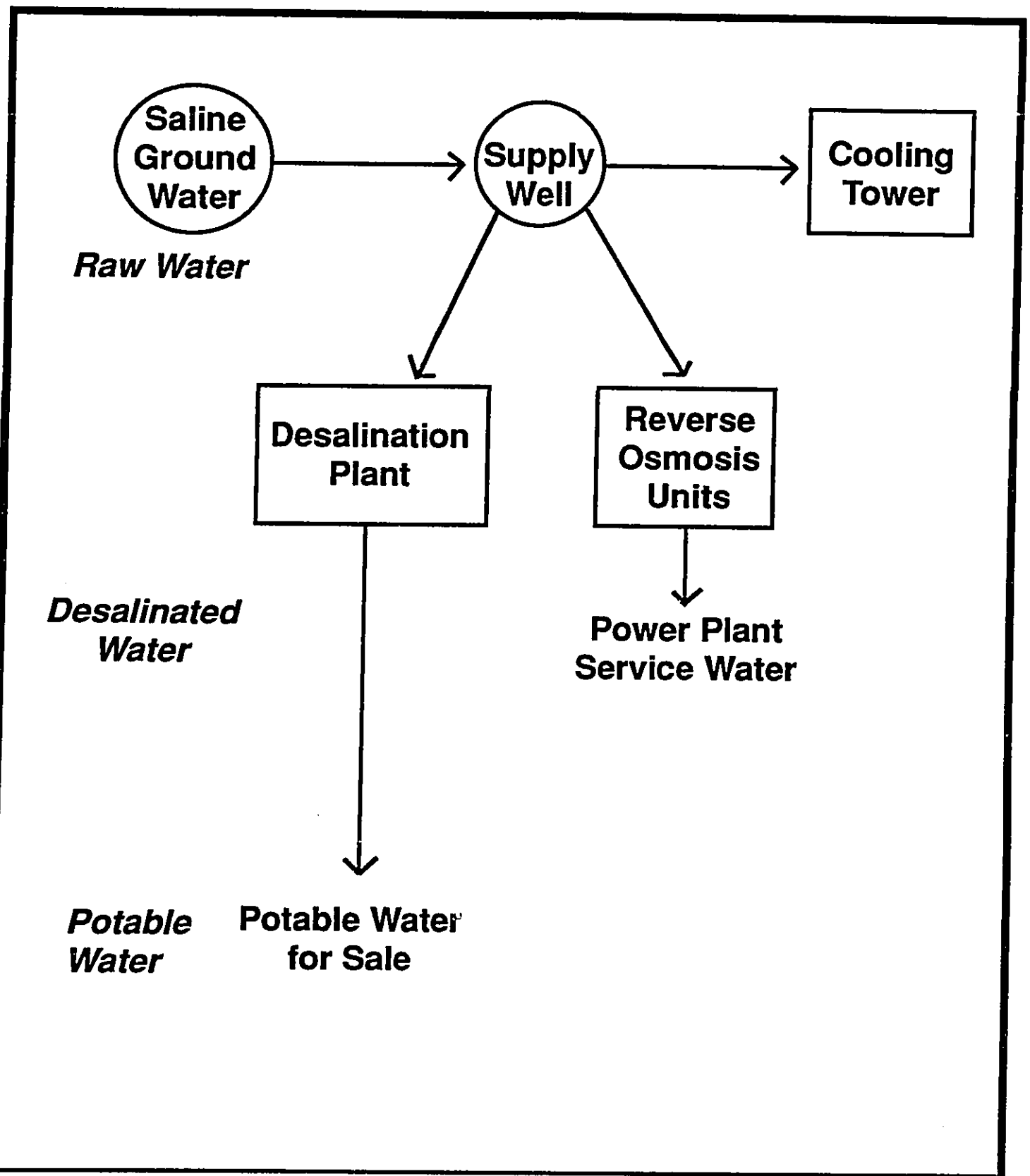


Exhibit III-8
Water Systems

plant operation, with a third well serving as a backup source. The third well also allows normal rotational maintenance of the supply wells. Maximum pumpage from the supply wells during full plant operation, including desalination, will be approximately 10.4 million gallons per day (mgd). See Exhibit IV-6, Water Flow Diagram.

Desalinated water is raw water that has been processed by either the multiple effect desalination (MED) plant or reverse osmosis (RO) units. Potable water is desalinated water that has also been treated to meet the State drinking water requirements. The MED plant will produce 2.6 mgd of desalinated water, all of which will be made available to DHHL for treatment and use as potable water. Potable water will be stored and distributed through DHHL's proposed water system.

The plant's water treatment system will process raw water to meet the plant's service, maintenance, and make-up water needs. The two RO units, operating at 100% capacity, will be able to treat enough raw water from the supply wells to meet the daily water needs of the plant. HRSG (boiler) make-up (109,600 gpd) will be RO processed water further treated in a condensate polisher. Approximately 350,000 gallons of treated water will be stored on site of which 200,000 gallons will be reserved for the project's fire water system.

KCP will utilize a combination of water from the RO units and County water for domestic water uses and irrigation (approximately 3,000 gpd).

3. Cooling System

The cooling system consists of a woodframe cooling tower and circulating cooling water system (piping, pumps). The cooling water flow consists of saline groundwater pumped from supply wells located on the project site as described above. The cooling tower make-up will be 1.6 mgd during full-desalination plant operations.

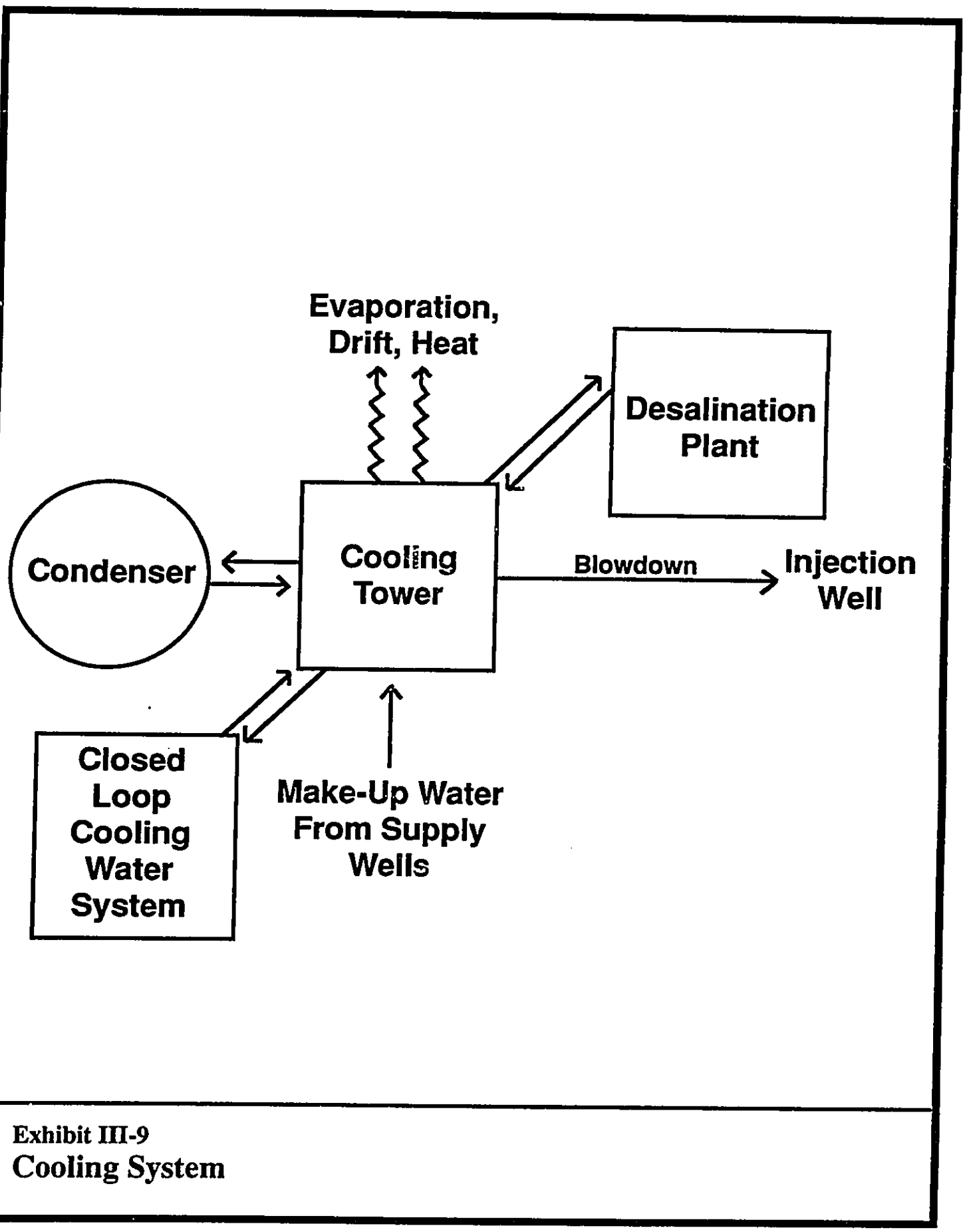


Exhibit III-9
Cooling System

The plant's counterflow, mechanical draft cooling tower uses water for steam cycle heat removal and other cooling water system uses. The primary use of the cooling tower is to reduce wastewater temperatures before injection into the ground. Water from the cooling tower is also circulated in a closed loop system to the desalination plant and back (176 gpm) to provide a source of cooling to be used in the distillation process.

At full desalination plant operation, approximately 144,000 gpd will be lost from the cooling tower to evaporation and drift.[3] It is estimated that between 98 and 99 percent of this will be in the form of evaporation. Drift losses are expected to be less than 1 to 2 percent of the total loss.

Due to the evaporation that occurs in the cooling tower, the water in the cooling system generally has a higher salinity and mineral concentration than the initial and makeup raw water used. The blowdown temperature, salinity and mineral concentration may be further reduced (if required by DOH) by mixing with supply water prior to injection.

About 1.4 mgd of cooling tower blowdown will be re-injected into the saline groundwater strata.

4. Auxiliary Systems

The following are subsystems of the cogeneration facility which are supportive of the major systems described above.

a. Centrifugal Refrigeration Units (CRU)

Power output is directly affected by the mass, or weight, of air used in the CTG. The lower the CTG inlet air temperature, the heavier the air is, and therefore the higher the power output. To increase the efficiency of the CTG, and to produce a more levelized power output during summer months, the CTG inlet air temperature is cooled to 55° F during high

[3]Drift is water particles that are carried into the air and quickly fall back down.

ambient temperature months from a maximum ambient temperature of 85° F. To obtain this air temperature on hot ambient days, chilled water from the centrifugal refrigeration units (CRUs) is circulated through the system. Service water, chemically treated, is used in the chilled water loop. The CRU is operated with electrical power. The heat given off in this process is dissipated at the cooling tower. Refer to Exhibit III-10.

b. Demineralized Water System

Two 100% capacity condensate polishers (also referred to as mixed bed demineralizers) are provided to upgrade treated water from the R.O. units to a quality level suitable for condensate cycle make-up. From the condensate polisher, the water is stored in a 108,000 gallon tank. This water is used as make-up water to the condenser. Refer to Exhibit III-11.

c. Fuel and Fuel Handling

The proposed power plant will consume approximately 43,000 gallons of No. 2 diesel oil per day per CTG at baseload operation (86,000 gpd total). Fuel oil is to be transported bi-monthly by an ocean tanker or barge, docking at Kawaihae Harbor. Fuel suppliers will coordinate barge delivery schedules with the Department of Transportation (DOT), Harbors Division, and with other users of the harbor facilities. Fuel will be pumped via underground piping directly from the barge to two fuel storage tanks located on the plant site. This will eliminate the need for fuel trucks. KCP is discussing various options with Harbors Division for installation of the fuel lines. The options include either using existing fuel lines or installing new fuel lines similar to those already existing. The new lines will be designed using a double containment system and in accordance with applicable standards and regulations. The fuel lines will be pressure tested periodically for leaks. The transport barges are required to have a mitigation plan in place during off loading of fuel should a fuel spill occur.

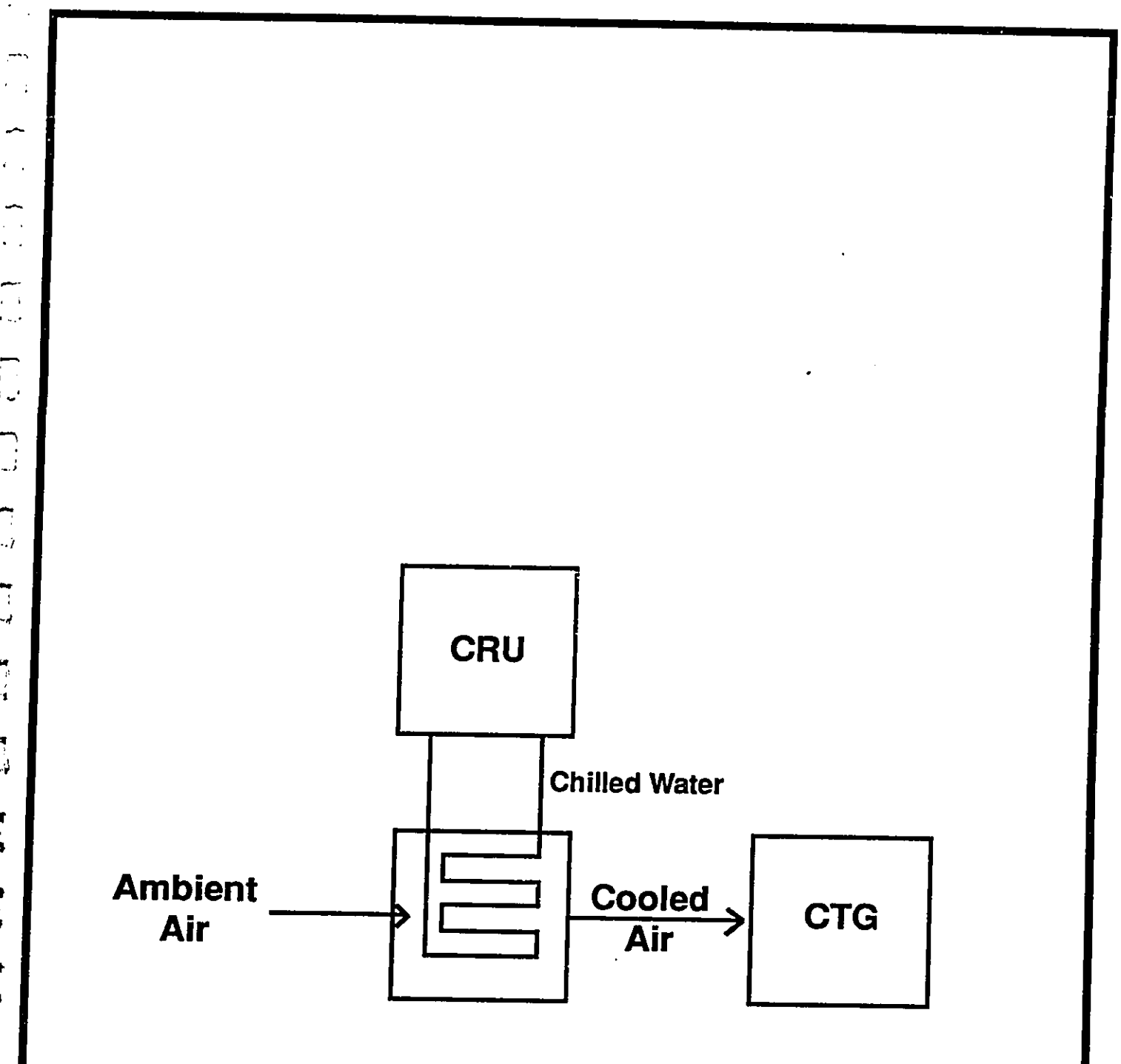


Exhibit III-10
Centrifugal Refrigeration Unit (CRU)

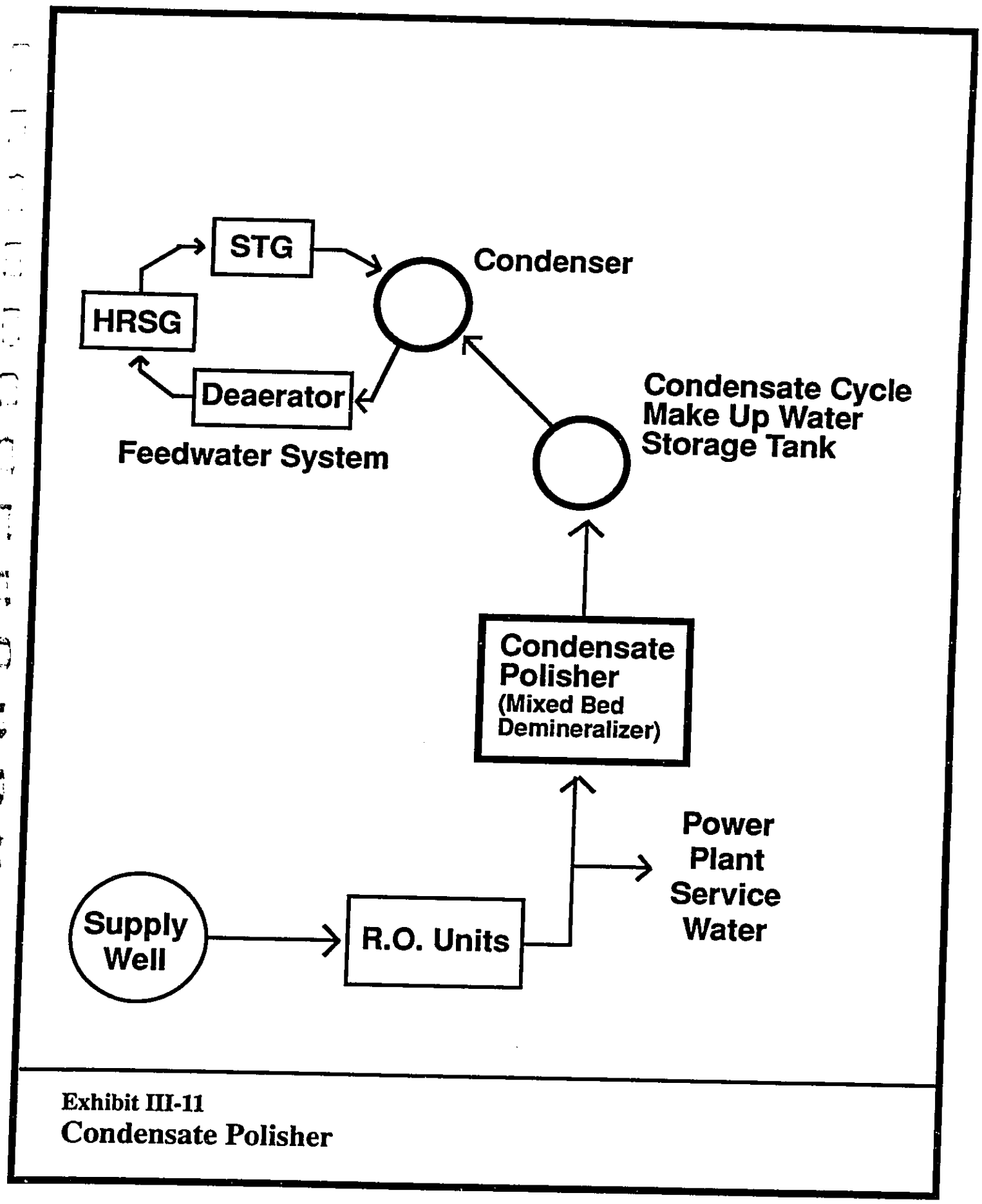


Exhibit III-11
Condensate Polisher

Each fuel oil storage tank is designed for a 1,300,000 gallon capacity, which, together, will support 30 days of base loaded operation. The storage tanks, made of carbon steel, will be 50 feet tall, with a 75-foot diameter, and will be constructed at grade within a containment dike designed to contain a spill equal to 110 percent of the storage capacity. The containment area will be lined with an impermeable lining to prevent any spills from seeping into the ground.

Two fuel oil forwarding pumps, one operating and one on standby, will supply oil from the storage tanks to the CTGs.

d. Emergency Start-up Capability

During normal operation, plant start-up load will be supplied from the HELCO electrical system. An emergency diesel generator capable of starting one CTG and associated plant auxiliary load will be provided for "black start"[4] capability in case of HELCO's electrical system outages, resulting in increased system reliability.

e. Instrumentation and Control

Internal control of the plant will be through a sophisticated computer system referred to as a distributed control system (DCS). A central control room will house the DCS system and operator interface stations. The DCS system will interface with and provide supervisory controls to the CTG and STG control system while providing total control for plant equipment.

This plant will be dispatchable by HELCO via telephone communications to the plant. The facility can be designed to include remote dispatchability through Automatic Generator Control if so desired by HELCO.

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[4] "Black start" is the ability to commence generating electricity without external assistance or irregardless of the condition of the utility.

5. Plant Wastewater System

The power plant will generate several types of waste streams. These include sanitary wastewater; output from the water treatment system; effluent from plant and equipment drains; surface rainfall runoff; and desalination plant blowdown. All uncontaminated waste streams will be combined with cooling tower blowdown and routed for deep-well injection into the saline groundwater strata. These waste stream will be certified nonhazardous and nontoxic prior to injection into the wells. The amount and composition of each of these are summarized below. The maximum wastewater production for injection will be approximately 7.6 mgd, of which 1.4 mgd is cooling tower blowdown, and 6.0 mgd is desalination plant blowdown. (Exhibits III-12 and IV-6.) Contaminated waste streams will be disposed of in accordance with applicable laws and permits.

a. Desalination Plant Blowdown

The blowdown from the desalination plant is brine consisting of approximately three to five percent total dissolved salts and minerals normally found in the groundwater and compared to sea water which is about three percent total dissolved salts. Non-hazardous amounts of chemicals used for control of scaling and fouling in the desalination process will be present in the waste stream. The brine temperatures will be cooled by mixing with cooling tower blowdown and further cooled by the supply water to near harbor water temperature prior to reinjection. Six million gallons per day of desalination blowdown will be discharged into the reinjection well.

b. Water Treatment System Wastewater

The wastewater from the water treatment system, which consists of filter backwash, R.O. unit reject, and condensate polishers regeneration, will be neutralized on a batch basis in a chemical-resistant neutralization basin. A mixer will be used to enhance the self-neutralizing tendencies of the alkaline and acid waste streams that enter it. Wastewater will also be produced from the HRSG operation. The wastewater will contain a number of chemicals such as phosphates, sulfites,

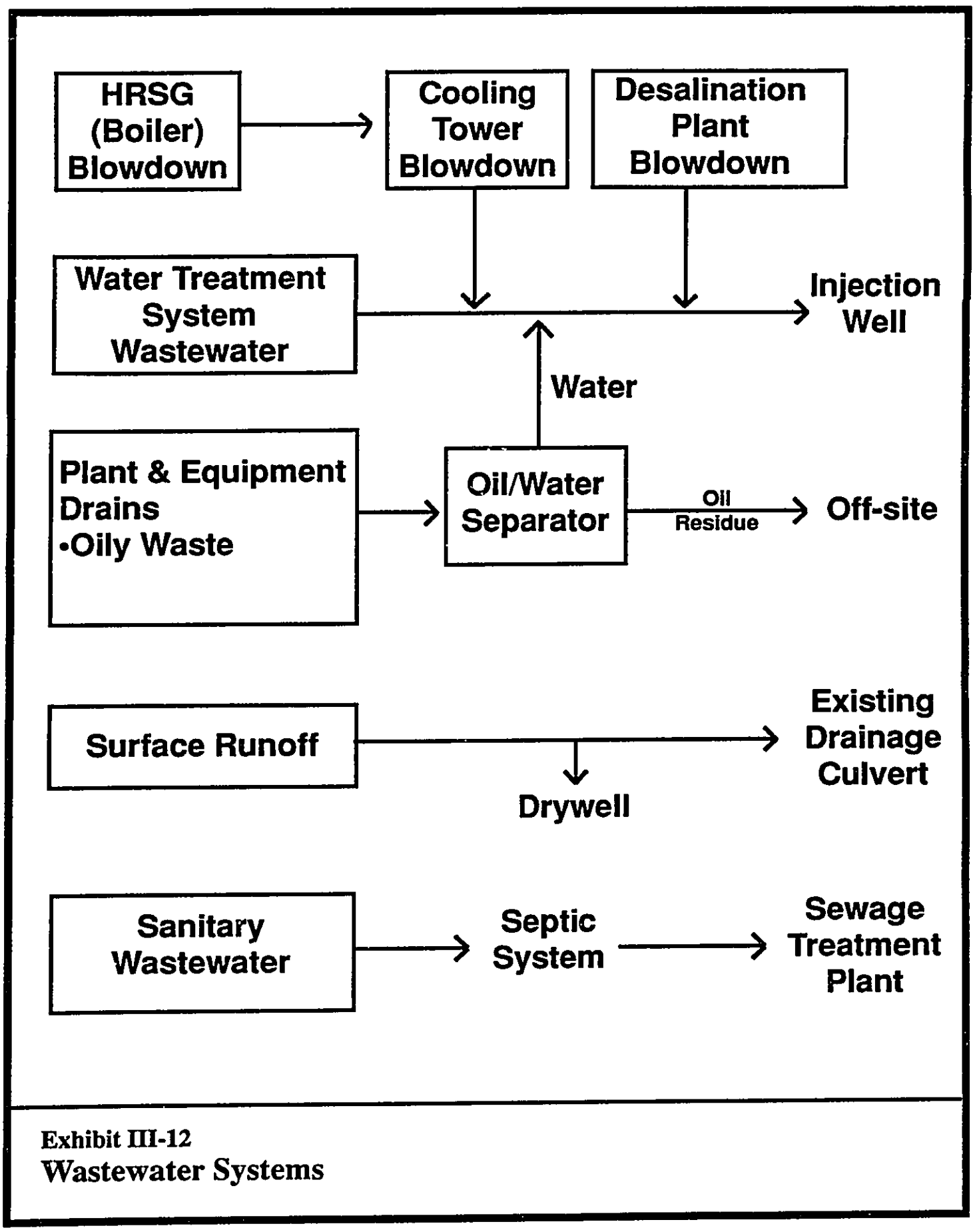

Exhibit III-12
Wastewater Systems

ammonia, acids and caustics which are used to control erosion. HRSG blowdown will be routed to the cooling tower. A maximum of 200,000 gpd of neutralized wastes, which are classified non-hazardous, will be combined with cooling tower blowdown and desalination plant blowdown and discharged into the water reinjection well.

c. Plant and Equipment Drains

Water that is collected in plant and equipment drains will be passed through coalescing type oil separators. The clean portion will be reinjected with other wastewater. The oily residue will be periodically removed from the separators and will be transported off-site for processing and disposal. A private disposal company will be contracted to dispose of the oily wastes in accordance with the U.S. Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) regulations.

d. Surface Runoff

On-site drainage will be properly designed to accommodate the site slopes and potentially significant cuts at the site. Drainage improvements shall include shallow swales and ditches and/or underground drainpipes and drywells around improved areas to intercept surface runoff, if required. Surface runoff will not be allowed to flow to the adjacent highway. All drainage improvements will minimize storm runoff, soil erosion, and sedimentation into the existing drainage culvert seaward of Kawaihae Road, and ultimately the harbor. Runoff that maybe contaminated with oil will be routed to the oily wastewater separator. The clean water will be injected with the other wastewater and the oily waste disposed of off site.

e. Sanitary Wastewater

The facility is expected to generate an average of 3,000 gallons per day of sanitary wastewater based on typical domestic requirements for the control building and office. This will be

treated in a septic tank and pumped as necessary to a county or private sewage treatment plant. Once DHHL builds a treatment facility as part of their master plan, the power plant may either connect directly to the sewer system or continue using a septic system and pump into the DHHL sewage treatment plant.

6. Electrical Transmission

An electrical sub-station will be located on-site. Three 13.8 kV to 69 kV step-up transformers will be provided (one for each of the two CTGs and one STG). Separate transformers for each individual generator provide for a more reliable system to HELCO.

The plant will have incoming and outgoing 69 kV electrical service. The outgoing 69 kV transmission line, for interconnection with HELCO's system, will interface at the plant's dead-end structure on insulators provided by HELCO. All dispatch and routing of the electrical power generated at the facility will be controlled by HELCO. The final location of the transmission lines are being negotiated with HELCO. The project intends to use existing transmission corridors and right of ways to minimize the impact on cost and the environment. The lines will be routed away from future residential areas in the DHHL planned development. All the protection and measuring equipment will be built to HELCO's standards.

7. Desalination Plant

A multi-effect distillation (MED) plant was selected as the most economical process to be used in conjunction with the proposed KCP cogeneration plant. This process uses evaporation-condenser units (or "effects") in a series arrangement, through repetitive steps of evaporation and condensation, each at a lower temperature and pressure, to produce multiple quantities of distillate from a given quantity of steam.

Each effect consists of horizontal heat transfer tubes. Low pressure process steam is taken from an extraction port at the STG and piped

to the heat transfer tubes of the first effect. The steam is condensed in the first effect by thin films of saline supply water sprayed over the outer surfaces of the tubes. The condensate is returned to the cogeneration plant and the vapor from the evaporating saline supply water is drawn into the tubes of the next effect and the evaporation - condensation process is repeated.

The vapor, once condensed, is the desalinated product water which is collected and pumped to storage tanks. The by-product of the evaporation-condensation process is a concentrated brine which is cooled and mixed with saline supply water before re-injection.

A conceptual diagram of the MED plant is shown on Exhibit III-13.

8. Ancillary Features

a. Access and Circulation

Access to the project site will initially be from Kawaihae Road by a two-lane paved driveway. Internal driveways and vehicle parking and storage areas will have an all-weather surface. Parking will be provided on-site for employees, visitors, and delivery vehicles.

Future access to the site may be from an interior collector road constructed as part of the DHHL Kawaihae Ten-Year Master Plan.

b. Chemical Storage

On-site storage will be provided for a one-month supply of chemicals required for plant operation. A complete chemical inventory will be provided to the Department of Health prior to the start of plant operations. A list of chemicals that may be used for the treatment of water and for emissions control are provided below. The storage, use and handling of chemicals will comply with all federal, state, and county regulations.

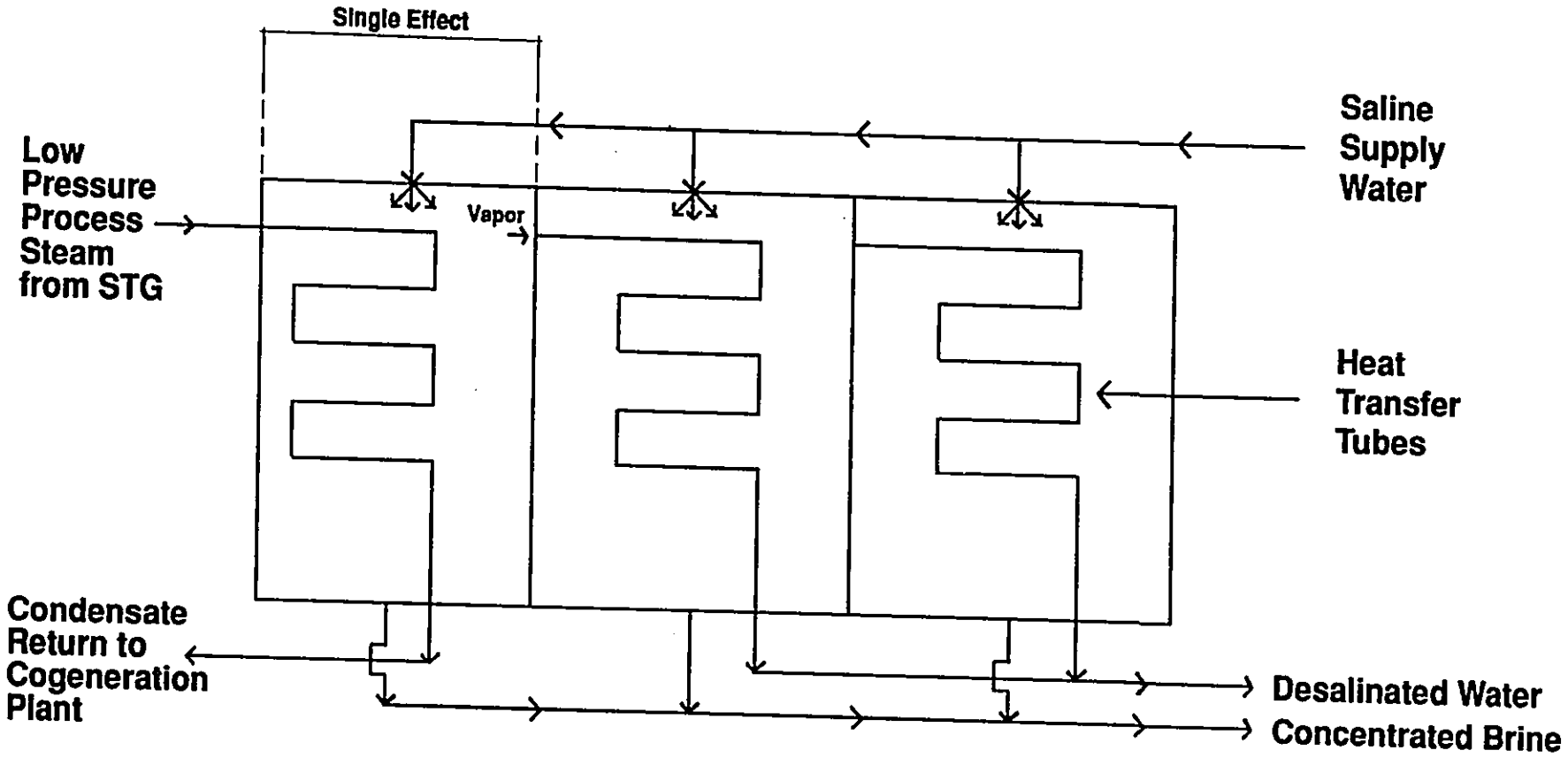

Exhibit III-13
Multi-Effect Distillation Plant

CHEMICAL	USE
Ammonia	Selective Catalytic Reduction (SCR) for Nitrogen Oxide Control
Anti-foaming	Desalination Water Feed Treatment
Chlorine	Makeup Water Biocide
Polyphosphate or Polyacrylic	Makeup Water Anti-scaling
Cyclohexylamine	HRSG Anti-scaling Treatment
Hydroquinone	HRSG Feedwater Oxygen Scavenger
Sulfuric Acid	Demineralizer System Regeneration
Sodium Hydroxide	Demineralizer System Regeneration

The project will use ammonia for control of nitrogen oxide emissions. The project will require facilities for handling and storage of the ammonia and will be required to file an annual Chemical Inventory report with the Office of Hazard Evaluation & Emergency Response of the Department of Health. An automatic deluge sprinkler system will be provided as well as other safety features to prevent overheating and overpressurization and to contain potential leaks. The appropriate agencies such as the Fire Department and the Civil Defense will be notified of the projects intent to use and store ammonia.

c. Landscaping

Perimeter landscaping will be installed to visually screen the project from nearby roads and future surrounding land uses. Landscaping requiring minimal irrigation and maintenance will be used. Security fencing will be installed around the developed portion of the property.

C. PROJECT SCHEDULE AND COST

Construction is scheduled to take place over an 18-month period from May 1995 to November 1996. Commencement is contingent upon satisfying license and permit requirements, financing, and upon equipment and materials acquisition.

The total development cost for the cogeneration project, including design and planning fees, is estimated to be in the range of 100 million dollars (1993 value). Kawaihae Cogeneration Partners assumes all of the costs and risks of project development, including planning, engineering, permits and approvals, goods and materials, and employment of workers. Being privately owned and operated, the project will bring needed services to the public without ratepayer risk or capital.

IV. ENVIRONMENTAL CONDITIONS AND IMPACT ASSESSMENT

A. PHYSICAL ENVIRONMENT

1. Land Use and Land Ownership

Existing Conditions

Study Area

The KCP study area consists of 40 acres of land owned by the Department of Hawaiian Home Lands (DHHL). It is identified as portions of TMK 6-1, plats 1 and 2, and is adjacent to Kawaihae Road. The study area and vast majority of the surrounding lands are undeveloped and unused.

The makai portion of the DHHL industrial area, along Kawaihae Road, (TMK 6-1-plats 2) has been subdivided into numerous homestead lots. Refer to Exhibit IV-1. Four of the 25 DHHL lots have been leased to Hawaiian homesteaders and contain occupied dwelling units on all of the four lots. Two lots have commercial leases with revocable permits. Six parcels along the road are privately owned, on which there is one restaurant, a commercial building, and one house. The State of Hawaii also owns one vacant parcel along Kawaihae Road. The private- and State-owned lots are not within the KCP study area. One occupied homestead lot is located within the KCP study area.

Surrounding Area (Exhibit IV-2)

Kawaihae is a lightly populated region, combining a major industrial harbor facility with rural residential and pasture and grazing agricultural land uses. Much of the following information has been obtained from the DHHL Kawaihae Ten-Year Master Plan Environmental Impact Statement (EIS).

Kawaihae Harbor, with associated industrial activities, is located directly makai of the study area below Kawaihae Road. The harbor lands are owned by the State of Hawaii. It is the second largest harbor on the island, and was constructed in 1958 by blasting and dredging a coral reef platform. The material removed from the reef

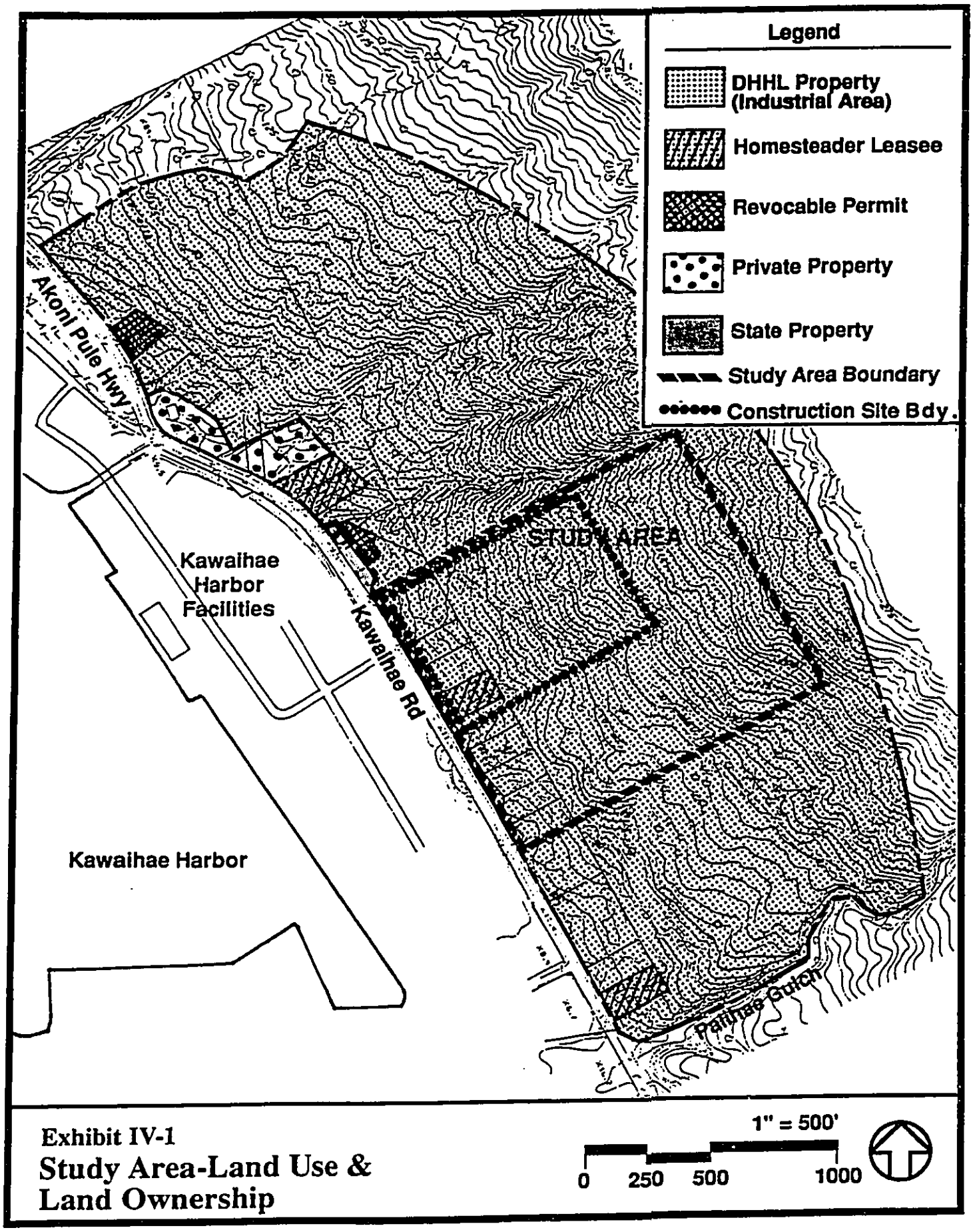

Exhibit IV-1
Study Area-Land Use & Land Ownership

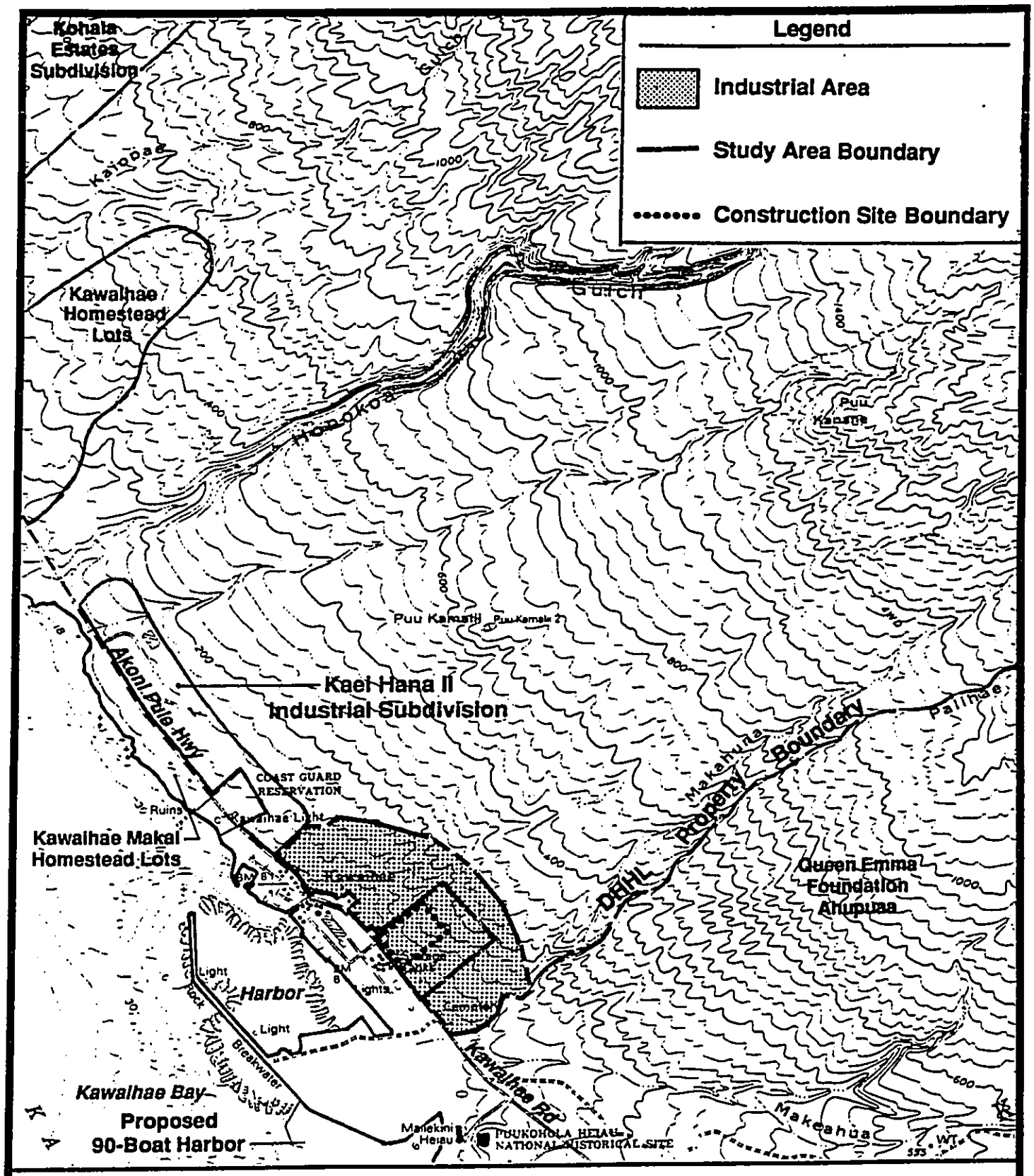

Exhibit IV-2

Surrounding Land Uses

for the harbor basin was used for approximately 46 acres of landfill around the perimeter of the 35-acre basin. An 850-foot long breakwater extends southeast from the main harbor and was constructed in anticipation of a future small boat harbor. The entrance channel and basin for the future harbor were blasted through the reef in 1970 and 1971. The State Department of Transportation, Harbors Division prepared an EIS in 1985 for a 360-boat harbor, however in 1991 it was decided to downsize the harbor to 90 boats because of economic and social concerns. The Army Corps of Engineers prepared a federal Draft Environmental Assessment (EA) *for the Kawaihae Harbor for Light Draft Vessels, dated September 22,* 1992. The EA concluded that an EIS was not needed.

A Hawaiian temple, the Pu'ukohola Heiau National Historic Site is located adjacent to the harbor on the coast, 3,000 feet south of the project site (TMK 6-2-2:9, 10, and 16). The temple was completed in 1791. The Mailekini Heiau is located north of Pu'ukohola Heiau. Another historic site, Haleokapuni Heiau, is believed to be submerged just offshore of Pu'ukohola. Remains of the John Young Homestead, situated upland of the heiau sites, reflect the first European-type structures in the Hawaiian Islands.

Spencer Beach Park is a County-owned park on State-owned land (TMK 6-2-2:8) located just south of Pu'ukohola Historic Site. The park is used for tennis, camping, picnicking, swimming, and snorkeling. Facilities at the park include restrooms, picnic tables, showers, tennis courts, a pavilion, a parking lot, and a lifeguard tower. The extensive reef off Spencer Beach Park is a continuation of the reef off the harbor.

South of the study area, across Palihae Gulch, are undeveloped lands belonging to the Queen Emma Foundation (TMK 6-2-2). The lands were part of a development agreement with Mauna Kea Properties at one time, however this agreement is currently in litigation.

North and east (mauka) of the KCP study area is the DHHL Ten-Year Master Plan area (2,115 acres), currently undeveloped. It

stretches from the shoreline up to an elevation of 1,200 feet (TMK 6-1-2 and -6, portion of 6-1-3 and 6-1-1:3). The Ten-Year Plan area is within the overall Kawaihae Long Range Master Plan encompassing approximately 10,000-acres of DHHL lands located on the southwestern slopes of the Kohala Mountains. (Refer to Exhibit III-2 in Chapter III).

Within DHHL's Ten-Year Master Plan area, along Akoni Pule Highway, there is a partially developed 90-acre industrial park with nine parcels leased out. On these parcels are several small to medium sized warehouses and other small structures. On the makai side of Akoni Pule Highway are 22 half-acre homestead lots on which there are three dwelling units.

North of the Ten-Year Master Plan area and Honokoa Gulch, within DHHL property, is a 195 single-family residential lot subdivision being developed by DHHL as part of the Department's homesteading program. Lands mauka of that are leased to Kahua Ranch and used for grazing.

The 3,900-acre Kohala Ranch and 750-acre Kohala Estates subdivisions are located to the north of the master plan area. Both are "upscale" developments with lots ranging in size from about 3 acres to 20 acres.

Between Akoni Pule Highway and the Kawaihae Wharf Road are small commercial establishments on privately owned land. These include a gas station, convenience store, and retail/office center.

2. Topography and Soils

The study area lies on the southwestern slopes of the Kohala Mountains. The elevation of the 40-acre study area ranges from approximately 10 to 30 feet at Kawaihae Road to a high point of 225 feet at the mauka boundary. (Exhibit IV-3). Palihae Gulch defines the southern boundary, mauka to makai. Drainage is in a south westerly direction along relatively well defined drainage paths. Terrain generally slopes in a south westerly direction at 10 to 20

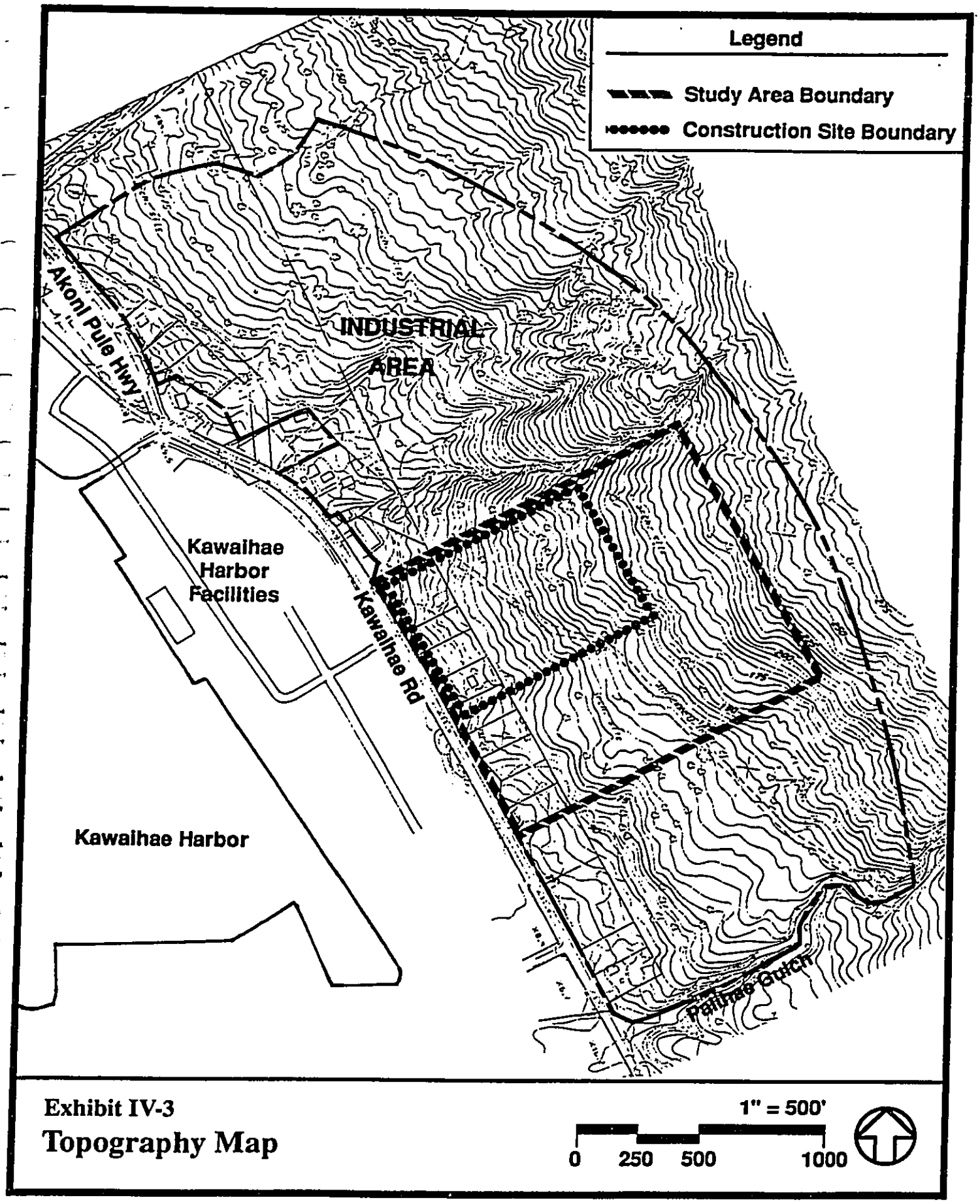

Exhibit IV-3

Topography Map

percent, however slope conditions vary throughout the site, with gradients ranging from 5 percent to greater than 20 percent. The site is generally vegetated with a thin cover of grasses and isolated stands of Kiawe trees. Under the grass cover, there is a surface layer of ash soil mantling the site and the ground is covered with boulders and cobbles creating a very rugged surface.

According to the Soil Survey of the Soil Conservation Service,[5] the entire study area consists of soils in the Kawaihae Series, identified as "KOC" or "Kawaihae very rocky very fine sandy loam." Rock outcrops occupy 10 to 20 percent of the surface of this soil type. Kawaihae series consists of somewhat excessively drained extremely stoney soils that formed in volcanic ash. These soils have a very thin surface layer of fine sandy loam over silt loam and loam. They are gently to moderately sloping, but include severely eroded areas in which small gullies are forming and the vegetation is sparse. KOC soils have a low shrink-swell potential, high erodability on steep slope, and bedrock is found at a depth of two to four feet beneath the surface. The natural vegetation consists of kiawe, piligrass, ilima, and fingergrass.

Kohala Mountain is a single shield volcano composed of two rock units: 1) the Pololu basalt and 2) the Hawi volcanics. Based on previous experience in the study area, Geolabs-Hawaii states that the subsurface conditions generally consist of young volcanic rock formation at relatively shallow depths. Young basaltic lavas generally have rapid permeability characteristics and are usually capable of yielding large amounts of water to wells. These lavas are also usually capable of handling relatively large amounts of water through injection wells.

Where Pololu Volcanic series rocks are overlain by Hawi Volcanic series rocks, it may be necessary to penetrate through the Hawi formation to the underlying Pololu rocks for disposal of runoff water and injection wells. Based on Geolabs' visual observations and

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[5]U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of the Island of Hawaii, December 1973.

seismic refraction survey, it is anticipated that the Hawi formation may have a thickness on the order of 20 to 25 feet in the study area.[6]

The Land Study Bureau[7] gives the study area an overall Productivity Rating of "E", which is the lowest of five ratings, for suitability in agricultural use. The area has very poor productivity potential for vegetable, orchard, and grazing uses.

3. Hazards

Geologic hazards which should be considered for developments on the islands of Hawaii are seismic activity, volcanic activity, inundation, and ground subsidence. *The geotechnical study of the area*[8] *did not* identify any unusual problems for the DHHL Kawaihae parcel in comparison to any other development in this area of West Hawaii.

Seismic Activity: Seismic activity includes earthquakes and faulting. On the island of Hawaii, earthquakes are relatively frequent but are generally of relatively low magnitude and cause a low intensity of damage.

Under the Uniform Building Code (UBC), the island of Hawaii has been designated as Seismic Zone 3 which indicates a relatively significant potential for strong ground motion generated by seismic events. The UBC also establishes minimum seismic design criteria for any structures constructed in such a zone for resistance to deformation and damage resulting from such strong ground motion. Therefore, any structures that will be built as part of the development will be designed with consideration of the hazards of seismic activity.

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[6]Geolabs-Hawaii, Geotechnical Engineering Reconnaissance, Kawaihae 10-Year Master Plan, September 13, 1991.

[7]Land Study Bureau, Detailed Land Classification - Island of Hawaii, University of Hawaii, November 1965.

[8]Geolabs-Hawaii, Geotechnical Engineering Reconnaissance, Kawaihae 10-Year Master Plan, September 13, 1991.

Volcanic Activity: The site is on the southern flank of Kohala Mountain, which appears to have last been active during the Pleistocene Epoch. Based on the available geologic evidence, it appears that the level of volcanic hazard threat to the study area is low since Kohala Mountain has been dormant for such an extended period of time. The U.S. Geologic Survey has established volcanic hazard zones for the Island of Hawaii for long-term planning purposes. On a rating scale where Zone 1 reflects the greatest volcanic hazard and Zone 9 the lowest, Kawaihae is located within Lava Flow Hazard Zone 9.[9]

Inundation: Inundation, or flooding, can originate from surface water or from tsunami. The study area is sufficiently inland and at a high enough elevation that the possibility of inundation by tsunami is infinitesimal. The estimated 50- and 100-year tsunami elevations for this coastline are 5.9 and 8 feet, respectively. The lowest elevation of the KCP study area is about 20 feet in elevation.

The surface soils at the project site are highly permeable and well drained. There are well-defined drainage paths up slope and through the site. The majority of precipitation falling on the site either infiltrates immediately or moves towards and through the drainage paths.

Ground Subsidence: Ground subsidence resulting from the consolidation of soft or loose subsoils is generally not a consideration for the study area as the site is underlain by volcanic rock formation at the surface or at very shallow depths below the surface. Voids, or lava tubes, are sometimes encountered in volcanic rock formation. However, it is common engineering practice to probe the subgrades of building foundations during construction to check for potential voids. If voids are encountered, they are filled to reduce the potential of collapse of the foundations.

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[9]HELCO, Draft EIS, Volume I, Keahole Generating Station Expansion, December 1992.

4. Climatic Characteristics

The climate of the Kawaihae area is very much affected by its leeward and coastal situation. Airflow is most commonly onshore from mid-morning until just before sunset, and offshore from early evening until the following morning. The average wind velocity is 7 to 8 miles per hour (mph), however, generally vary between about 5 and 20 mph. Gusty winds blowing through the saddle between the Kohala Mountains and Mauna Kea do reach the shoreline during periods of strong trade winds. Kona storms generate occasional strong winds from the south during winter.

The Kawaihae area is one of Hawaii's driest localities. Average annual rainfall at the Weather Bureau's Puako gauge is about nine inches, equivalent to desert conditions. Most of this rainfall typically occurs during a few storms in the October-to-April winter season, with one or two unseasonable rains at other times. Intense storms along the Kohala coast are rare. More than 90 percent of the days in the year are sunny and free of cloud cover. Low humidity levels (commonly under 40 percent) and cooling breezes maintain a consistent level of comfort throughout the year.

The mean annual temperature is about 78 degrees Fahrenheit, with relatively small daily and seasonal fluctuations. Daytime highs above 90 degrees F. or nighttime lows below 63 degrees F. are extremely rare.

5. Groundwater Resources

Existing Conditions

Each island is divided into "aquifer sectors" which reflect broad hydrogeological similarities yet maintain traditional hydrographic, topographic and historical boundaries, where possible. "Aquifer systems" are areas within a sector that are more specifically defined by hydraulic continuity among aquifers in the system. The study area is located within the Kohala aquifer sector (entire Kohala Mountain),

and the Mahukona aquifer system which encompasses the western (leeward) side of Kohala Mountain.[10]

Within the Mahukona aquifer system, basal and high level dike water occur in the highly permeable Pololu basalt along with a small amount of perched water in the overlying, dense Hawi volcanics. High level water may reach as far as two miles seaward of the Kohala Mountain crest in the mid-section of the system. Basal groundwater may be potable two or more miles inland, but brackish toward the coast. Groundwater discharges freely at the coast because no caprock is present. The Mahukona aquifer system's estimated sustainable yield of 17 mgd assumes that groundwater is taken far enough inland to be potable.

In the study area, groundwater occurs as a basal water table in saturated volcanic rocks at or very near to sea level. No data is available specifically concerning the quality of the groundwater below the site, however, based on the Ghyben-Herzburg principle and the proximity of the project to the shoreline, it is anticipated that the basal water occurs as a thin lens of highly brackish water floating over saline groundwater. A diagram is provided that shows the anticipated groundwater profile based on the Ghyben-Herzburg theory. (Refer to Exhibit IV-4).

Groundwater tests performed in the Kawaihae area measured chlorides at levels equal to ocean levels.[11] Two recent well drilling activities in Kawaihae were conducted by the Department of Land and Natural Resources for DHHL. A well drilled at the 1,400 foot elevation yielded highly saline water, and a second well drilled at the 1,600 foot elevation yielded a thin lens of potable quality water sustainable at a pumpage rate of 130 gpm. Wells below this elevation

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[10]State of Hawaii, DLNR, Commission on Water Resource Management, Hawaii County Water Use and Development Plan, February 1992.

[11]CH2MHill, for HELCO, West Hawaii Site Study, August 1988.

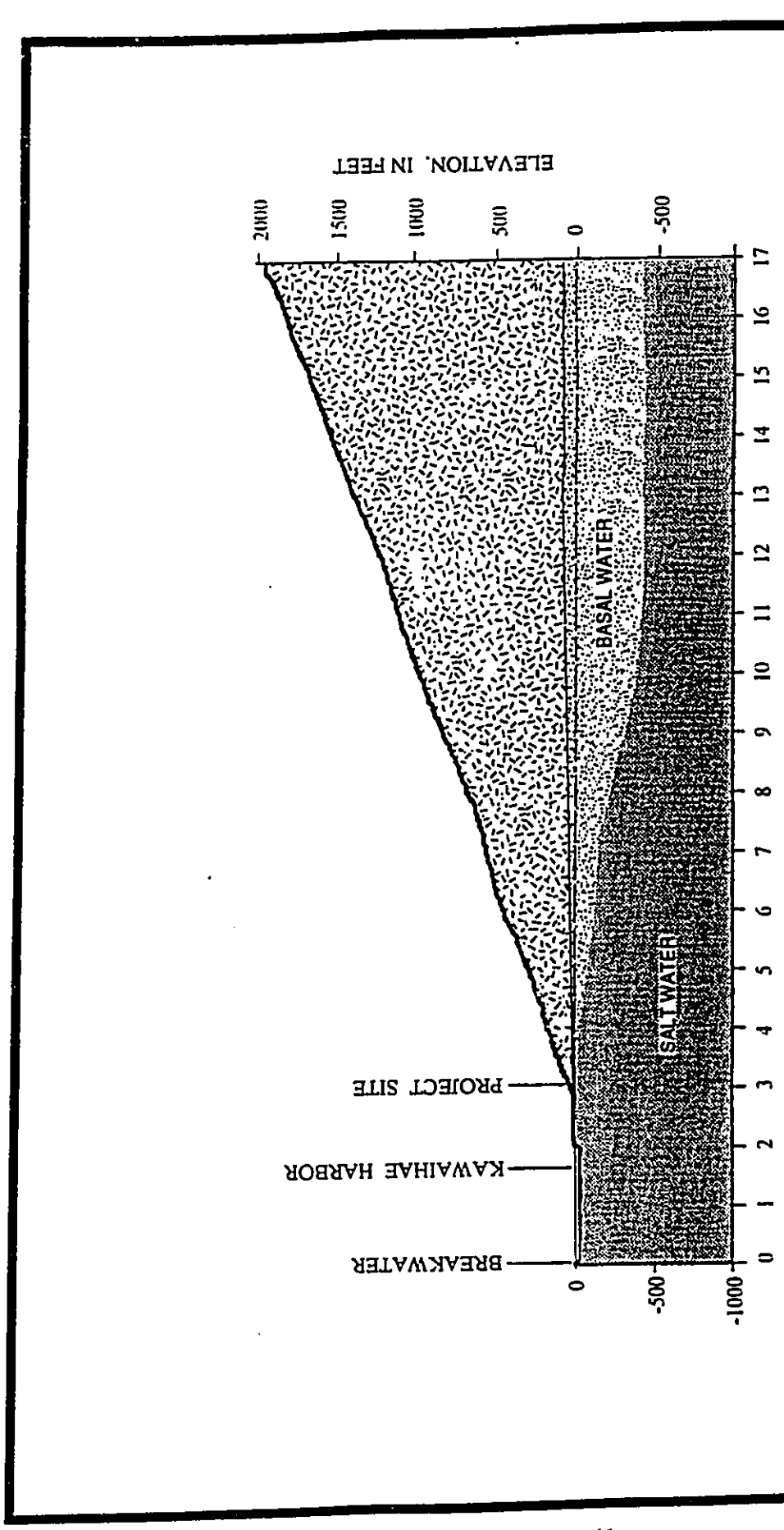

Exhibit IV-4
Ghyben-Herzburg Diagram

are likely to produce brackish water with high chloride content.[12] Based on 1976 water quality tests in the study area, the groundwater appears to be comparable to ocean water (e.g. chloride content and temperature).[13] A conceptual engineering report for the KCP project by Harris Group Inc. estimated the temperature of well water (at the saline groundwater strata) to be three degrees F. cooler than ambient seawater; and the ambient seawater temperature range is 76.5 to 82.5 degrees F.[14]

The basal water is probably brackish to saline at the shore and for several thousand feet to several miles inland, as in the Kona area. In dry areas such as Kawaihae, where fresh water exchange is small and tidal influences is felt, the effect of mixing may extend such that the entire lens is brackish for more than a mile inland. Movement is continuous within the water body as fresh water moves laterally to the sea. The thickness of the brackish basal lens depends on the magnitude of mixing caused by the tides and the variation in recharge. Mixing is greatest near the shore due to the proximity to tidal fluctuations. Groundwater quality varies considerably from place to place, due to variations in the extent of fresh and marine water mixing.[15]

The groundwater flux in the Kawaihae area is probably comparatively low because of the small recharge resulting from the generally low rainfall and high evapotranspiration. Recent well development between Kona and Waikoloa, where rainfall is similar to Kawaihae, indicates an estimated flux, or groundwater outflow, of 5 to 7 mgd per mile of coastline.[16] Groundwater was probably discharged along the

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[12]R.M. Towill Corporation, Final EIS, Kawaihae Ten-Year Master Plan, December 1992.

[13]CH2MHill, for HELCO, West Hawaii Site Study, August 1988.

[14]Harris Group Inc., Conceptual Engineering Budgetary Capital Cost Estimate, July 1992.

[15]Woolsey, Miyabara & Associates, Inc., for State Dept. of Transportation, Harbors Division, Final EIS for Development of Kawaihae Boat Harbor, July 1985.

[16]CH2MHill, for HELCO, West Hawaii Site Study, August 1988.

shoreline prior to the construction of the commercial harbor. Excavation and landfill areas of the completed harbor have probably displaced the natural discharge points in the immediate area. There are no data indicating groundwater discharge areas in the present commercial harbor. Landfill may have been impervious enough to displace groundwater discharge to one or both ends of the harbor area, or landfill may have been impervious enough to displace the groundwater discharge point farther seaward within the harbor area.[17]

Hawaii State Department of Health has established an Underground Injection Control (UIC) line to protect groundwater sources of drinking water from contamination by injection well activity. The location of the UIC line conforms to the estimated boundary of the fresh water aquifer, with a generous margin of safety to assure the aquifer will not be impacted. As shown on Exhibit IV-5, the UIC line crosses the mauka border of the industrial area, at approximately 250 feet above mean sea level, well below the 1,400 foot elevation where DLNR drilled a test well that produced brackish water with high chloride content. The study area is located makai or seaward of the UIC line where injection wells may be permitted.

Potential Impacts

General Information

The study area is approximately 800 feet from the present shoreline of Kawaihae Harbor and extends as far mauka as 2,300 feet from the harbor shoreline. The elevation at the actual construction site, within the 40-acre study area, will be between 20 feet above mean sea level and 150 feet above mean sea level. The entire construction site will be located below the UIC line.

Water Supply Wells

Water supply wells will provide 10.4 mgd of saline groundwater for plant cooling, desalination, and other service water needs, as described

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[17]Woolsey, Miyabara & Associates, Inc., for State Dept. of Transportation, Harbors Division, Final EIS for Development of Kawaihae Boat Harbor, July 1985.

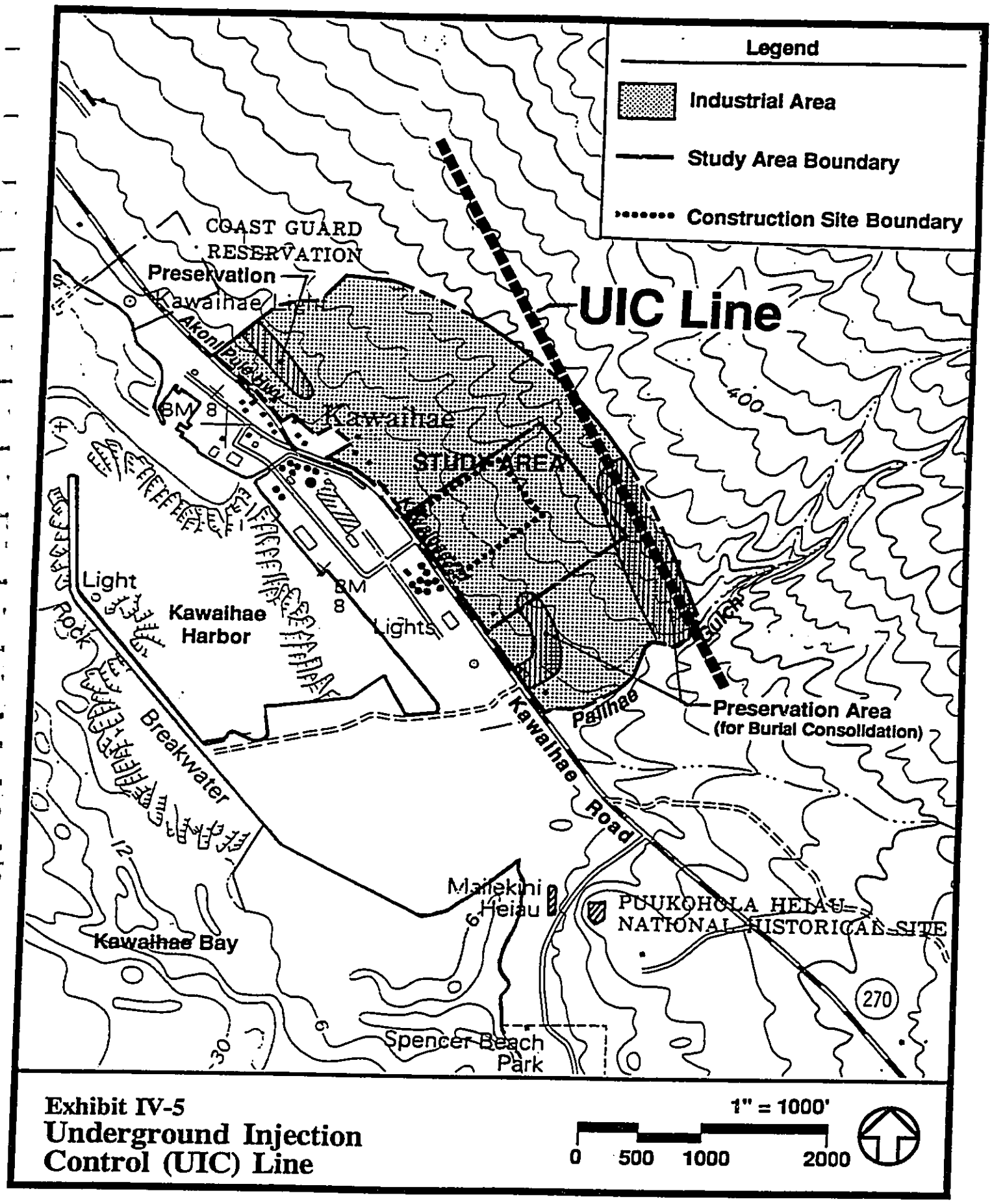

Exhibit IV-5
Underground Injection Control (UIC) Line

in Chapter III. The wells will be approximately 150 feet deep, depending on test results to determine pumping capacity of each well.

To minimize impact to the basal aquifer system, the wells will be drilled to a depth where withdrawal is anticipated to be predominately from the saline groundwater strata. A 1992 engineering study for a proposed coal plant in Kawaihae found that, based on expected conditions at the site, 21,000 gpm is sustainable from supply wells.[18] The KCP project withdrawal is less than 7,500 gpm.

The plant supply wells will be located below the UIC line and outside the impact zone of the fresh water aquifer. The wells will be drilled into the saline aquifer which is essentially the same composition as ocean water and virtually unlimited in supply. It is anticipated that pumping will pull ocean water horizontally into the porous geologic stratum of the zone of well development. This is supported by hydrogeological investigations conducted by Dames and Moore of two sites in Kawaihae where HELCO was considering the development of a 200 megawatt power plant. Both sites were immediately north of the study area, within and near the existing industrial area. Evaluation was made of drawing 160,000 gpm (compared to KCP's proposed withdrawal of 7,500 gpm), and it was found that at this rate of withdrawal (160,000 gpm), the ocean waters would be pulled onshore (from wells at a depth of 140 to 190 feet below ground surface).

It is anticipated that supply well pumping for the project will have an insignificant impact on the basal aquifer by drawing water mainly from the underlying saline aquifer. Furthermore, the quality of the basal water is anticipated to be unsuitable for drinking or irrigation purposes. Groundwater quality will be verified during well installation and testing.

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[18]Dames & Moore, Waimana Power Plant Project, Final Report Licensing and Permitting Evaluation, June 2, 1992.

Injection Wells

The KCP project will use gravity injection wells to dispose the process wastewater into the saline groundwater strata below ground (with exception of sanitary wastewater). Injection wells are used in other areas of Hawaii as a means to dispose of non-hazardous waste and sewage effluent. The AES-Barbers Point coal fired plant on Oahu, which is located approximately 1,000 feet from the shoreline, injects 8.6 mgd of wastewater with a temperature of 10 degrees F. above ambient groundwater temperature. HELCO's proposed power plant expansion at Keahole is designed to inject the plant wastewater. Injection wells are permitted by the State Department of Health.

The average daily injection rate for the KCP project will be 7.6 mgd at maximum desalination plant operation. The waste stream will reflect typical plant processes associated with the operation of a combustion turbine, cooling tower, and desalination plant. The water flow diagram on Exhibit IV-6 shows the project's water and wastewater quantities and relationships. The principal sources of wastewater will be from the desalination plant (6 mgd) and the cooling tower (1.4 mgd).

The by-product of the desalination process will be a concentrated solution of salts and minerals normally found in the groundwater supply. Additional sources of wastewater will be generated by other plant operations such as the reverse osmosis process, demineralization process and operation of the HRSG. By-products of these processes include concentrated solutions of salts and minerals from the R.O. process, minerals removed by backwashing of the demineralizer, and a variety of chemicals such as acids, caustics, phosphates, sulfites and ammonia which are added to the steam cycle in the HRSG to minimize corrosion. Trace amounts of these chemicals will be contained in the waste stream.

Storm runoff from the project that may be contaminated with oil will be directed to the oily waste separator to remove contaminates and then injected with the wastewater.

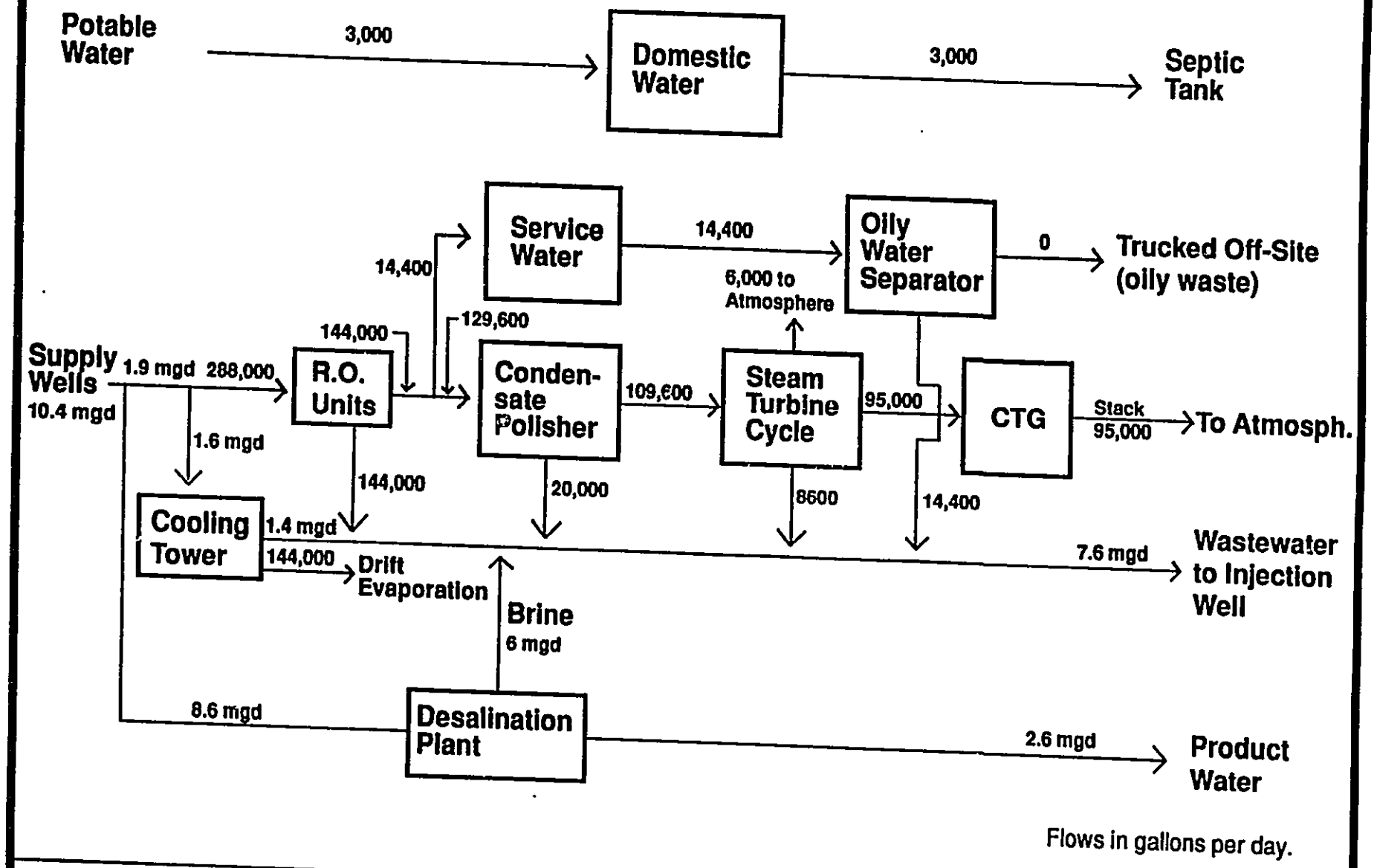

Exhibit IV-6
Water Flow Diagram

The predominant characteristic of the wastewater will be a higher salinity concentration in the range of 1.0 to 2.0 times that of ambient groundwater, depending on desalination plant operation. It is anticipated that the groundwater characteristics below the construction site are the same as ocean water, making it suitable only for cooling and other uses which are not quality dependent. Therefore the salinity differential between the injected wastewater and the ambient groundwater will not significantly impact the saline groundwater or uses associated with it. Adequate horizontal and vertical distance will be maintained between KCP supply wells and injection wells so there are no interference effects on each other. There are currently no other down-gradient users of the saline groundwater. All wastewater will be certified non-hazardous prior to injection.

The proposed disposal by gravity injection will be confined to the saline groundwater strata. The injected water will mix with ambient saline groundwater and will flow in a seaward direction, dispersing into the harbor and eventually the ocean. It is expected that the receiving basalt will respond as a confined aquifer, resulting in a conical shaped flow pattern toward the shoreline. As the wastewater plume migrates downgradient from the injection well, it will be affected by dispersion. 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.

The cooling tower blowdown will be mixed with desalination plant brine and cooled to near harbor water temperature. If necessary, the wastewater may be further cooled using well raw water supply prior to reinjection. The cooler temperatures of the ambient groundwater and the natural tendency to disperse will also mitigate the higher temperature and saline concentration of the wastewater as the plume discharges as a non-point discharge into surrounding ground and ocean waters.

The injection wells will be located below the UIC line precluding impact to the drinking water of the Mahukona Aquifer. Compliance with UIC regulations require identification and monitoring of injected

wastewater quality. Additional measures will be taken by drilling the wells to a depth that will allow adequate dispersal of the wastewater. Dispersal properties of the subsurface geology and quality of the groundwater will be verified during well installation and testing. The injected wastewater is expected to have an insignificant impact on the groundwater aquifer.

6. Marine Environment

Existing Conditions

Water Quality

All coastal waters and embayments are designated either Class AA or A by State of Hawaii Department of Health (DOH) Water Quality Standards Map, October 1987, Waters in Kawaihae Harbor, Kawaihae Bay, and the open ocean north of Wai'ula'ula Point (near Spencer Beach Park) are designated Class A. Class A waters are to be protected for recreational purposes and aesthetic enjoyment, with other uses permitted as long as they are compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. The objective of Class AA waters is for them to remain in their natural pristine state with an absolute minimum of pollution. No discharges are allowed into Class AA waters. Discharges into Class A coastal waters are regulated by the State DOH, and must comply with discharge standards regulated through the state administered National Pollutant Discharge Elimination System (NPDES) permit process, (Chapter 54 of Title II, Administrative Rules, DOH, as amended October, 1984).

The Water Quality Standards also identify Kawaihae Harbor as an artificial basin bottom subtype, meaning a dredged or quarried channel or harbor. Within this subtype, many organisms can attach to the vertical structures, but the soft, shifting sediment bottoms of harbors may only be colonized by a few hardy or transient species.

The Department of Health does not routinely sample the waters of the harbor nor the waters outside the harbor; however in April and

May 1991, samples were taken in the harbor and analyzed for 11 metals. All were well within the published standards.[19]

Water quality samples from the outer reef of the deep-draft harbor were obtained in April 1978 during reconnaissance surveys for the proposed 90-boat harbor.[20] Samples were collected during high and low tides at the surface and bottom, and nearshore (100 meters) and offshore (250 meters). The high and low tide salinity and temperature readings have been averaged in the table below.

Depth	Station	Salinity(S°.qq)	Temp°F
Bottom	Offshore	33.5	76.5
Surface	Offshore	33	77.5
Bottom	Nearshore	33	77.9
Surface	Nearshore	34	77.9

Inshore waters are frequently turbid, due to resuspension of silt and fine sediments by wind and waves. Infrequent storm water runoff from usually dry streambeds in the area initially carries silt and debris into Kawaihae Bay. Windborne coral dust from the dredging stockpiles at Kawaihae Harbor also adds to the sediment load.

Oceanographic Conditions

The coast in this area is sheltered from the northeast tradewind waves, but is exposed to wave approach from the northwest, west, and southwest. North Pacific swell diffracts and refracts around the islands, and the portion of the energy reaching the shore depends upon the approach direction. Kona storm waves and south swell, however, directly approach the coast. Kona wave periods range from 6 to 10 seconds, and wave heights may be as great as 10 feet. South swell

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[19]U.S. Department of the Army, Army Engineer District, Draft Environmental Assessment for Kawaihae Harbor for Light-Draft Vessels, September 22, 1992.

[20]Ocean Research Consulting and Analysis, for U.S. Army Engineer District, Reconnaissance Surveys of the Marine Environment, Kawaihae Small Boat Harbor Project Site, 1978.

periods range from 12 to 20 seconds, and deepwater heights range from 1 to 4 feet.[21]

Nearshore currents are relatively weak. Six months of current measurements off the Mauna Lani Hotel, approximately six miles south of Spencer Beach Park, indicated that the nearshore currents (inside the 40-foot contour) had an average speed of less than 0.1 knot. The resultant flow was a weak net transport to the southwest.

The estimated 50- to 100-year tsunami elevations for this coastline are 5.9 and 8 feet, respectively.

Marine Biological Setting

As part of the Army Corps of Engineers' Environmental Assessment for the proposed 90-boat harbor at Kawaihae, U.S. Fish and Wildlife Service (FWS) biologists surveyed the small boat harbor site in April 1990.[22] Initial qualitative surveys of the site were conducted to identify and delineate habitat types. Quantitative surveys of corals and reef fishes were completed for selected habitat types, and indicated that coral coverage within the small boat harbor basin (which was dredged in 1970) has apparently increased since the late 70's. By 1990, a coral community with high coral coverage had developed on the limestone mounds along the northern and eastern boundary of the small boat harbor basin. Much of the basin is a low-relief sand flat, which lacked suitable substratum for the development and maintenance of reef corals. The reef fish community within the harbor basin was relatively diverse, however the abundance of reef fishes was low. Since a 1978 survey, the diversity and abundance of reef fishes in the basin has apparently increased. However, FWS states that the apparent increase in the diversity and abundance of reef fishes may reflect different sampling conditions

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[21]R.M. Towill Corporation, Final Environmental Impact Statement, Kawaihae Ten-Year Master Plan, December 1992.

[22]U.S. Department of the Interior, Fish and Wildlife Service, Fish and Wildlife Coordination Act Report, Kawaihae Small Boat Harbor, July 1990.

such as water clarity, diver experience, and seasonal differences in fish distributions.

A study by Ocean Research Consulting and Analysis, Ltd., in 1978 for the small boat harbor, states that the reef within the breakwater of the deep-draft harbor demonstrated a marked recovery in coral growth since basin dredging and breakwater construction. This recovery is believed to be due to (1) availability of hard substrate, (2) ample water circulation, and (3) sufficient water clarity for growth.

Many varieties of corals, including Porites and Pocillipora are common components of the remaining living reef communities outside of the small boat harbor project area. An uncommon Hawaiian coral, Porites (Synaraea) convexa, seems to achieve unusual abundance at Kawaihae offshore from Spencer Beach Park and off of the commercial harbor breakwater. The reef, seaward and to both sides of the proposed small boat harbor, is a well-developed, pristine, wave-exposed coral reef with abundant fish population and a typical dominance of the finger coral Porites compressa and the lobed coral Porites lobata.

Two species of macroscopic algae, which are sometimes indicative of polluted water, Ulva faciata, and Enteromorpha species were present along the Kawaihae commercial harbor revetment.

Puukohola Bay, south of the harbor, is a focal point for shark activity within Kawaihae Bay. Sharks are commonly seen within the embayment. The shark fauna within Puukohola Bay is composed of grey reef, reef blacktip, and reef whitetip. The site is apparently a breeding ground for blacktip and grey reef sharks?[23]

A juvenile Hawaiian green sea turtle was seen within the harbor basin during the FWS survey, approximately 30 to 45 feet from the shoreline. Humpback whales are known to frequent the offshore

[23]Ibid.

waters of Kawaihae Bay. These are threatened and endangered species.

Potential Impact

The injected wastewater from plant operations will have a higher temperature and salinity concentration than the ambient saline groundwater. The impact on the groundwater has been addressed in the previous section. The cooling tower will substantially reduce the temperature of the wastewater to near the harbor water temperature. The ambient groundwater, essentially equivalent in composition to sea water and approximately three degrees cooler than the ambient ocean temperature, will dilute and cool the injected wastewater as the wastewater plume disperses as it migrates downgradient. The plume is expected to be effectively dispersed and diluted before reaching the shoreline over 800 feet away. There will be no direct discharge into the ocean. Any remaining thermal and salinity effects of discharge reaching the shoreline will be further dissipated by the mixing effects of tides and currents. The injected wastewater from the project is not expected to significantly impact the marine environment of Kawaihae Harbor. The dispersed properties of the subsurface geology will be determined during well installation and testing. The quality of the injected wastewater will be continuously monitored in compliance with the UIC program.

7. Flora and Fauna

Existing Conditions

A Biological Database and Reconnaissance Survey of the DHHL Kawaihae parcel was conducted in 1989 by the Nature Conservancy of Hawaii as part of the Kawaihae Ten-Year Master Plan EIS. The survey included the 40-acre study area. The vast majority of the DHHL parcel consists of pasture or kiawe (Prosopis pailida) forest. Most of the original vegetation of Kawaihae has been destroyed by hoofed animals and introduced plants. A few native forest pockets and three rare plants were observed, although all were located outside the KCP study area in Honokoa Gulch and on the slopes of cinder cones above 2,400 feet elevations.

The KCP study area consists primarily of pasture and small lowland dry shrubland. The remainder contains intermittent stands of alien kiawe open forest with a grass understory (fountain grass and/or buffel grass were dominant). The grass understory is highly susceptible to brush fires, and the entire study area has been burned by fires over the past few years. The kiawe forest extends from sea level to about 1,500 feet, well above the KCP study area.

No rare native animal species were observed during the 1989 survey nor have any been reported within the DHHL parcel. Two common endemic forest birds, the 'apapane and the Hawaii 'amakihi were seen during the survey, along with numerous alien birds and invertebrates. Four rare animal species have been reported from lands adjacent to the DHHL parcel: Hawaii hoary bat, Hawaiian duck, Hawaiian hawk, and a rare land snail (Partulina physa).

Potential Impacts

The proposed project is not expected to have a significant negative impact on the botanical or biological resources of the site. The vegetation in the area consists entirely of introduced species in pasture areas and kiawe forest.

Because the DHHL property is not known to contain any rare animals, impacts on rare animals are not expected. The relatively dry climate and sparse vegetation in the area does not provide good habitat for the rare animals that have been reported from other properties in the region.

8. Air Quality

Existing Conditions

Most of the following information on the existing air quality around the KCP study area is from B.D. Neal's Air Quality Study for the Proposed Kawaihae Master Plan.

Air quality in the vicinity of the project is mostly affected by emissions from natural, industrial, agricultural and/or vehicular sources. The dominant factor for the past several years has been the volcanic haze

(vog) from Kilauea Volcano which eventually drifts into the Kona and Kohala areas from more than 60 miles away. Other natural sources of air pollution that may affect the air quality of the site include the ocean, plants, and wind-blown dust. Some particulate and hydrocarbon emissions presently occur from small-scale industries located at Kawaihae Port, although no major industrial air pollution emission facilities are currently operating in the area. Agriculture in the area may also contribute relatively minor amounts of fugitive dust to the atmosphere. Automotive emission, primarily nitrogen oxides and carbon monoxide, from traffic associated with the port or from vehicles passing through the area on Kawaihae Road and Akoni Pule Highway may reduce air quality slightly. Virtually no air quality monitoring data from the State Department of Health are available for the South Kohala area, but based on what little data are available, it appears likely that both state and national ambient air quality standards are currently being met despite the persistent vog. On the whole, air quality for the area is presently considered good except for the vog and for occasional fugitive dust problems or problems related to occasional congested traffic locations.

Potential Impacts

Construction Air Emissions

During construction activities, the project area will be subjected to increased levels of dust and vehicle exhaust emissions. Dust would be generated during clearing and grubbing activities and site excavation. Emissions would be generated during the operation of construction equipment and vehicles. Dust control measures stipulated by Department of Health regulations will be employed during the construction period. As a result, construction emissions are not expected to be significant and no long-range impacts are expected.

Operational Air Quality Regulations

Emissions of air pollutants are regulated at the federal level pursuant to the Clean Air Act (CAA). Major provisions of the CAA include:

1) National Ambient Air Quality Standard (NAAQS). NAAQS represent the maximum pollution levels considered to be acceptable for six criteria pollutants: sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, particulate matter less that 10-microns in diameter, and lead. Hawaii's ambient air quality standards are very similar to the NAAQS, although the State has more stringent standards for carbon monoxide and nitrogen dioxide.

2) New Source Review / Prevention of Significant Deterioration (PSD). PSD requirements apply on a pollutant-specific basis to any project that is a major new stationary source. A source is major if potential emissions of any pollutant will exceed 250 tons per year. A source is subject to PSD review for a specific pollutant if the emissions of that pollutant will exceed PSD significance levels. The State DOH is responsible for New Source Reviews and implementation of the PSD program.

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

4) Good Engineering Practice (GEP) Stack Height Provisions are federal guidelines for stack height and design to minimize ground level concentrations of emissions.

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

Operational Air Emissions

Based on preliminary emissions data, the proposed Kawaihae Cogeneration Power Facility qualifies as a "new major stationary source" of pollutants based on the federal Clean Air Act, assuming the project consists of two turbines operating full time.

The estimated emissions are calculated based on equipment manufacturers' data, fuel sulfur content 0.4% by weight, and assuming 8,760 operating hours per year.

Because estimated emissions from the proposed project will exceed PSD significance levels, the project is subject to PSD review which consists of the following analyses:

- Best Available Control Technology analysis (BACT),
- Applicable PSD air quality increments,
- Compliance with ambient air quality standards,
- A Class I area impact analysis,
- An analysis of the effects of the project on soils, vegetation and visibility.

If a project is subject to review for a specific pollutant, it must use the best available control technology for that pollutant. This technology is evaluated on a case-by-case basis, and generally takes into account economic factors such as the cost of the technology per ton of pollution reduced. BACT review will be required for all pollutants for which PSD review is required. The project's air quality consultant, Sierra Research, believes that the KCP proposal to use steam injection and selective catalytic reduction (SCR) to control nitrogen oxides from the turbine to 15 ppmvd[24] at 15% oxygen will be considered BACT for nitrogen oxide by both DOH and EPA. It is also expected that good combustion efficiency will adequately control carbon monoxide and particulate matter. In addition, the use of steam injection instead of water injection for nitrogen oxide control results in lower carbon monoxide emissions levels. The proposed fuel

[24]Ppmvd is the abbreviation for parts per million by dry volume.

sulfur level of 0.4% is expected to be considered BACT for sulfur dioxide.

For projects that are subject to PSD review, an applicant must collect one year of weather and six months of air pollutant data prior to submitting the permit application (unless there are recent ambient air quality data available at or near the project location). KCP has installed, and is operating a meteorological monitoring site for one year to collect on-site meteorological data for use in the ambient air quality monitoring analysis. The meteorological or "met" tower began operations in early May 1993, and data will be collected at 10, 30, and 60 meter levels above the ground. The monitoring plan is consistent with EPA's applicable guidelines and requirements. The monitoring protocol has already been submitted to DOH for approval. One month of meteorological data collected at the site is provided in Appendix B.

If the project is subject to review for any of the regulated pollutants, an analysis must be performed of the available PSD increment. This increment is an allocation of the available clean air for industrial projects. Increments analyses are extremely complicated, and generally require the collection of data from a variety of different sources (not only those owned by the project applicant) within the broad region where the proposed project may affect local air quality. If the combined air quality impacts of the proposed project and other existing sources exceed the available increment, the proposed project will be denied. Based on the initial emissions calculations, increments analyses will be required for nitrogen dioxide, sulfur dioxide, and particulate matter. (There is no increment standard for carbon monoxide.)

Finally, each project subject to review must perform an air quality impact analysis. This analysis takes the background data collected from the pre-construction monitoring site, adds the contribution associated with the proposed project, and compares the totals with the state and national ambient air quality standards. If the combined

effects of the proposed project and existing concentrations would cause a new violation of a state or federal ambient air quality standard, the proposed project would be disapproved.

In addition to satisfying the requirements of the PSD process, the project must obtain an Authority to Construct from DOH. To receive an Authority to Construct, the applicant must show that BACT is provided to control those pollutants subject to national and state ambient air quality standards that might be emitted at levels over applicable standards. In addition, the applicant must show that the review requirements pertaining to the PSD are met. During DOH's review of the application for Authority to Construct, there is generally a 30-day public comment period.

After construction of the facility, a Permit to Operate must be received from DOH. Actual emissions testing will be performed at this stage to verify compliance with the air quality standards. The Permit to Operate is generally reviewed every three years.

The 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. Proposed mitigation measures will be reviewed and approved by the DOH during the permitting process. Post-construction air quality monitoring will be performed as required by DOH.

All phases of construction will require specific permits to assure that all procedures are in accordance with applicable government laws and regulations. A PSD permit and Authorization to Construct permit may be obtained only after vigorous review of detailed engineering and project design data showing that the project will conform to all applicable national and state air quality standards. The power plant will be required to have continuous monitoring equipment to assure continued compliance with regulated air emissions levels. After the project begins operation, the DOH will continue to review plant emissions to assure compliance with permitted emission rates.

An analysis of the air emissions with mitigative measures and their potential impacts reveal the maximum project impacts for all federal and state pollutants are less than 29% of the strictest applicable standard. A summary of the air impacts is included in Appendix C.

9. Noise

Existing Conditions

Sound can be measured on a variety of scales and reported in a number of ways. The unit commonly used to describe the magnitude of a sound is the decibel (dB). Because the human ear is less sensitive to sounds in the high- and low-frequency ranges, a weighing scale is sometimes used to approximate the responses of the ear. This is called A-weighing and is abbreviated dBA. Instantaneous sound levels as read on a standard sound level meter are also A-weighted.

In assessing impacts on adjacent land uses, the day-night sound level (Ldn) is typically used for evaluating the acceptability of a noise generator environment for various land uses.[25] The Ldn represents the 24-hour average sound level for a typical day and incorporates a 10-decibel penalty that is added to nighttime (10 p.m. to 7 a.m.) noise levels, when people are more sensitive to noise. The average hourly sound level is referred to as "equivalent" sound level, or Leq.

Relatively high exterior noise levels of 65 to 80 Ldn are considered to be "Compatible" or "Marginally Compatible" for commercial land uses. Industrial land uses are considered to be compatible in areas with noise levels as high as 80 Ldn as long as sound attenuation measures are provided to reduce interior noise to acceptable levels.[26]

The present noise quality of the area is primarily affected by vehicular generated noise on Akoni Pule Highway and Kawaihae Road, natural sounds from the surf, and sounds from the wind moving through the

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[25]Ldn has been recommended by the American National Bureau of Standards (May 29, 1980) for determining land use compatibility.

[26]American National Standard Institute, Land Use Compatibility With Yearly Day-Night Average Sound Level, 1980.

vegetation on-site. With the exception of areas affected by traffic noise, ambient sound levels are very low, typical of rural areas.[27]

Existing background ambient and traffic noise levels were measured by Y. Ebisu in the study area, and were relatively low at an average level of 53.7 decibels (Leq).[28] The maximum noise level measured was 75 Leq within the existing industrial area north of the study area.

Noise levels at lots that front Queen Kaahumanu Highway, Kawaihae Road, and Akoni Pule Highway are typically above 60 Ldn.

Noise regulations do not currently apply to the island of Hawaii. On the island of Oahu, the State Department of Health regulates noise emissions from industrial and other land uses.[29] Noise limits contained in the DOH regulations do not use the Ldn metric. They express noise limits in terms of maximum allowable decibels (dB) at the property line. The property line limit for industrial/agricultural districts is 70 dBA.

Because the DOH regulatory limits represent short-term levels rather than 24-hour averages, they are not directly comparable to noise compatibility criteria expressed in Ldn. However, the State DOH limit for industrial/agricultural districts is approximately equal to 76 Ldn. No explicit federal standards exist that are applicable to these land uses. However the federal guidelines intended for land use planning are generally similar to the State standard described above. For purposes of the study, we will assume that these standards will apply in the future to the island of Hawaii.

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[27]Typical average day/night sound level for an undeveloped rural area is 35 Ldn and for a partially developed rural area is 40 Ldn, according to National Research Council, National Academy of Sciences (1977).

[28]Y. Ebisu & Associates, Noise Study for the Kawaihae Ten-Year Master Plan, October 1991.

[29]State of Hawaii, Department of Health, Administrative Rules, Chapter 43, Community Noise Control for Oahu.

Potential Impacts

Construction Noise

During construction, there will be temporary and localized adverse noise impacts. Project-related construction activity may produce noise in excess of the DOH's 70 dBA property-line limit for the power plant. If so, a construction noise permit will be needed from the State DOH. The increase in noise levels will vary according to the particular phase of construction. The noisiest periods will occur during site preparation, when large earth-moving equipment is active, and during well-drilling activities. Even then, however, compliance with the DOH construction noise limits and curfew times will ensure that project-related noise is mitigated, reducing significant adverse effect on its neighbors.

Operational noise

The proposed power plant is an industrial facility containing numerous noise sources. The major sources of operational noise are expected to be the combustion and steam turbines, various pumps, the boiler vents, and the cooling tower fans. Power plant operations will potentially take place 24 hours per day, seven days a week.

The extent to which noise from one industrial activity leaks out to adjoining properties depends on the location (or set-back distances) of the noise source from the property boundaries and the degree of enclosure around the noise source. Features such as mufflers and enclosures, which are typically used throughout the industry, will be used to attenuate sound levels to meet both the DOH exterior noise level limits as well as OSHA's standards for interior noise levels. An engineering study will be performed during the final design of the project to determine the level of mitigation that will be required to maintain the 70 dBA noise limit at the property line.

10. Historic and Archaeological Resources

Existing Conditions

An extensive archaeological survey was conducted for the DHHL's

Kawaihae parcel.[30] The following description of the cultural history of Kawaihae, the methodology and findings of the archaeological survey, and description of nearby historic sites are taken from the Cultural Surveys Hawaii (CSH) report and the Kawaihae Ten-Year Master Plan EIS.

Cultural History

Kawaihae has been the focus of several fairly detailed surveys of the historical and ethnographic record. However, much of the research material focuses on Pu'ukohola, John Young's residence, Puako, and Waimea. While studies in these areas touch on important aspects of Kawaihae's history, the archaeological consultant study concluded that much of this research has little direct relevance to the archaeology of the present study area. The archaeological consultant conducted oral history interviews with long time Kawaihae residents.

Kawaihae has been well known as a residence of kings. Alapai moved to Kikiakoi in Kawaihae and appointed his son Keaweopala to be his successor at Mailekini Heiau in 1754. Kamehameha I and his entourage lived at Pu'ukohola during its construction (renovation) and with the assassination of Keoua-Kuahuula there in 1790, Kamehameha I became Alii nui of Hawaii Island. Kawaihae was also the residence of Kalanimoku (Kamehameha's treasurer and war leader), Chief Keeaumoku (Kamehameha's general), John Young (Governor of Hawaii 1802-1812), Kuakini (Governor of Hawaii under Liholiho), and the birth place of Queens Kamamalu (wife and half sister of Liholiho) and Emma (wife of Kamehameha IV).

However, to a very large extent, the residence of chiefs was below Pu'ukohola (the "King's Residence" designated Site 50-10-05-2297) in the ahupuaa of Kawaihae 2 (Hikina).

Kawaihae was in the early historic period, as it is today, the best anchorage in west Hawaii and as a result early reports exist of the

[30]Cultural Surveys Hawaii, Archaeological Survey and Testing, Kawaihae 1 (Komohana), South Kohala, Hawai'i, Revised July 1991.

settlement there. The introduction of cattle to Waimea was a major economic boom to the Kawaihae-Waimea area. The shipment of cattle was the major activity with cattle being herded down "cattle road," just back of Doi's Store, and held in corrals near the old wharf until ship day. Cattle were driven into the water, tied by their horns to a small boat, and floated out to the waiting ship even after the construction of a concrete pier in 1937.

The biggest impact on Kawaihae in historic times was the construction of a new Federal deep-draft harbor in 1958.

Archaeological Sites

One of the most significant features of the Kawaihae lands is the presence of archaeological sites. An extensive archaeological reconnaissance survey was performed in March 1990 by Cultural Surveys Hawaii. This survey was limited to the lower portion of the Ten-Year Master Plan project area, below the 1,000-foot elevation.

Exhibit IV-7 reflects archaeological features encountered within the KCP study area. The features depicted include sites recommended for preservation; sites of known, probable, or possible burials; and sites requiring further data recovery. There are also numerous other sites that have been investigated and determined to be no longer significant and requiring no further work.

As part of the DHHL Master Plan and EIS, Cultural Surveys Hawaii recommended two sites, a shelter complex and a habitation complex, for preservation in that both are "good examples of sites". The 40-acre study area may encompass one of the archaeological sites recommended for preservation. Any site recommended for preservation will be treated in accordance with applicable recommendations and with the provisions of the lease with DHHL.

Burials are commonly encountered features in the uplands of Kawaihae, particularly north of Makahuna Gulch. Seven possible, probable, or known burial sites were identified within the study area. Cultural Surveys Hawaii (CSH) tested seven supposed burial features

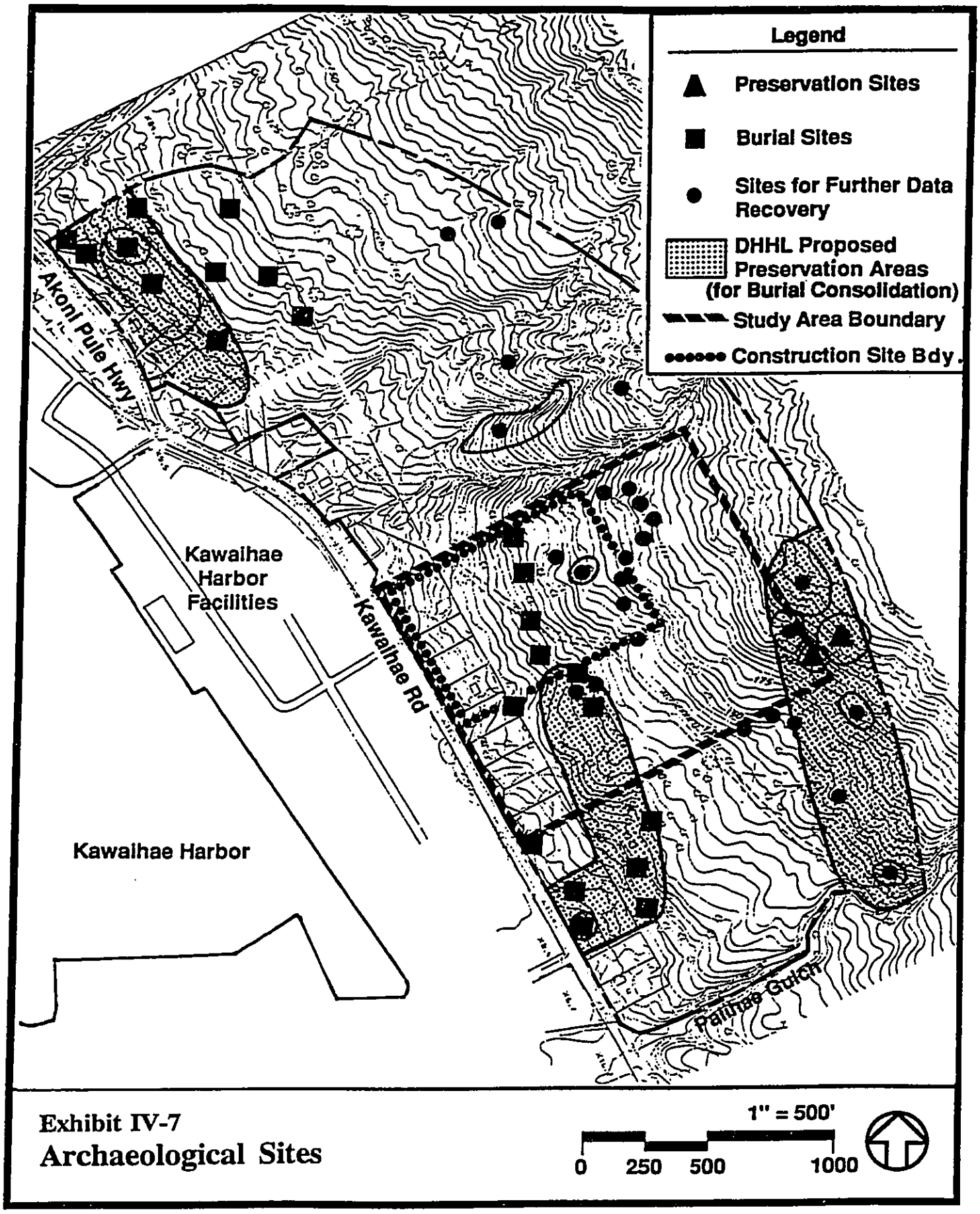

Exhibit IV-7
Archaeological Sites

during their survey and found burials in five. CSH states it may be desirable to test identified burials within a development area in light of the suggested probability that 30 percent of these features may not actually be burials. The DHHL and KCP are developing a burial mitigation plan that will address all the sites within the industrial area and will include the seven sites located within the study area. This plan will encompass the recommendations and obtain the approval of the appropriate Native Hawaiian Organizations which will include the following groups; Hawaii Island Burial Council, Office of Hawaiian Affairs, and Hui Malama I Na Kupuna O Hawaii Nei.

Approximately twenty-six archaeological sites within the industrial area were recommended for data recovery[31] of which fourteen are located within the study area. The "possible functions" assigned to the majority of the sites include agriculture, shelter, and habitation, with a few activity areas, trails, and WWII fortifications. No caves were found in the industrial or the study area. Each site was evaluated by Cultural Surveys Hawaii in terms of significance according to State and Federal criteria for site significance. All data recovery sites (as well as burials and sites recommended for preservation) were coded C, D, or E. A significance code "C" indicated the site is an excellent example of a particular "site type."[32] A number of sites were regarded as excellent examples of site types in their regional context of coastal sites in Kohala District. Typically these sites (which included trails, overhang shelters, graves, habitation enclosures and complexes, and agricultural areas) were more formal in construction, better preserved, and appeared to have been utilized more extensively than other sites of the same type.

Sites with a significance code "D" may be likely to yield information in prehistory or history. Any site which was regarded as likely to contain a stratified cultural deposit or to yield significant quantity or quality of

[31]There may be additional Bishop Museum designated sites from previous surveys in the area that will be recommended for data recovery by the State Historic Preservation Office.

[32]Standard archaeological procedure is to give each identified site a "site type" designation, such as trail, shelter, enclosure, mound, etc.

midden or artifacts or charcoal suitable for carbon dating was regarded as significant under code D.

Under code "E", a site has cultural significance. Any site which was regarded as having a probable grave or shrine component was given this significance code assessment.

Nearby Historic Sites

The Cultural Surveys Hawaii reconnaissance of DHHL's Master Plan area revealed that there is a high concentration of archaeological features mauka of Kawaihae Road and Akoni Pule Highway and south of Honokoa Gulch to the 300-foot elevation. Also, a significant number of features were located makai of Akoni Pule Highway between the North Kohala boundary line and Honokoa Gulch. Cultural Surveys Hawaii recommended a number of sites for preservation. The most significant area recommended for preservation was the coastal area of Honokoa Gulch (two miles north of the KCP study area) which contained a habitation complex, a canoe shed, four shrine features and a probable area of an observatory. Two caves, the Forbes and Mummy caves within the Honokoa Gulch, were also recommended for preservation, as were a high status and/or men's house and a cave shelter in the Kaiopae Gulch near the coastline.

Three historic sites, Pu'ukohola heiau, Mailekini heiau, and the John Young homestead are located immediately south of the study area. The John Young homestead is on Queen Emma Foundation property mauka of Kawaihae Road; the two heiaus are makai of the road. The John Young homestead has been conveyed to the U.S. Department of Interior's National Park Service by Queen Emma Foundation. The Pu'ukohola heiau and Mailekina heiau have been declared a National Historic Site by Congress in August 1972 "to restore and preserve in public ownership the historically significant temples associated with Kamehameha the Great, ...and the property of John Young..." These three sites have been included in a national park concept plan that was prepared by the U.S. Department of the Interior's National Park Service.

Potential Impacts

The DHHL's Kawaihae Ten-Year Master Plan proposes future development over much of the area where there is a high concentration of archaeological features. According to the results of the 1990 Cultural Surveys Hawaii Study, the majority of the features have been recorded and do not require further data recovery or preservation. However, within the 40-acre KCP study area, there is one site that is recommended for preservation and approximately 14 that have been designated for further data recovery. In their Master Plan EIS, DHHL states that sites recommended for preservation will be identified, set aside, and secured to insure that they are not disturbed. Data recovery on identified sites will be performed prior to the start of any construction activities that could affect the sites in order to determine their final disposition. In addition, the archaeological survey listed 23 known possible or probable burial sites within the industrial area with seven sites located within the study area. DHHL proposes that the burials be consolidated into areas that will be designated for preservation and will be continually maintained. The proposed preservation areas are shown on Exhibit IV-7. DHHL is also considering an alternative site location outside of their Master Plan development area.

Kawaihae Cogeneration Partners will support DHHL's commitment to preserve, study, and respect the archaeological sites in the study area.

Construction activity resulting from the proposed generating facility will be limited to about 15 acres of the 40-acre study area. The archaeological survey conducted by Cultural Surveys Hawaii has identified the archaeological features recommended for data recovery and preservation which are located within the proposed 40-acre KCP lease parcel.

All identified archaeological sites will be located and plotted by professional surveyors on a topographic map of the project area, with the aid of an archaeologist. This locational plotting will identify all the sites located within the 40-acre parcel that were recommended for data recovery. Because of the large number of sites in this area which

will require data recovery, it was recommended by CSH that archaeological data recovery be planned at least one year in advance of any proposed development. A detailed mitigation plan will be prepared and executed in coordination with the appropriate Native Hawaiian organizations to meet the requirements of all applicable laws and regulations prior to any site construction.

KCP will work with appropriate Native Hawaiian organizations, as well as the Federal government in compliance with the Native American Graves and Repatriation Act, to assure proper treatment of all burial sites.

Should unidentified archaeological or burial features be encountered during the course of the project, the Federal Parks Service Division will be notified immediately and the approved recommended mitigative measures implemented.

11. Visual Resources

Existing Conditions

The viewshed of Kawaihae and the study area is characterized by the moderately sloping land (now covered with kiawe and lowland shrubs) extending from the Kohala Mountains, the harbor, the harbor facilities, and a rural coastline north and south of the harbor. The visual experience is unique and reflects the rural qualities that are associated with North and South Kohala. The study area offers expansive views of the South Kohala coast; Kawaihae Harbor; Mauna Loa, Mauna Kea and Hualalai mountains; and the vast expanses of undeveloped lands of West Hawaii.

The study area is visible from various locations in the vicinity including Kawaihae Road and Akoni Pule Highway; Pu'ukohola Heiau National Historic Site; the adjacent industrial uses (harbor); and four residences currently within the study area. Distant views of the area from Queen Kaahumanu Highway and coastal recreational and resort areas south of the harbor are dominated by the harbor and the slopes of the Kohala Mountain. From these distant locations, present harbor facilities and land scarification produce strong contrasting visual

impacts, especially due to the color of the coral land fill and buildings against the hillside.

Potential Impacts

Photographs toward the study area from various locations overlaid with computer generated simulations of the project comprise Exhibits IV-8a, b, c, d, e, and f. The major structures of the power plant, such as the exhaust stack and fuel storage tanks, will be visible from some distance as shown in the visual simulations. Equipment enclosures and buildings will not exceed 40 feet in height. The fuel storage tanks will be approximately 50 feet in height. Results of the latest analyses, based on the most current meteorological data, indicate the stack will be 100 feet tall. Under most meteorological conditions, there will be little if any condensation above the cooling tower. Only during periods of particularly high humidity and/or low temperatures will a visible plume form. The plume, consisting of water particles, is expected to dissipate within a short distance from the cooling tower.

The visual impact from Kawaihae Road and Akoni Pule Highway would be brief but probably dominant, i.e., the focus of the viewers' attention. Under normal travel speeds, the period of viewer impact would be less than five seconds. With landscaping and berms in place, much of the view of the project will be buffered.

The site would also be visible from the industrial harbor uses across Kawaihae Road.

The study area is not visible from Hapuna State Park due to undulating coastline and surrounding topography. It is visible, as seen on Exhibit IV-7, from Pu'ukohola Heiau, Spencer Beach Park, and Mauna Kea Beach Resort.

The existing vegetation along most of Kawaihae Road will serve as an effective screen from close range, and project landscaping will be designed to screen the project to the extent possible from more distant vantage points. Distant views would likely be inconspicuous (evident, but not particularly noticeable) because of the existing industrial

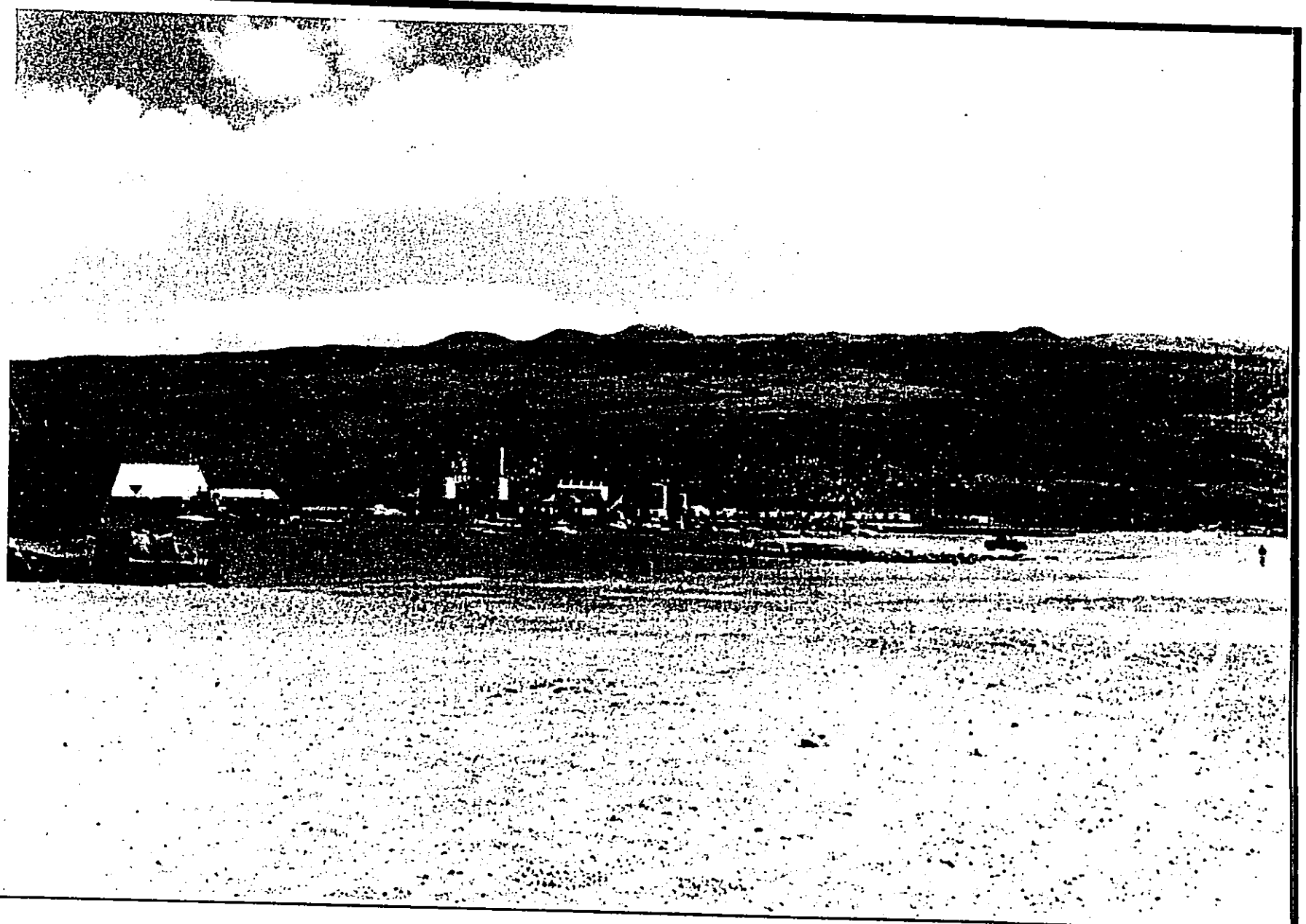

Exhibit IV-8a
Photos of Study Area

View from Kawaihae Harbor breakwater

Exhibit IV-8b
Photos of Study Area

View from Pu'u Kohola Heiau

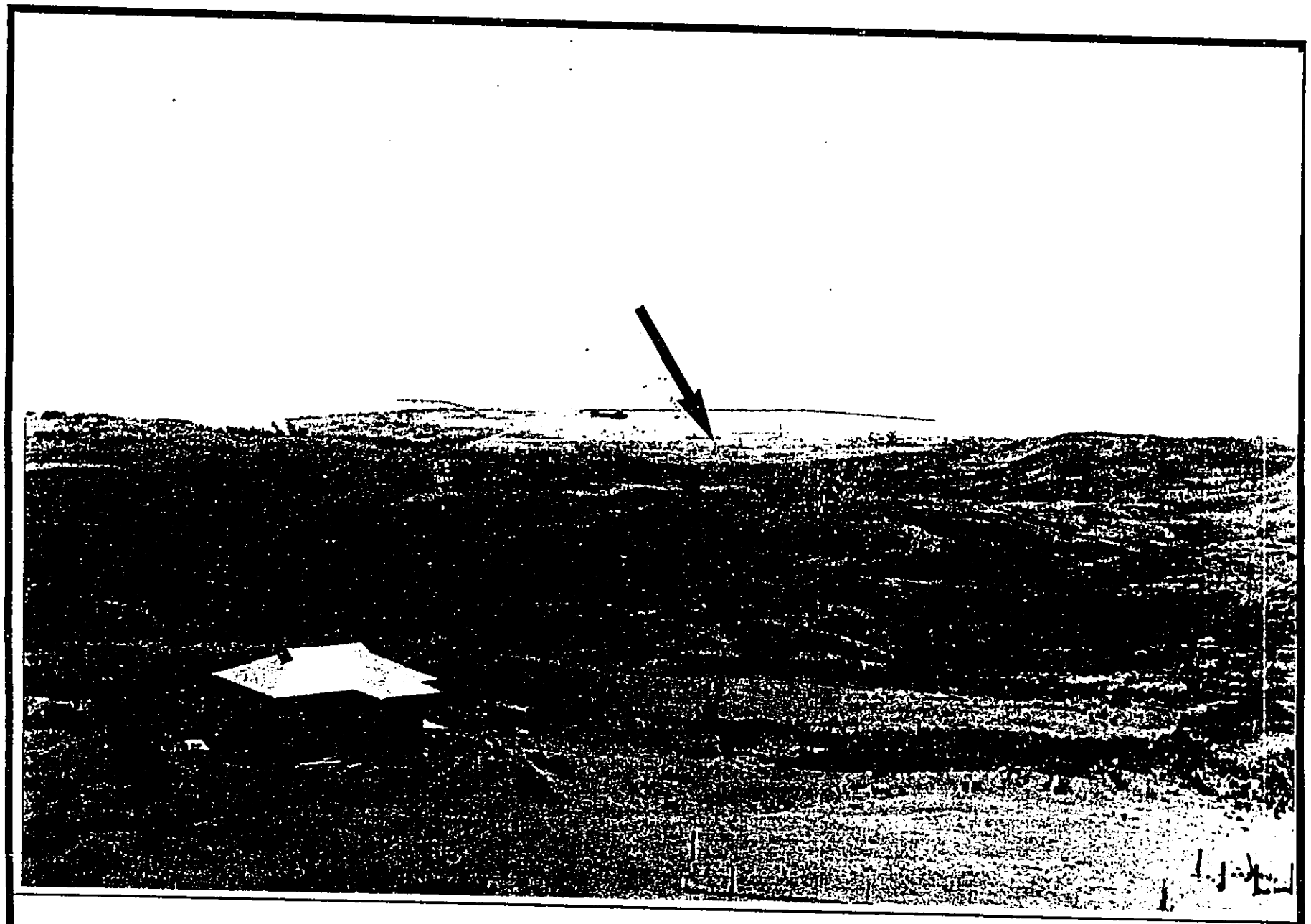

Exhibit IV-8c
Photos of Study Area

View from Mauka Road

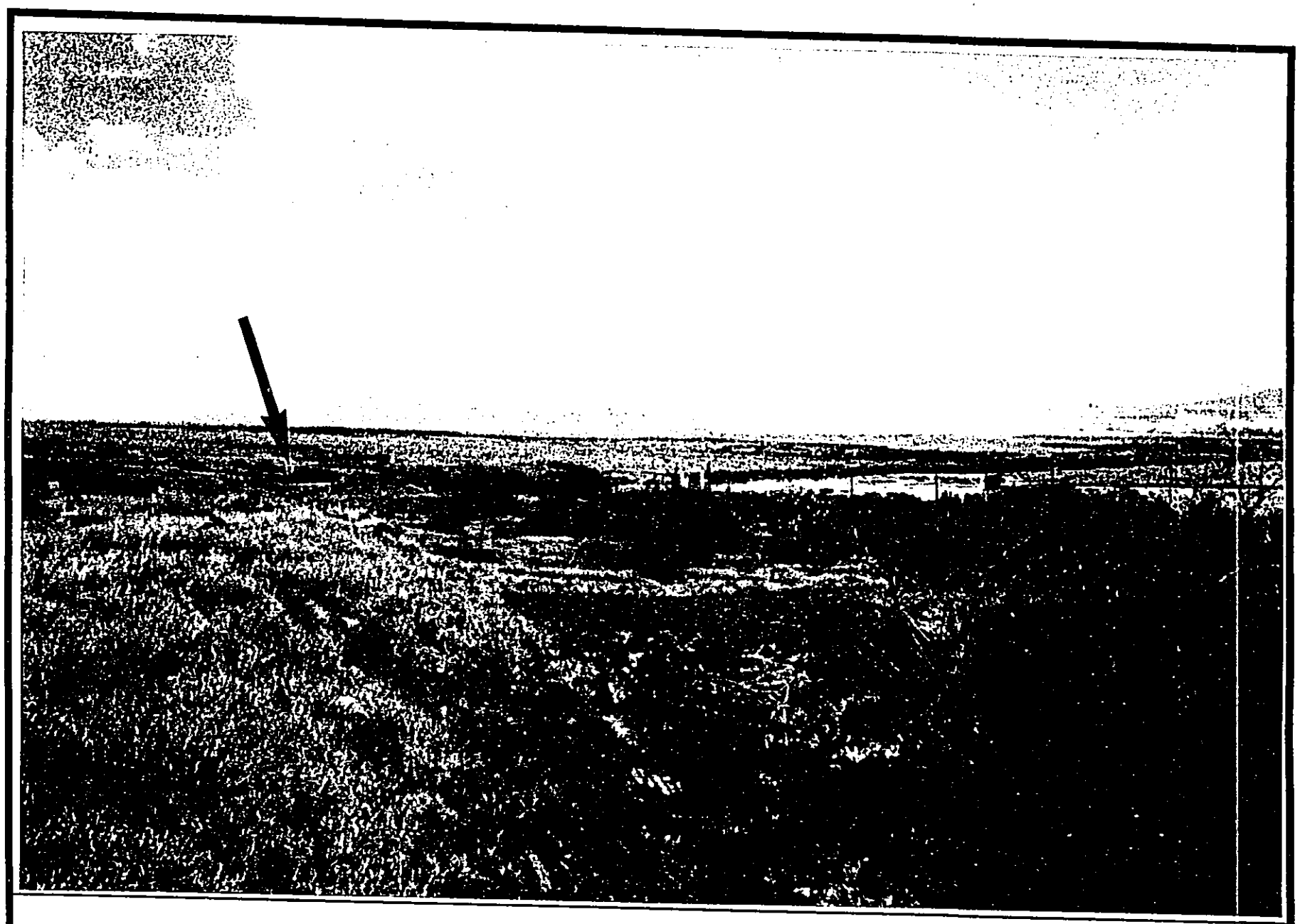

Exhibit IV-8d
Photos of Study Area

View from DHHL light industrial area (top 10' of exhaust stack visible)

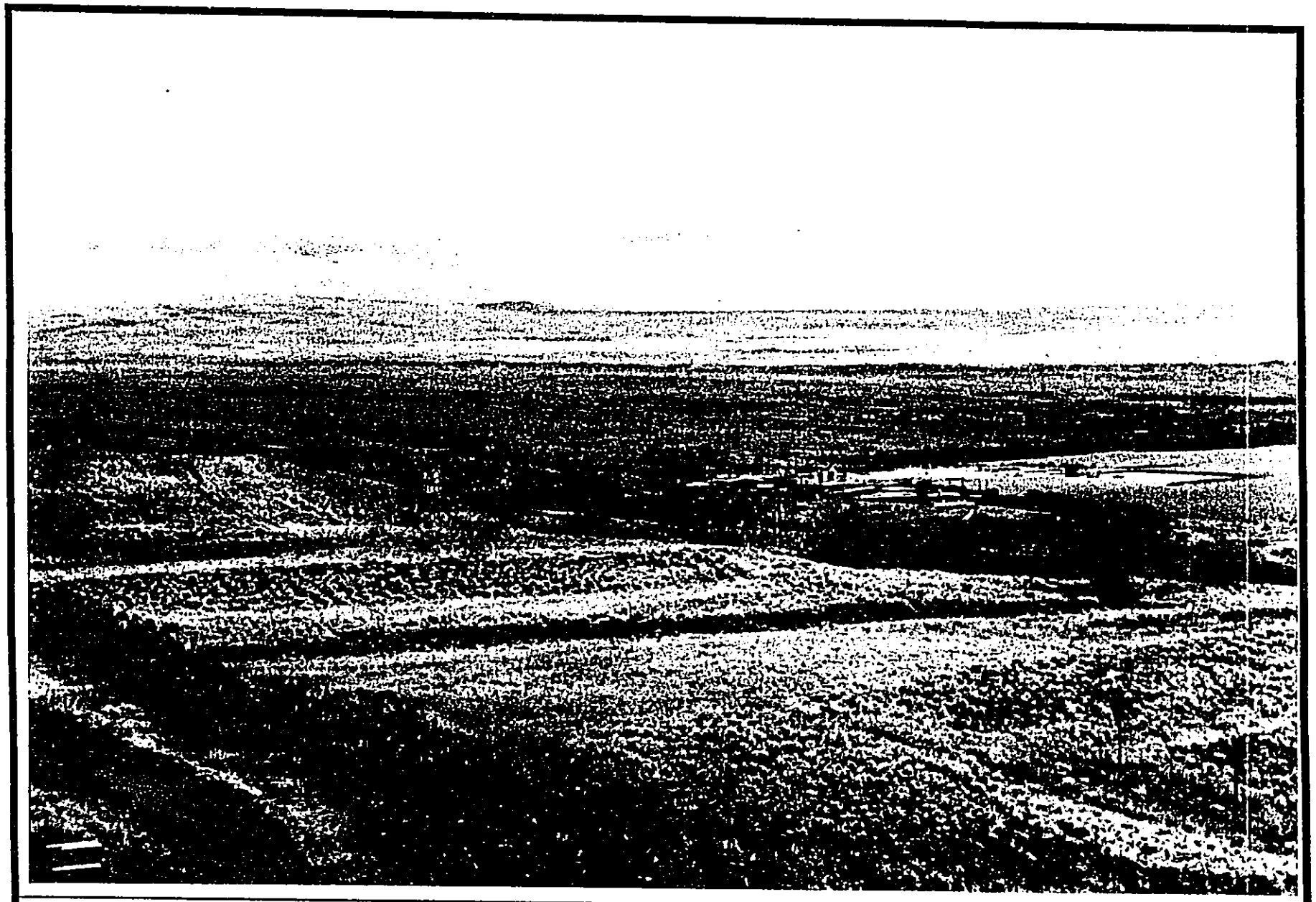

Exhibit IV-8e
Photos of Study Area

View from Kohala Ranch Estates (power plant not visible due to terrain variation)

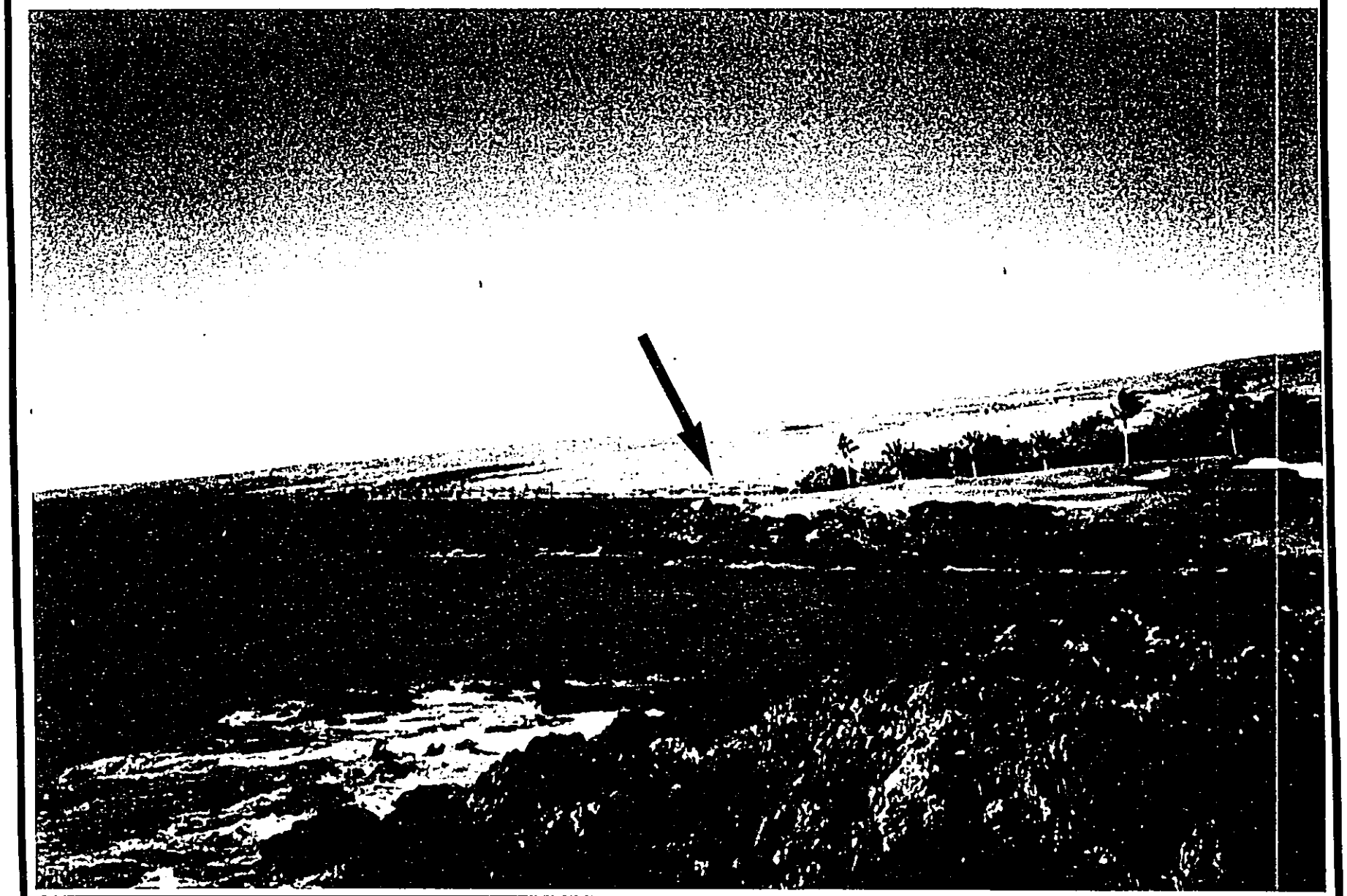

Exhibit IV-8f
Photos of Study Area

View from Mauna Kea Beach Hotel

facilities in the immediate area and view distance. The tall, bright white structures at Kawaihae Harbor will be more visually dominant from a distant view toward the area than the KCP project features will be, with the possible exception of the stack. Visual impacts of the project features will be mitigated by site design and buffering efforts. The design of building profiles, use of earth tone colors, topographic setting and effective grading techniques, and vegetation screening can provide significant mitigation for visual impact as indicated by the photographs and computer generated images.

B. SOCIAL/CULTURAL/ECONOMIC CHARACTERISTICS

The study area is in the northern portion of the South Kohala district of the county of Hawaii. The South Kohala District boundaries are equivalent to those of Census Tract 217 as defined by the U.S. Bureau of the Census. Population and socio-economic data for Census Tract 217 (South Kohala) is used in this section to give an overall picture of the existing characteristics of the region.[33]

1. Population and Housing Characteristics

Existing Conditions

The South Kohala district has grown rapidly in the past twenty years. From 1970 to 1980 the population increased by 99.4 percent, the third fastest-growing district on the island and at a rate twice that of the county's growth of 45 percent. South Kohala had the second highest increase in resident population in Hawaii County during the 1980's, 98.4 percent. The resident population increased from 4,607 in 1980 to 9,140 in 1990. Much of this increase in population was attributed to the development of three major resorts along the Kohala Coast. The county's growth rate in the 1980's was 30.7 percent, with a 1990 population of 120,317.

South Kohala encompasses the high plains area of the Kohala mountain foothills, extending down to the dry coastal region which includes the small residential communities of Kawaihae Village,

[33] All data, unless otherwise noted, is based on the U.S. Bureau of the Census, 1990 Census of Population and Housing, Census Tracts, Hawaii.

Puako, and Waikoloa Village. South Kohala is dominated by the Parker Ranch, which creates a ranching lifestyle that is still evident in the area, especially in the town of Waimea. The basic population and commercial center within the South Kohala district is Waimea where a variety of small businesses serve the local population.

The median age in South Kohala (32 years) is consistent with that of the island as a whole (34 years); however only 7.4 percent of South Kohala's residents are 65 years or older, compared to 12.5 percent island-wide. South Kohala and the county have an average household size of 2.9 persons. The median value of owner-occupied homes and rents paid are nearly twice as high in South Kohala as they are island-wide, however. South Kohala's rental vacancy rate (percent) is 21.7 compared with the county's rate of 10.4.

While the same four ethnic groups make up about 90 percent of the population both in South Kohala and island-wide, there is a greater proportion of Caucasians and Hawaiians in South Kohala, and fewer Japanese and Filipinos.

	South Kohala	Hawaii County
Caucasian	49%	40%
Hawaiian	24%	19%
Japanese	10%	21%
Filipino	7%	13%

Although the population of the South Kohala district is relatively high, population in the Kawaihae area is low (about 150 people) according to the 1985 Kawaihae Development Plan. There are no major residential developments in the vicinity of the KCP study area. Within the study area there are four Hawaiian homestead housing units, and there is one private residential lot adjacent to the study area.

Potential Impacts

The proposed project is not expected to significantly impact the existing housing stock and population level in the area. Construction

personnel's need for housing will have a negligible impact on local communities and may, through the collection of rent, benefit the local economy. The majority of the 90 to 110 daily construction workers will be residents of Hawaii County. However, if skilled workers for specialized tasks are not available on the island, they will be brought in from outside Hawaii, and will make their own arrangements for housing. Because they will be residing on Hawaii for a relatively short time, it is likely that they would rent quarters rather than build or buy housing.

The power plant and desalination plant will have an operational employment of 20 to 25 people. It is expected that all, or almost all, needed labor and skills to operate the plant is available on the Big Island or in the State.

The project is likely to cause displacement and relocation of between one and four Hawaiian Homestead lessees on parcels along Kawaihae Road, depending on the specific project site within the study area. All relocation procedures will be handled by the Department of Hawaiian Home Lands.

2. Economic Characteristics

Existing Conditions

Tourism and agriculture are Hawaii County's main industries. Largely during the last decade, the island's economy has been undergoing a transition from agriculture to tourism, particularly in West Hawaii where the Kona and South Kohala coasts have almost all the County's hotel room inventory. Ranching continues to be a dominant factor shaping the physical character of the area, but tourism has surpassed cattle operations as the leading economic activity during the 1980's.[34]

During the economic growth in the 1980s, the island underwent rapid build-up of its visitor industry accommodations inventory, golf courses, agricultural operations, and residential and commercial real estate.

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[34]Belt Collins & Associates for Mauna Kea Properties, Inc., Final EIS, South Kohala Resort, December 1987.

Upon entering the 1990s, the county's booming economy began to show signs of a slowdown as the island felt the combined effects of the national recession, faltering Japanese economy, and the Persian Gulf War in 1990.

Particularly hard hit have been the island's two largest industries: tourism and agriculture. Unemployment jumped to 9.1 percent in mid 1992, far exceeding the statewide average of 4.8 percent. Bankruptcy filing increased by 116 percent in the first six months of 1992, and construction activity dropped by approximately 25 percent, compared to the same period in 1991.[35]

Kawaihae Harbor, the only deep draft harbor in West Hawaii, is an economic factor in the region. In 1985, the harbor handled over 732,000 tons of non-military cargo. The current phase of the harbor expansion has been completed to accommodate the growing number of commodities being shipped directly to West Hawaii rather than shipped and trucked via Hilo. Projections indicate that Matson container activity at Kawaihae will triple with no corresponding decrease in container activity in Hilo.[36]

Kawaihae also has anchorage for small recreational boats. Construction of a harbor for light-draft vessels adjacent to Kawaihae Harbor on the south side is planned to meet the need for increased commercial vessels, such as charter fishing boats, to be located in the vicinity of the increase in tourist facilities.

The West Hawaii Regional Plan recognizes that harbors not only provide a significant employment base, but also act as a catalyst to ancillary activities that may be developed around the harbor.

The labor force profile in South Kohala differs in some respects from that of the county, as shown on the table below. Most notably, the

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[35]Hill & Knowlton/Communications-Pacific, Inc., Letter report to Waimana Enterprises, September 1992.

[36]State of Hawaii, Office of State Planning, West Hawaii Regional Plan, November 1989.

area has fewer eligible people in the labor force, a higher percent of high school graduates, a higher unemployment rate, and a higher median income. A greater percent of the South Kohala labor force have service occupations (24%) and executive, administrative, and managerial occupations (15%) than is typical for the County (15% and 10% respectively).

	South Kohala	Hawaii County
% Persons 16 years & over in Labor Force	64%	74%
% High School Graduate	88%	78%
% Civilian Labor Force Unemployed	4.6%	2.8%
Median Household Income	$39,900	$29,700

There is no employment associated with the study area.

Potential Impacts

The immediate and long term impacts of the project on the state and local economies will be positive. The immediate benefit would be the infusion of capital and provision of 90 to 110 daily temporary construction jobs in the region. To the extent possible, materials would be purchased in Hawaii. Specialized equipment such as the CTGs, HRSGs, STG, R.O. units, and desalination plant will have to be purchased out of state. The major portion of the labor and services required would be provided from within the State and County. These expenditures would provide tax revenues to the County, State and Federal governments. The direct expenditures, particularly wages and salaries, would also generate an increased demand for goods and services from construction workers and suppliers.

Development of the KCP cogeneration plant is expected to generate additional direct employment to operate the new facilities. The power plant is expected to have 18 full-time operational positions and the

desalination plant, 5 full-time positions. The direct operational positions would also indirectly generate employment beyond the project site.

The KCP project would have a long-term positive impact on personal income for residents of the island and state through employee wages, salaries and benefits, and income to business proprietors. The dispersion of indirect and induced employment effects among many industries increases the income benefits of the project.

The proposed project is expected to generate positive fiscal benefits for the County of Hawaii and State of Hawaii. The project would necessitate minimal expenditures of state and county public resources (maintenance on highways, public safety, recreational facilities, etc.), County government revenues would be principally in the form of real property taxes on the developed acreage and new facilities. New revenue to the state government would primarily be generated by the four percent general excise tax on power and water sold, and taxes paid by in-migrant employees.

Use of Kawaihae Harbor for fuel deliveries results in shorter barge travel and reduced trucking distances, which result in lower fuel costs.

KCP's project will socially and economically benefit the DHHL and the Hawaiian community. The development of the project within the industrial-designated area on DHHL's Ten-Year Master Plan will provide an anchor industrial development, and encourage additional tenants. Growth in this area will provide needed revenues to DHHL for the development of infrastructure improvements required before residential lots on the Kawaihae land can be available to eligible Hawaiians.

Over the long-term, the project will provide social and economic benefits to the community and the county by providing 58 MW of additional generating capacity and 2.6 million gallons per day of potable water. These benefits are further discussed in section C of this chapter.

C. PUBLIC FACILITIES AND SERVICES

1. Power and Communication

Existing Conditions

Existing 69 kV and 12 kV electrical overhead lines and structures and telephone lines are located along Kawaihae Road and Akoni Pule Highway from Kawaihae to Kohala Ranch. The section of Akoni Pule Highway from Kohala Ranch to Mahukona is not currently serviced by HELCO. The area north of Mahukona is serviced by HELCO's lines along Kohala Mountain Road, via Hawi. The electrical system in the Kohala region is connected to the windward side of the island of Hawaii by 138 kV and 69 kV lines that run across the saddle between Mauna Kea and Mauna Loa. The closest electrical substation is located at Kohala Estates and the nearest telephone switching station is in Kawaihae.

HELCO's electrical power generating stations near the area are the Waimea Power Plant, Keahole Power Plant, and Lalamilo windfarms. Currently, HELCO is experiencing some significant problems in supplying the average daily island-wide energy demand of approximately 157 megawatts. Numerous power outages have occurred on the island as a result of HELCO's low margin of reserve generating capacity and aging plant equipment.[37]

Potential Impacts

HELCO's forecasts show peak demand increasing by four to five percent annually, with a 1997 peak demand of 184 MW (34 MW greater than the 1992 demand).[38] Between 1990 and 1994, more than half of HELCO's forecasted demand is expected to occur in the West Hawaii area. At the same time, HELCO's Resource Plan calls for the scheduled retirement of older generating units producing about 20

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[37]Between July 1991 and July 31, 1992, HELCO scheduled 22 rolling blackouts. An undetermined number of unscheduled blackouts have also plagued the island. (Hill and Knowlton.) HELCO experienced three power outages within one week in May 1993. (Honolulu Advertiser/Star Bulletin, March - May 1993).

[38]HELCO Forecast Planning Committee, Forecast of Sales, Peak and SLT 1993-1998, March 1, 1993.

MW of power by 1997.[39] The possible loss of 10 MW from Hamakua Sugar Company is an unplanned loss of power, and Hilo Coast Processing Company, which sells 18 MW of power to HELCO, is scheduled to close in two years.

Puna Geothermal Venture recently became a provider of 25 MW of firm capacity to HELCO's system. HELCO has plans for two 20-MW simple cycle combustion turbines at Keahole, one in 1994 and the other in 1995.

Despite HELCO's forecasted power facility additions, the rapid growth in West Hawaii and the planned and unplanned losses of power facilities indicate a strong demand for additional generating sources on the Island of Hawaii, particularly in West Hawaii by 1997. The West Hawaii Site Study, prepared for HELCO in 1988, identified two Kawaihae sites as most suitable (out of 22 candidate sites) for a power plant facility, considering land use, environmental impacts, costs, operational issues, and site development constraints. The Kawaihae Cogeneration Power Plant will be on line in late 1996, capable of providing an additional 58 MW to meet projected demand for electrical service and also to allow for HELCO to retire their aging and inefficient generating units.

Other positive impacts of the project include an increase in overall system reliability, the ability to replace generation facilities scheduled for retirement, and lower electrical rates by offering to sell power to HELCO at below its own production cost.

2. Transportation

Existing Conditions

Kawaihae Road and Akoni Pule Highway are the major roadways serving the study area and population centers along the rural coast north of Kawaihae. (Refer to Exhibits III-1, 2, and 3.) Both roads are State two-lane highways. The low level of development within South and North Kohala result in comparatively light to moderate traffic

[39]HELCO, Draft EIS, Volume I, Keahole Generating Station Expansion, December 1992, p. 1-4.

volume on most roadways. Harbor activities contribute significantly to the truck activity on the roadways.

Kawaihae Road (Route 19) runs between Waimea and Kawaihae in the east-west direction. This two-way, two-lane minor arterial has a 22 foot pavement width and intersects with the south end of Akoni Pule Highway, and the north end of Queen Kaahumanu Highway in the Kawaihae region. The capacity of Kawaihae Road has been estimated at 2,140 vehicles per hour (vph) total for both directions.[40] Kawaihae Road has a posted speed limit of 45 mph.

Akoni Pule Highway (Route 270) is a two-lane, two-way arterial that runs from Kawaihae to Hawi to the north. It has 12-foot lanes and full shoulders giving it an estimated capacity of 2,430 vph total for both directions.

Queen Kaahumanu Highway (Route 19) is a two-lane, two-way major arterial between Kawaihae and Kona, providing access to major resorts. The posted speed limit is 55 mph along most sections of the road. Existing weekday peak hour traffic volume are relatively low with peak hour volume typically ranging between 200 to 500 vehicles in each travel direction on the major roadways in the area.

At present, there is no traffic signal-controlled intersection in the vicinity of the project. Major intersections with stop sign controls include the Kawaihae Road intersections with Queen Kaahumanu Highway and Akoni Pule Highway. Kawaihae Road is the through route at each intersection.

The State Department of Transportation (DOT) had developed plans for a bypass road around Kawaihae, connected with plans for a bypass road around Waimea. More recently, the Final Report, Island of Hawaii Long Range Highway Plan, published in May 1991, identified highway segments that need improvement to adequately serve traffic

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[40]The Traffic Management Consultant, Traffic Assessment Report for the Kohala Ranch Project IV, October 1990.

demand. The construction of the proposed Kawaihae Bypass Road between Waimea and Kawaihae is recommended for implementation in the period 2000-2005. A new two-lane highway bypassing the Kawaihae Wharf area is also recommended.

Master plan studies commissioned by DHHL for their Kawaihae Ten - Year Master Plan in early 1990 indicated a need for a new four- to-six lane bypass road with 150-foot right-of-way that will route traffic away from Kawaihae Harbor. The purpose is to serve as a land use boundary separating the harbor and planned industrial activities from the planned residential community. The proposed alignment is adjacent to the mauka boundary of the master plan's 122-acre industrial area and the KCP study area for this environmental assessment. The DHHL alignment deviates significantly from the previously proposed DOT alignment to avoid a high concentration of archaeological sites.

Kawaihae Harbor is the only deep draft harbor in West Hawaii. It is used primarily by interisland barges and is used periodically by the military. Cargo handled includes building materials, consumer goods, large equipment and machinery, agricultural goods, as well as provisions and supplies needed to operate hotels and resorts in South Kohala and Kona.

Potential Impacts

Construction-related vehicles will create short-term impacts on traffic conditions along Kawaihae Road and Queen Kaahumanu Highway between Waimea and Kona, respectively. The number of vehicles used to transport workers and materials between the site and local supply sources is expected to have an insignificant impact on traffic flow. The majority of construction equipment and materials will arrive at the Kawaihae Harbor, and be transported less than 2,000 feet along Kawaihae Road to the construction site. Construction-related traffic will be limited to weekday daylight hours except for possible overtime or additional shifts. Slow moving, large transport vehicles will be required to carry large and heavy materials, and special arrangements will be made to insure that their delivery does not

unnecessarily disrupt traffic. Increased traffic resulting from the project will not generally be noticeable along the major State highways.

Operational traffic impacts will be limited to the slight increase in employee traffic on the roads serving the site. The maximum number of employees at the project would be around twelve, during the day shift.

Recognizing the heavy increase in flow of goods and problems with existing facilities at Kawaihae Harbor, the State DOT is expanding the harbor to accommodate the growing number of commodities being shipped directly to West Hawaii rather than shipped and trucked via Hilo. The harbor expansion includes enlargement of the barge terminal backup area, dredging of the barge terminal berth, paving the container yard area, and extending the overseas pier.[41] The current phase of harbor expansion has been completed. There are also plans for a small boat harbor adjacent to Kawaihae Harbor on the south side.

The existing and expanded facilities are adequate to handle the additional harbor traffic and use resulting from project construction as well as the bi-monthly delivery of fuel oil by barge or tanker during plant operation. All arrivals will be scheduled with the Harbor Master as required by the Department of Transportation. By using Kawaihae Harbor for fuel delivery, the project eliminates the potential traffic impacts associated with approximately 12 fuel trucks per day on the region's highways.[42]

3. Water

Existing Conditions

There is an existing 8-inch county water main along Kawaihae Road which is operating at capacity. Population trends in the Waimea area

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[41]RMTC, Final EIS, Kawaihae Ten-Year Master Plan, December 1992.

[42]HELCO, Draft EIS, Volume I, Keahole Generating Station Expansion, December 1992, p. 1-4.

indicate that the existing source of water is inadequate to meet the future demand. The County Water Supply Department is limiting water use to 600 gallons per day per lot of record, with a maximum 5/8 inch meter. The Kohala Ranch, north of and adjacent to the DHHL property, has developed their own private water system which includes wells, reservoirs, and a distribution system.

The 1,600-foot elevation has been determined through previous well drilling activities in the region to be the elevation at which limited quantities of potable quality water can be obtained. Wells below this elevation are likely to produce brackish water with high chloride content. The KCP study area is below 250 feet elevation.

The county recognizes an increased need to develop additional water sources to supply the support communities associated with the resort development proposed in West Hawaii. The estimated number of housing units under the "maximum build-out" scenario could result in a demand for an additional 23 million gallons per day (mgd) of potable water.[43]

Potential Impacts

The cogeneration facility will have a positive impact on potable water supply in West Hawaii. Two point six (2.6) mgd of potable water will be made available for the DHHL to be used for their Ten Year Master Plan. KCP is also looking into other potential users such as the County and nearby private landowners. The project demand for potable water is expected to be 3,000 gallons per day. Potable water use will be limited to domestic uses within the facility. KCP will utilize a combination of water from the project's reverse osmosis units and county water.

4. Sanitary Wastewater

Existing Conditions

Presently there are no municipal sewage systems or sewage treatment facilities in the area. Residential development in the region relies

[43]State of Hawaii, Office of State Planning, West Hawaii Regional Plan, November 1989.

primarily on private septic tanks, cesspools, or private sewage treatment plants. The nearest municipal wastewater treatment facility for the West Hawaii Region is located at Kealakehe in North Kona.

The State Department of Health has identified "Critical Wastewater Disposal Areas" on the Big Island, within which cesspools are not allowed, however septic tanks are allowed on lots greater than 10,000 square feet. The "Critical" zone in the Kawaihae region includes lands less than 1,000 feet from the shoreline or less than 100-foot elevation, whichever is greater. Most of the DHHL lots along Kawaihae Road are in the Critical zone, and the portion of the study area above 100-feet elevation is in the Non-Critical zone.

Potential Impacts

Sanitary wastewater disposal on the project site will be through a septic system which will be installed, maintained, and disposed of in accordance with DOH and EPA regulations. A septic system is allowed anywhere within the study area. The 3,000 gallons per day of wastewater generated by the project will have an insignificant effect on the municipal treatment plant to which it is transported after partial treatment in the septic tank. Once DHHL builds a treatment facility as part of their master planned development, the power plant may either connect to the DHHL sewage system or continue using the septic system and pump into the DHHL treatment plant. In this case, the municipal treatment plant would no longer be impacted.

5. Solid Waste

Existing Conditions

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 Airport, 22 miles south of Kawaihae. 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.

Potential Impacts

Refuge collection and disposal will be privately handled by the cogeneration facility operator in conformance with governmental regulations. There will be no impact to County collection operations.

6. Drainage

Existing Conditions

Under existing conditions, natural runoff from seasonal rainfall percolates the surface soils which are highly permeable and well drained. Additional surface runoff that occurs during storm events flows overland towards the well-defined drainage paths which eventually discharge the runoff into Kawaihae Bay. The majority of precipitation falling on the site either infiltrates immediately or moves towards and through the drainage paths. Due to low rainfall, drainageways and gulches experience only intermittent flow.

There are no existing drainage structures on the study area. Existing culverts under Kawaihae Road at Palihae Gulch and the unnamed gulch, just north of the Blue Dolphin restaurant, provide for the storm water runoff to leave the site and discharge into an existing culvert along the makai side of Kawaihae Road and then into the Class A coastal waters of the harbor.

Potential Impacts

The development of less than 15 acres for the proposed power plant project and ancillary facilities will increase the amount of surface runoff. The project-related drainage improvements will be designed to intercept on-site surface runoff and direct it into drywells, major gulches, and/or existing culverts, as necessary to prevent any increase in storm runoff and sedimentation to the harbor. Drywells will be constructed and operated in accordance with the Department of Health's UIC regulations. No surface runoff will be allowed onto the adjacent Kawaihae Road.

7. Schools, Medical, and Recreational Facilities

Existing Conditions

The Kawaihae area is served by three public schools: Waimea

Elementary, Waimea Intermediate, and Honokaa High School. Two private schools, Hawaii Preparatory Academy (grades 1 through 12) and the Parker School (grades 8 through 12) are located in Waimea.

The Kohala area is served by two state-operated hospitals, the Kohala Hospital located in Kapa'au in North Kohala and the Kona Hospital (in Kealakekua). The Kona Hospital is a "full-service" health care facility. In Waimea, the private Lucy Henriques Medical Center provides outpatient health care.

The two major public recreation areas are Hapuna Beach State Recreation Area, five miles south of Kawaihae; and Spencer Beach Park, near Kawaihae Harbor. The National Park Service officially opened a national park at the Pu'ukohola Heiau National Historic Site in July 1974. The site contains two major heiaus near Kawaihae and also includes the site of a house used by John Young, who was made a full chief by King Kamehameha, and who was governor of the Island of Hawaii from 1802 to 1812. Kawaihae Harbor and ramp allow boat launching facilities and serve recreational and commercial sport fishing activities.

Potential Impacts

Minor increases in demands on public facilities or services such as schools, health care, or parks during construction and operation is expected to be minimal since it is likely that most workers will be Big Island residents. Any imported workers during construction will be on the project for a short time and would probably not relocate their families to the island. The capacity of public services on Hawaii appears to be adequate to accommodate any increase resulting from the project construction.

8. Police and Fire Protection

The Kawaihae region is served by the Waimea Police Station, about 10 miles away. At present, the staff includes 22 officers with plans to increase staff by five additional patrol positions within the next two years. Currently, the Waimea Station averages three to four police officers per shift. Under normal conditions, where officers are

available, response time is 10 to 15 minutes to the Kawaihae community.

The South Kohala Fire Station, located near the Mauna Lani Hotel (8-9 miles from the site on Queen Kaahumanu Highway), provides fire protection to the area with their fire engine and water tanker. Backup support to Kawaihae would come from the North Kohala and Waimea stations. South Kohala Station also provides advanced life support ambulance unit services.

Potential Impacts

The study area will be fenced and protected by a private security system. The project will provide 200,000 gallons of protected water storage for fire protection, in accordance with County standards. The fuel oil storage tank will be within a bermed containment area which will contain any potential fuel fire. "AFFF" protein foam is used to smother fuel fires, as water is not effective. The project facility will be designed with fire prevention in mind, and adequate fire-fighting equipment and materials will be stored on-site, recognizing the limitations of the local fire department in terms of specialized equipment. Police and fire protection services would not be significantly affected by project.

V. ALTERNATIVES

The proposed project has been designed to meet two objectives. The first objective is to meet the need for additional power generation identified by HELCO. A 58 MW, dual train combined cycle with selected catalytic reduction in Kawaihae best meets HELCO's needs for a clean, economic, reliable source of electricity with maximum dispatchable flexibility, located on the West side of the island and which can be completed in 1996.

The second objective of the project is to provide benefits to Native Hawaiians. Coupling the 58MW, dual train combined cycle with a desalination plant and locating the project on leased DHHL lands in Kawaihae best meets DHHL's needs for a secure source of water, significant lease revenues and job creation to support their Master Plan for Kawaihae.

The project will increase the island's electrical system reliability and reduce the likelyhood of renewed rolling blackouts. The project will also assist DHHL in completion of its Kawaihae Master Plan by providing water, revenues and employment for Native Hawaiians. Currently, DHHL does not have any water available to develop Kawaihae. The lease revenues from this project will increase by 25% the total annual lease revenues collected by DHHL throughout the State. This project will provide a limited number of job opportunities, however, the project will provide the needed infrastructure for the continued development of DHHL's industrial area which will create numerous other job opportunities for Native Hawaiians.

There are no other alternatives that will feasibly meet the objectives of this project.

VI. PERMITS/APPROVALS

The following is a list of permits and approvals that are applicable to the project:

FEDERAL:

Permit	Agency	Requirement[44]
Prevention of Significant Deterioration of Air Quality (PSD)	U.S. Environmental Protection Agency Regional IX	R
Qualifying Facility (QF) under Public Utility Policy Act (PURPA)	Federal Energy Regulatory Commission (FERC)	R
Native American Grave Protection and Repatriation Act	Department of the Interior, Parks Service Division	R
Notice to Alter Navigable Airspace	Federal Aviation Administration	R

STATE:

Environmental Impact Statement, State of Hawaii	State Department of Hawaiian Home Lands	R
Authority to Construct and Permit to Operate	Department of Health	R
Prevention of Significant Deterioration (PSD)	Department of Health	R

[44]"R" indicates it is a Required Permit
"P" indicates it is being reviewed by appropriate agency

STATE (continued):

Permit	Agency	Requirement
National Pollutant Discharge Elimination System (NPDES)	Department of Health	R
Well Construction Permit	Commission of Water Resource Management	P
Pump Installation/ Groundwater Use Permit	Commission of Water Resource Management	P
Underground Injection Control Permit (UIC)	Department of Health	R
Coastal Zone Management Program Federal Consistency Determination	Office of State Planning	P
Permit to Exceed Allowable Noise Levels	Department of Health	R
Permit to Perform Work on a State Highway	Department of Transportation	R
Drinking Water Approval	Department of Health	P
Power Purchase Agreement Interconnection Agreement Approval	Public Utilities Commission	R

HAWAII COUNTY:

Permit	Agency	Requirement
Special Management Area Use Permit	Planning Commission & Planning Department	P
Grading, Grubbing, Excavation, and Stockpiling Permits	Department of Public Works	P
Building Permit	Department of Public Works	P
Plan Approval	Department of Public Works	P
Building Plan Approval (Fire)	Hawaii County Fire Department	P

VII. CONCLUSION

The KCP cogeneration facility will provide immediate and long term benefits to the State and local economies. The immediate benefit is the infusion of capital and provision of 90 to 110 daily construction jobs in the region, and for the long-term, twenty three full-time operational positions. This direct employment will also generate indirect employment beyond the project. In addition, project-related expenditures will provide tax revenues to the County, State and Federal governments. These expenditures will also create indirect and induced economic benefits throughout the State.

Power from the project will be sold to HELCO. This will benefit HELCO and residents of the Big island by providing additional capacity to meet projected demand for electrical service, developing generation capacity near the area of demand, and increasing overall system reliability.

The desalination plant associated with the project will produce 2.6 million gallons per day of potable water in West Hawaii where the existing sources of water are inadequate to meet the future demand. The water will be made available to the DHHL to use for their Master Plan. Additional benefits to DHHL and Native Hawaiian Beneficiaries will be derived by the income generated from lease revenues.

The proposed project will have no significant adverse effects on groundwater resources, marine environment, flora, fauna, archaeological resources, or public facilities and services. The project is compatible with the surrounding industrial land use of the harbor, and DHHL's designated industrial land use for the study area. The project will likely be visible from various vantage points in the region. However, distant views of the site from Queen Kaahumanu Highway and coastal recreational and resort areas are dominated by the contrasting visual impacts of the harbor facilities and land scarification.

During the construction period there may be temporary and localized increased levels of dust and vehicle exhaust emissions and adverse noise impacts. However, all potential impacts will be monitored to comply with Department of Health regulations and limits.

The KCP plant qualifies as a new major stationary source of pollutants based on the Clean Air Act. The project is subject to the extensive PSD review process which includes collecting one year of weather data, six months of air pollutant data, and an air quality impact analysis. In addition to the requirements of the PSD process, the project must obtain an Authority to Construct and a Permit to Operate from DOH. The 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. As a result, no adverse air quality impacts should result from the project.

The impacts resulting from the construction and operation of this facility will be fully disclosed during public hearings and applications required to obtain the numerous permits and licenses that will be needed to complete development of this project.

VIII. AGENCIES CONSULTED IN PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

A. FEDERAL

Army Corps of Engineers
Department of the Interior, National Park Service
Environmental Protection Agency
Federal Aviation Administration
Federal Energy Regulatory Commission

B. STATE

Department of Hawaiian Home Lands
Department of Health
- Clean Water Branch
- Drinking Water Branch
- Environmental Management Division

Department of Land and Natural Resources
- Aquatic Resources Division
- Land Management Division
- State Parks and Historic Sites Division
- Water and Land Development Division
- Water Resource Management Commission

Department of Transportation
- Harbors Division
- Highways Division

Department of Business, Economic Development & Tourism

C. COUNTY OF HAWAII

Department of Parks and Recreation
Department of Public Works
Department of Water

COUNTY OF HAWAII

Fire Department
Planning Department
Police Department

D. OTHER

Hawaii Electric Light Company, Inc.
Hawaiian Telephone Company
Queen Emma Foundation

APPENDIX A

COMMENT LETTERS AND RESPONSES

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

RECEIVED
AUG 19 1993
Ans'd.....

REPLY TO
ATTENTION OF:

August 18, 1993

Planning Division

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the Kawaihae Cogeneration Project, Kawaihae, Hawaii (TMK 6-1: 1, 2, 3). 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. Drainage improvements associated with the project may involve work in waters of the U.S.; therefore, a DA permit may be required. Drainage plans should be coordinated with our Operations Division to determine DA permit requirements. You may contact them at 438-8552 for further information and refer to file number PO93-077.

b. According to the enclosed Federal Emergency Management Agency's Flood Insurance Rate Map, panel number 155166-0137C dated September 16, 1988, the project site is located in Zone X (unshaded; areas determined to be outside the 500-year flood plain) and Zone X (shaded; areas inundated by the 500-year flood). Should you require additional information regarding the flood hazard designations, please contact Ms. Jessie Dobinchick of our Planning Division at 438-7008.

Sincerely,

Kisuk Cheung, P.E.
Director of Engineering

Enclosure

CORRECTION

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

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

August 18, 1993

REPLY TO
ATTENTION OF:

Planning Division

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

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Sincerely,

Kisuk Cheung, P.E.
Director of Engineering

Enclosure

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A — No base flood elevations determined.

ZONE AE — Base flood elevations determined.

ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X — Areas determined to be outside 500-year flood plain.

ZONE D — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet*

(D) — Cross Section Line

(EL 987) — Base Flood Elevation in Feet where Uniform Within Zone*

RM7X — Elevation Reference Mark

•M20 — Coastline Mar

*referenced to the National Geodetic Vertical Datum of 1929

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

HAWAII COUNTY, HAWAII

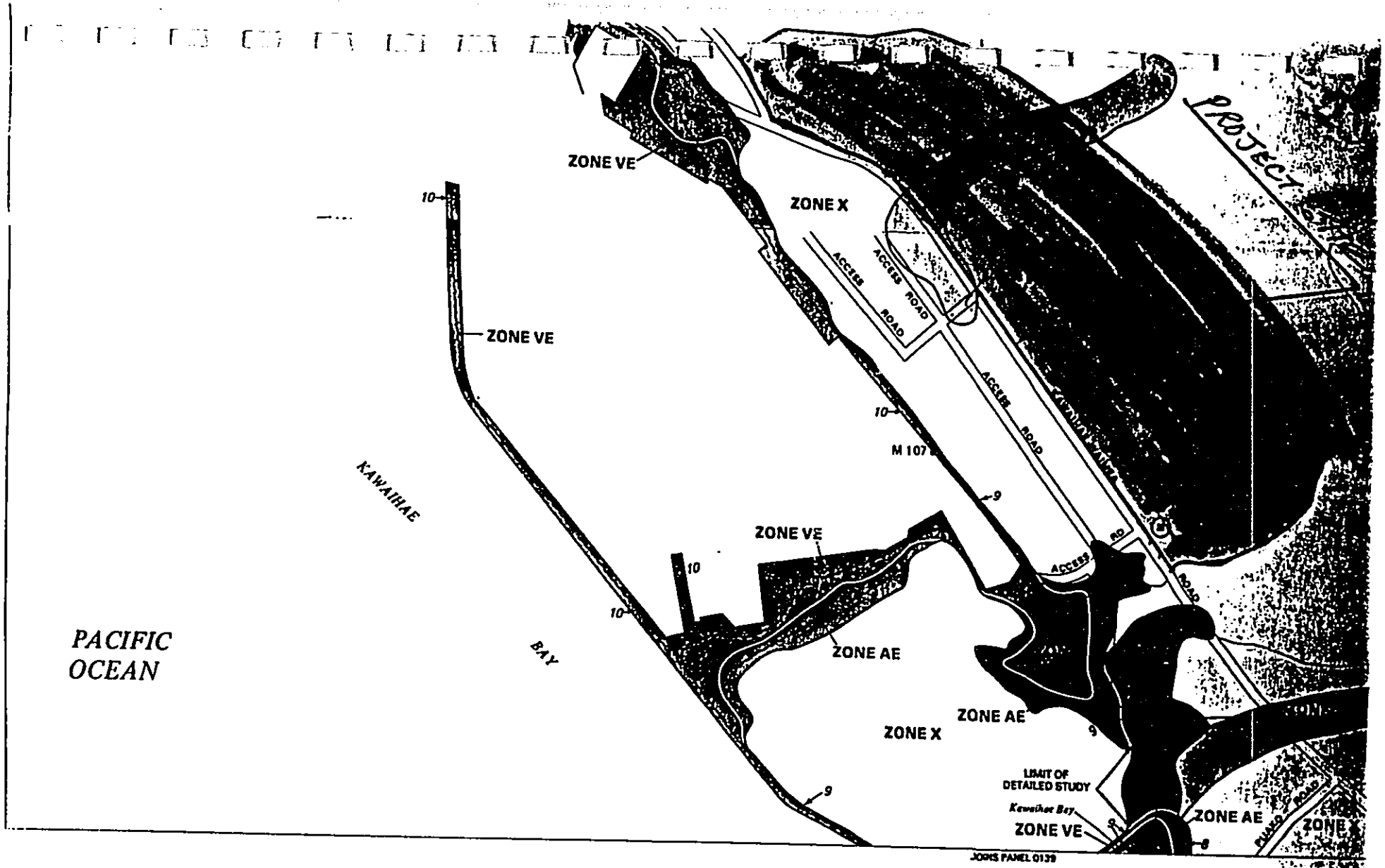
PANEL 137 OF 1900
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
155166 0137 C

MAP REVISED:
SEPTEMBER 16, 1988

Federal Emergency Management Agency

CUSTOMER COPY



Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

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

Dear Mr. Cheung,

Thank you for your review of the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We are is in the process of determining the requirements for all permits that will be applicable to the projection which will include any permits required for work in waters of the U.S.. The Department of the Army will be consulted during the final design phase of the drainage plans.

Sincerely,

Rodney Kaulupali

ealetter1

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

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

August 23, 1993
EA:00028

Department of Hawaiian Home Lands
Attention: Linda Chinn
335 Merchant Street
Honolulu, Hawaii 96813

Dear Ms. Chinn:

Draft Environmental Assessment
Kawaihae Cogeneration Plant
South Kohala, Hawaii

The Kawaihae Cogeneration Plant project involves the development of a cogeneration power plant and appurtenant desalination facility on Department of Hawaiian Home Lands (DHHL) in Kawaihae, on the Big Island. The power plant will provide up to 58 megawatts of electical power and up to 2.6 mgd of potable water. The facility will be placed on a 40 acre parcel somewhere within a 122 acre area designated for industrial use in the DHHL master plan for Kawaihae, however, no specific site has been identified yet.

Our review was prepared with the assistance of George Curtis, UH Hilo; and James Morrow, Public Health.

Major components of the facility will include two combustion turbines and a steam generator. Stack heights will be somewhere between 50 and 150 feet with a diameter of about 8 feet. The plant will fire approximately 86,000 gal/day of No. 2 diesel fuel oil. Two fuel storage tanks of 1.3 million gallon capacity will be constructed on the site.

Because of its size and emissions, the proposed power plant is by definition a "major source" and thus subject to Prevention of Significant Deterioration (PSD) requirements under the federal Clean air Act regulation (40 CFR 52.21). As noted in the Draft EA (p. 53) its emissions of NO2, SO2, CO, and particulate matter all exceed the "significance" levels specified in 40 CFR 52.21.

General Comments

We note that the announcement of the availability of this EA for review was published in the OEQC Bulletin as a Draft Environmental Assessment of an action wherein "A negative declaration determination is anticipated...."

Given the size of the proposed facility and its potential to generate significant air emissions, visual impacts, noise, and impacts to cultural sites and adjacent parcels, the conclusion that there would be no significant impact and thus no need for an EIS is both inappropriate and unsubstantiated. Under federal Clean Air Act regulations the facility is considered a "major" source and its emissions are considered "significant". Under Chapter 343, HRS and its EIS Regulations, an EIS is required for any action which MAY (emphasis added) have a significant effect. The significance criteria in Chapter 11-200 specifically mention air impacts, and this facility will clearly impact local air quality.

Specific Comments

Air Quality. The argument stated in the Draft EA that no adverse air quality impacts would result from the project because of the existing state and federal permitting requirements is false. If that were the case then one could also maintain that an EIS should not be necessary for any new air pollution source that must go through state or federal permitting. This is simply not the case either locally or nationally. EIS's are routinely required for such sources so as to more fully define potential impacts and mitigative measures.

In the Kawaihae Cogeneration Plant case, the plant will be constructed in an area of virtually pristine air quality. Because existing pollutant levels are so low, emissions from the proposed plant might, for example, cause a multi-fold increase in pollutant levels yet still comply with air standards and still get permitted. However, such a large change in air quality must be considered "significant". Sources going through permitting and demonstrating compliance with various emissions and ambient air quality standards may still cause a "significant" change in local air quality and thus should undergo the full disclosure of a Chapter 343 EIS. As recognized by the development of the PSD regulations, significance of impact can not be equated to compliance with standards especially in areas of largely pristine air quality such as Hawaii. If existing air pollutant levels are close to zero, then any action or new facility that substantively raises those pollutant levels would have a "significant" impact.

Cummulative Impacts. There is no discussion of the relationship between this new cogeneration plant and the proposed expansion of electrical generating facilities at Keahole (EIS, June, 1993); the proposed new Hawaiian Electric generating plant, West Hawaii Power Facility (EIS, June, 1993); or, the integration and expansion of geothermal power. In accordance with the EIS regulations, cummulative effects of the proposed action must be addressed in the EA.

Fuel Supply. The Draft EA (p. 19) briefly describes the fuel needs and transportation requirements for the power plant. There is no indication of the physical characteristics of the piping and storage tanks that are proposed nor is their any discussion of the docking and offloading

facilities for fuel at the harbor. Given the potential risk to the environment posed by fuel leaks either from tankers, storage tanks, or pipelines, a discussion of the systems being considered for off-loading, transport and storage should be discussed in the EIS.

Injection Wells. Wastewater and brines are proposed to be discharged into injection wells. Has consideration of either the potential for contamination of coastal waters or possible clogging been considered?

Desalination Plant. There is almost no discussion of the physical description of the desalination plant or its operation. Since this is a major component of this project it should be assessed and evaluated accordingly.

Groundwater. The EA mentions that some 10.4 mgd of groundwater will be used. What effects will this have on the aquifer? Is the aquifer currently used for any other purposes? Can this rate of extraction be maintained without significantly altering the composition of the aquifer?

Conclusions. Given the magnitude of this project and its potential impacts a full Environmental Impact Statement should be required. This EIS should evaluate all aspects of the development of another power generation facility in West Hawaii, the cummulative effects of its development particularly in relation to other proposed and existing power generation facilities, the desalination plant, and the potential impacts to the natural and physical environment that are likely to result from these two projects.

We appreciate the opportunity to comment on this Environmental Assessment.

Sincerely,

Jacquelin N. Miller

Jacquelin N. Miller
Associate Environmental Coordinator

cc: OEQC
Kawaihae Cogeneration Partners
DHM, Inc.
Roger Fujioka
George Curtis
James Morrow

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 24, 1993

Ms. Jacquelin N. Miller
Associate Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
A Unit of Water Resources Research Center
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller,

Thank you for your review and comments on the Environment Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

1. Plant emissions are regulated by the Department of Health through the permit for Prevention of Significant Deterioration (PSD). It was determined that the project will be subject to the PSD permit process. The criteria was established by the Clean Air Act and implemented by Federal and State agencies. Maximum project emissions must be maintained below the levels set by federal and state regulations or the project will not be allowed. The maximum allowable levels of emissions are designed to protect public health and welfare and to prevent the significant deterioration of air quality with an adequate margin of safety thereby minimizing impact to the environment. If the project exceeds the allowable levels the PSD permit and the project will not be approved for operation.

   Most of the power plants currently in operation were constructed before Chapter 343 of the HRS was enacted and were not subject to the EIS process. However, an example of a major power plant facility constructed after the enactment of Chapter 343 and which received a negative declaration is the expansion of Maui Electric's Maalaea Power Generation Facility in March, 1988. The Maui Planning Commission determined the project would not have a significant impact on the environment and an EIS would not be required. The project involved increasing the number of diesel generators by at least 8 more units adding 100 MW of new generating capacity. The facility expansion also includes two 56 MW combined cycle units one of which came on line in October 1993 and the other which is currently before the PUC for approval. Each of MECO's combined cycle units are similar to the unit being proposed for

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

Kawaihae. More recently, on Oahu the Kalaeloa Cogeneration Power Plant, a 180 MW oil fired combustion turbine plant, was constructed without an EIS. Unless a project triggers one of eight specific conditions as set forth in the Department of Health Administrative Rules, the environmental review process will generally not be required. The specific condition which requires this project to go through the environmental process is that the site is located on land administered by a State Agency (Department of Hawaiian Home Lands). Triggering PSD significant emission levels does not necessarily require an EIS as you suggest.

Existing conditions and identification of potential impacts to the air quality was addressed in DHHL's Kawaihae Ten-Year Master Plan EIS which was accepted in March 1993. While not addressing the specific impacts, the EIS included development of the power plant which we are proposing. The Final EA addresses the specific impacts.

2. The final decision as to the amount of new power generation that will be allowed to be constructed rests with the Public Utility Commission. Should the Commission allow our project to go forward, the affect on HELCO's proposed projects would probably be to defer their need to a later date. If on the other hand the Commission approves HELCO's proposed project, would probably defer our project indefinitely. The likelihood of the Keahole Expansion, Puu Anahulu West Hawaii Power Facility and the Kawaihae Project being developed together is very remote.

3. KCP is working closely with the staff of the Department of Transportation, Harbors Division to determine the various options available for transporting fuel from the harbor to the project site. Discussions with DOT concerning routing and easements are still being conducted. We are considering using the existing facilities or providing similar new facilities to meet our requirements. Either option will require extending underground lines to the project site. The new lines will be designed using a double containment system and in accordance with applicable standards and regulations. The present fuel transfer system utilizing underground fuel pipes have been and continue to be used successfully at all harbor facilities throughout the state. Fuel barges are regularly off loaded at Kawaihae Harbor utilizing this method. Fuel barge operators are regulated by the U.S. Coast Guard and are required to have a mitigation plan in place in case of a fuel spill. Underground fuel pipes will be pressure tested periodically for leaks. The fuel storage tanks will be built inside a containment area lined with an impermeable membrane to prevent leaks to the subsurface. The alternative to using direct pumping to the site is to truck fuel from fuel storage facilities across the street to the site. This alternative is more costly and potentially more hazardous to the public by increased exposure to potential fuel truck accidents and spills.

4. Waste water injection is regulated by the Underground Injection Control (UIC) permit which requires monitoring and reporting of the quality and quantity of injected waste. Mitigative measures will be taken to minimize the impact of the injected waste water on the groundwater and the marine environment. A cooling tower will be used to reduce waste water temperatures. The waste water temperatures and salinity concentrations will be further reduced by dispersion in the saline aquifer. Actual dispersal properties of the subsurface geology at Kawaihae will be verified during well installation to determine final well depths and whether additional mitigative measures will be required. Clogging of the wells is not considered a problem since solids will not be injected.

5. The design of the desalination plant is integrated with the design of the power plant to optimize overall plant performance. Two types of desalination units will be utilized. A multiple effect distillation (MED) unit will provide the potable water and a reverse osmosis (RO) unit will provide boiler feed water. The operation and impacts of the desalination plant are discussed adequately in the EA. The desalination plant operation involves the evaporation of saline water using heat from the power plant operation to produce potable water. The by-product of desalinating water is brine consisting of concentrated minerals already found in the groundwater. The brine will be cooled and if necessary diluted with additional supply water before re-injection.

   The desalinated water will be made available for use by DHHL. The cost of the water and transport system has not been determined at this time. Several factors that may impact the cost such as possible water subsidies and other arrangements available to DHHL make it difficult to determine at this time. DHHL's Kawaihae Ten-Year Master Plan identified the need for securing a source of water before their development could be implemented.

6. The water requirements for the project are based on maximum desalination plant operation and the power plant being operated at based load. The actual quantities will probably be less. However, the project will be drawing supply water from the saline aquifer which because of the close proximity to the ocean is essentially unlimited in supply. Depth of supply wells will be finalized during well installation at which time pumping capacity and water quality will be determined. Due to the proximity of the project to the shoreline the basal aquifer is expected to consist of a thin lens of highly brackish water unsuitable for drinking or irrigation uses. There are no current users of the saline aquifer at this time.

We would like to thank you again for your review of the Environmental Assessment. Please feel free to contact us if you have any more questions concerning the proposed project.

Sincerely,

Rodney Kaulupali

JOHN WAIHEE
GOVERNOR OF HAWAII

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

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

September 13, 1993

In reply, please refer to:
93-234/epo

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
Pauahi Tower, Suite 1520
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Subject: Draft Environmental Assessment (DEA)
Kawaihae Cogeneration Project
TMK: 6-1-01, 02 & 03

Thank you for allowing us to review and comment on the subject document. We have the following comments to offer:

Water Pollution

A National Pollutant Discharge Elimination System (NPDES) permit is required for any discharge to waters of the State including the following:

1. Storm water discharges relating to construction activities for projects greater than five acres;
2. Storm water discharge from industrial activities;
3. Construction dewatering activities;
4. Cooling water discharges less than one million gallons;
5. Ground water remediation activities; and
6. Hydrotesting water

Any person wishing to be covered by the NPDES general permit for any of the above activities should file a Notice of Intent with the Department's Clean Water Branch at least 90 days prior to commencement of any discharge to waters of the State.

Any questions regarding this matter should be directed to Mr. Denis Lau of the Clean Water Branch at 586-4309.

Underground Injection Control (UIC)

1. The study area for this project is primarily located below (makai) the UIC line.

2. Injection wells can only be constructed and conditionally operated through approval and authorization from the Department of Health's UIC program. The document alludes to this condition for the operation of anticipated injection wells. Additionally, the applicant should be informed that impending federal UIC regulations may require the facility to obtain a federal UIC permit to operate the injection wells.

3. Effluent discharge standards will be based on the quality of the groundwater within the receiving formation and the public health and environmental effects of the effluent.

4. Hydrogeologic studies may be required to address questions regarding groundwater and effluent seepage into coastal water bodies.

Questions about UIC matters may be directed to Chauncey Hew at the Safe Drinking Water Branch at 586-4258.

Drinking Water

1. According to the DEA, potable water will be produced by desalinating brackish water from three on-site wells. Also 2.6 MGD of desalinated water will be made available for sale to the county and private water users. Federal and state regulations define a public water system as a system that serves 25 or more individuals at least 60 days per year or has at least 15 service connections. Thus, it would appear that the owner and operator of this system will be required to comply with Hawaii Administrative Rules, Title 11, Chapter 20, Rules Relating to Potable Water Systems, and future amendments to the Federal Safe Drinking Act.

2. The DEA indicates that the project will include the development of new sources of potable water. Section 11-20-29 of Chapter 20 requires that all new sources of potable water serving a public water system be approved by the Director of Health prior to its use. Such an approval is based primarily upon the submission of a satisfactory engineering report which addresses the requirements set in Section 11-20-29.

   The report must identify all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate the potential for contamination, including treatment of the water source. In addition, water quality analyses, performed by a laboratory certified in the state of Hawaii, must be submitted as part of the report to demonstrate compliance with all drinking water standards. Additional tests may be required by the Director upon his review of the information submitted.

3. Section 11-20-30 of Chapter 20 requires that new or substantially modified distribution systems for public water systems be approved by the Director. However, if the water system is under the jurisdiction of the County of Hawaii, the Department of Water Supply will be responsible for the review and approval of the plans.

4. The DEA indicates that the proposed development will have a dual water system. The potable and nonpotable water systems must be carefully designed and operated to prevent cross-connections and backflow conditions. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow preventers to avoid contaminating the potable water supply. In addition, all nonpotable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption of nonpotable water.

Questions about drinking water matters may be directed to Stuart Yamada at the Safe Drinking Water Branch at 586-4258.

Hazardous Waste

The draft environmental assessment does not indicate any generation, treatment or storage of hazardous waste. However, hazardous waste may be generated during the maintenance of the power plant (i.e. equipment cleaning solvents). The developer and land owner should be aware of the following:

1. The developer of the site should be aware of the hazardous waste rules and regulations promulgated under Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Hazardous waste regulations are codified in Title 40, of the Code of Federal Regulations Parts 260 through 270. The hazardous waste regulations incorporate the management of hazardous waste from the point of generation to its final disposal, storage or treatment.

2. If the developer of the site generates solid waste as defined in 40 CFR 261.2, they must determine if that waste is a hazardous waste as defined in 40 CFR 261.3.

3. The developer of the site who generates and/or transports hazardous waste must notify the Environmental Protection Agency (EPA) Region 9 of their hazardous waste activities and are subject to 40 CFR Parts 262, 263, 268.

4. The developer of the site who intends to treat, store, or dispose of hazardous waste are subject to RCRA Section 3005, USC 6925, and 40 CFR Parts 264 and 270.

If you have any questions on this matter, please contact Mr. Paul Kalaiwaa of the Hazardous Waste Section of the Hazardous Waste Branch at 586-4237.

Underground Storage Tanks (UST)

On page 19 (section 4-d.) of the Kawaihae Cogeneration Plant Draft Environmental Assessment report entitled "Emergency Start-up Capability", it states that an emergency diesel generator will be installed to provide "black start" capability. We would like to point out that emergency generators are often fueled by products stored in an UST. USTs associated with emergency generators are fully subject to the federal regulations in 40 CFR 280 with the exception of Subpart D 40 CFR Part 280, Release Detection, from which emergency generator USTs are currently deferred.

The installation and use of any underground storage tanks would be regulated pursuant to the technical standards and financial responsibility requirements of 40 CFR Part 280. In addition, these USTs would be subject to State administrative rules promulgated under HRS Chapter 342L. Owners of newly installed USTs must notify our UST Section of the existence of such USTs within 30 days of installation. Also, the appropriate fire and building permits must be obtained from the City and County of Honolulu before the installation of any USTs.

If you should have any questions on this matter, please call Scott Lewis of our Underground Storage Tank Section of the Hazardous Waste Branch at 586-4233.

Very truly your,

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

c: Clean Water Branch
Safe Drinking Branch
Hazardous Waste Branch

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

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

Dear Dr. Lewin,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Plant. We are currently in the process of determining the requirements for all permits that will be applicable to the project. We will take all of your comments into consideration in assuring that the project will meet all applicable laws and regulations. We will contact your staff should we have any questions on the permits and regulations which your Department administers.

Sincerely,

Rodney Kaulupali

ealette6

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540
STREET ADDRESS: 250 SOUTH HOTEL STREET, 4TH FLOOR
TELEPHONE: (808)587-2846, 587-2800

FAX: Director's Office 587-2848
Planning Division 587-2824

Ref. No. C-233

September 13, 1993

Mr. Rodney Kaulupali
Kawaihae Cogeneration Partners
Pauahi Tower Suite 1520
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Subject: Kawaihae Cogeneration Plant Draft Environmental Assessment

We have reviewed the Draft Environmental Assessment for the Kawaihae Cogeneration Plant for compliance to Coastal Zone Management (CZM) policies and objectives and have the following comments.

A relevant Coastal Zone Management (CZM) policy is expressed in the following excerpt. "Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline". The proposed cogeneration plant buildings and associated structures are stated as not exceeding 40 feet in height. However, the exhaust stack is stated as ranging from 50 to 150 feet in height depending on the requirements of the air quality permits. In addition to mitigation measures such as the use of earth tone colors, topographic setting, and vegetation screening, visual simulation of a 150 foot exhaust stack on the proposed site may yield design alternatives to mitigate the potential visual impacts.

We appreciate very much the opportunity to review the proposal. If you have any questions, please contact Harold Lao at 587-2883.

Sincerely,

Harold S. Masumoto
Director

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 24, 1993

Mr. Harold S. Masumoto, Director
Office of State Planning
P.O. Box 3540
Honolulu, Hawaii 96811-3540

Dear Mr. Masumoto,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. The Final Environmental Assessment will include a visual simulation of the power plant overlaid on photographs of the site. The photographs will include the exhaust stack which will be 100' in height.

Sincerely,

Rodney Kaulupali

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

JOHN WAIHEE
GOVERNOR OF HAWAII

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

AUG 19 1993

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Kawaihae Cogeneration Project

We have reviewed your Draft Environmental Assessment and have no comments to offer at this time.

Sincerely,

MANABU TAGOMORI
Manager-Chief Engineer

HY:lc

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

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

Dear Mr. Tagomori,

Thank you for your review of the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant.

Sincerely,

Rodney Kaulupali

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

JOHN WAIHEE
GOVERNOR

RECEIVED
AUG 24 1993
Ans'd.....

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
JOYCE T. OMINE
AL PANG
Kanani Holt
CALVIN M. TSUDA

IN REPLY REFER TO:

HWY-PS
2.8064

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

August 19, 1993

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
Pauahi Tower, Suite 1520
1001 Bishop Street
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Subject: Kawaihae Cogeneration Plant
Draft Environmental Assessment

Thank you for your letter of August 5, 1993, requesting our review of the proposed project.

We have the following comments:

1. Runoff of surface water will not be allowed onto our State highway facilities.

2. Plans for all construction work within our State highway right-of-way must be submitted for our review and approval.

Sincerely,

for Rex D. Johnson
Director of Transportation

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Rex Johnson
Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Johnson,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. The project drainage system will be designed to direct surface runoff away from the highway. All work will be performed in accordance with all applicable permits and regulatory laws.

Sincerely,

Rodney Kaulupali

ealett13

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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

August 16, 1993

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
Pauahi Tower
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

The Department of Business, Economic Development & Tourism, Energy Division, is pleased to offer the following comments on the Draft Environmental Assessment (EA) for the proposed Kawaihae Cogeneration Project:

SECTION III PROJECT DESCRIPTION, B. PROJECT FACILITIES:

1. The proposed project is for a 58 MW oil-fired, dual train, combined cycle power plant designed to sell cogenerated steam to a planned desalination plant. Upon what does Kawaihae Cogeneration Partners (KCP) base the need for such a plant at the time (1997) planned for bringing the facility on line? This is a critical question given that HELCO's own forecasted system peak in 1997 – taking planned demand-side management programs into account – will be 179 MW, which is only 22 MW greater than HELCO's current system peak of 157 MW.

   Given this 22 MW increase of peak demand, coupled with the "modular" design of KCP's proposed plant (i.e., two combustion turbine generators, two heat recovery steam generators, and one steam turbine generator), it would seem prudent to consider an incremental construction plan which would be tailored to fit HELCO's system requirements. This is particularly important in view of Hawaii's ongoing energy utility integrated resource planning (IRP) process which takes all energy supply and demand-side resources into account within the planning process. Accordingly, it is conceivable that HELCO's planned demand-side management programs, or the bringing on line of additional geothermal or other renewable supply-side resources could diminish this expected 22 MW demand requirement even further by 1997.

Finally, has KCP met HELCO's requirement for non-utility generators, and when does KCP anticipate closing a power purchase agreement with HELCO? We recommend that these questions dealing with system needs be posed and answered in the final EA.

2. On page 8, KCP states that the proposed 58 MW facility will "sell between 10,000 and 95,000 pounds per hour of steam to a desalination plant that will be built as part of the project but owned and operated separately." It goes on to mention that the Public Utilities Regulatory Act of 1978 (PURPA) and Hawaii's corresponding Administrative Rules will treat the power plant as a cogeneration qualifying facility. Who will own the proposed desalination plant? Further, has KCP already negotiated a contract with these owners? We recommend clarification here.

3. The proposed project is planned to be a diesel-fired, dual-train, combined cycle generation plant. One of the state's principal energy objectives is to increase energy self-sufficiency (Section 226-18, HRS). It is the state's policy that increased energy self-sufficiency should be achieved by improving the efficiency by which energy is produced, transmitted and used, together with aggressive diversification of energy supply resources away from the use of oil, especially for electricity generation.

The draft EA does not provide any comparative data to support KCP's decision to use an oil-based fuel. Further, clean coal technologies are available on the same scale as the proposed plant and, unlike oil, the U.S. Energy Information Administration forecasts coal prices to remain stable in real terms over the next twenty years. On the other hand, experience with oil and its sensitivity to geopolitical and other forces on the world market make its price and supply vulnerable to extreme fluctuations.

On what basis did KCP decide to choose an oil-fired plant? We recommend that this decision be reviewed and made "transparent" in the final EA and, if this process did not include comparisons against coal-fired technologies, that this analysis be conducted and reported on in the final EA.

4. On page 12, KCP describes the proposed plant's exhaust stack to be from 50 to 150 feet high. We were unable to find in the draft EA any description of plans to mitigate the visual impacts of this intrusive structure. We recommend that KCP describe steps that it will take to mitigate this visual impact.

5. On page 15, the description of the proposed desalination plant states that it "will produce 2.6 mgd [million gallons per day] of desalinated water, all of which will be made available for purchase by a third party for use as a potable water supply." Who is this third party? Is a contract in hand or under negotiation? We recommend that this information be included in the final EA.

6. On page 19, the proposed fuel storage and handling facilities are described. However, there is no description of what type of impervious surface will be used under the storage tanks and the underground fuel pipeline to prevent seepage. Given the high permeability of the soil on the proposed site, we recommend that a more complete description of these preventative measures be provided in the final EA.

IV. ENVIRONMENTAL CONDITIONS AND IMPACT ASSESSMENT,
B. SOCIAL/CULTURAL/ECONOMIC CHARACTERISTICS

1. Under Subsection 2, Economic Characteristics, page 73-76, no impacts are reported on the 20-30 year irretrievable commitment to an oil-fired generating facility. 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 blame the current recession, at least in part, on the Persian Gulf Crisis and its attendant petroleum price spikes. With oil there is also the risk of grave environmental and unlimited economic liability impacts in the event of a spill (see U.S. Oil Pollution Act of 1990). We recommend that these issues be addressed in the final EA.

IV. ENVIRONMENTAL CONDITIONS AND IMPACT ASSESSMENT, C. PUBLIC FACILITIES AND SERVICES.

1. On page 78, KCP states that "Planned power facility additions include 25 MW from Puna Geothermal Venture [PGV] in 1993, however the past track record has showed this source to be unreliable." We presume that this was written prior to the time that PGV began furnishing 25 MW of firm, uninterrupted power to HELCO. Since coming on line, PGV's facility has been reliable and, in fact, could conceivably produce additional power within a much shorter timeframe than it would take to permit and construct a new fossil-fueled generator.

2. On page 81, KCP describes how "existing and expanded facilities are adequate to handle the additional harbor traffic . . . as well as the bi-monthly delivery of fuel oil by barge or tanker during plant operation." Earlier in the report, KCP describes a planned underground pipeline to the harbor. Is there now a pipehead terminal at Kawaihae Harbor? If not, who does KCP expect to pay for these dockside fuel handling facilities? This should be clearly discussed in the final EA.

VI. AGENCIES CONSULTED IN PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

1. We recommend that the Department of Business, Economic Development & Tourism, Energy Division, be added to the list of state agencies consulted.

Thank you for the opportunity to provide these comments.

Sincerely,

for John Tanthunger
Maurice H. Kaya
Energy Program Administrator

cc: Dr. Takeshi Yoshihara

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Maurice H. Kaya
Energy Program Administrator
Department of Business, Economic Development & Tourism
335 Merchant Street, Room 110
Honolulu, Hawaii 96813

Dear Mr. Kaya,

Thank you for your review and comments on the Environment Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

Section III Project Description, B. Project Facilities

1. The 22 MW does not include HELCO's planned retirement of their old generating units after the new generating facilities are constructed. HELCO's plans call for retirement of generating plants through 1997 that are currently providing a total of 30.85 MW bringing the total requirement for new power capacity to 52.85 MW. To meet this demand in a relatively short period of time, a proven and reliable technology must by utilized.

   The project filed an application with the Federal Energy Regulatory Commission (FERC) in 1992 for certification that the facility is a qualifying facility. This application was November 1992. After the project obtained confirmation of the lease award in May of 1993 by Department of Hawaiian Home Lands, additional efforts have been made to conclude the power purchase agreement which was initiated in 1991 with HELCO. Assuming that HELCO acted in good faith and fully complied with the intent of regulatory requirements of PURPA and FERC, the negotiations should have been concluded. However, KCP has had to file a complaint with the Public Utility Commission (PUC) regarding the negotiations. HELCO's answer to the complaint indicates that without PUC intervention a contract will not be completed soon regardless of the laws requiring HELCO to enter into such a contract.

2. The contracts for the sale of steam and/or desalinated water have not been completed. The ownership structure and/or operating arrangements for the Desalination Plant have also not been finalized. The DHHL has negotiated the right of first refusal as part of the lease. However, the Plant will meet PURPA, FERC and Hawaii's corresponding Administrative Rules.

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3. KCP originally proposed to HELCO to build either a coal fired plant or a combined cycle plant. It was finally decided not to go with coal fired plant because of:

- the protracted negotiations with HELCO made it impossible to build a coal plant by 1996,
- HELCO's desire for a dispatchable plant rather than a base loaded plant, and
- current public perception that a coal plant is more polluting than an oil fired plant.

Present technological advances in alternative energy sources are not able to economically meet requirements at the utility level with the exception of geothermal energy.

4. Based on the most current meteorological data and analysis, the exhaust stack height will be 100'. Various methods of visual mitigation are being investigated including painting to match the landscape, berming and landscaping. Simulations of the project will be overlaid on pictures of the site taken from various vantage points to evaluate the best solutions and will be included in the Final EA.

5. As part of the master lease agreement with Department of Hawaiian Home Lands (DHHL), the water produced by the desalination plant will be made available for use by DHHL. With a secure source of water the Department will be able to implement their planned development of Kawaihae. We are currently negotiating with DHHL for purchase of the water and continuing our investigation into other potential water users.

6. There are several products on the market that will meet the containment requirements. One such product is Claymax. These products are similar to the liners used for reservoirs and ponds but formulated to resist exposure to petroleum products like diesel fuel. However, final selection will be based on soils report.

IV <u>Environmental Conditions and Impact Assessment,</u>
<u>B. Social/Cultural/Economic Characteristics</u>

1. KCP had originally proposed to HELCO to build a coal fired plant. The reasons for rejecting this option are provided in response no. 3 of the previous section. Diesel fuel was chosen over residual oil because of environmental problems associated with a potential oil spill.

IV Environmental Conditions and Impact Assessment,
C. Social/Cultural/Ecgnomic Characteristics

1. Thank you for pointing out our mistake. Since publication of the Draft EA the status of Puna Geothermal Venture's production of 25 MW had been upgraded to firm capacity. The Final EA will be revised accordingly. Geothermal energy is still a technology with a short track record in Hawaii and has been subject to unforeseen difficulties. In order for geothermal energy to meet the future growth of West Hawaii, requires extensive upgrading of the transmission lines going over the saddle. This process would entail lengthy environmental and engineering studies. The transmission studies coupled with the permitting of another geothermal well creates enough uncertainty to require another generation of fossil fuel power plants to be located on the west side of Hawaii.

2. KCP is working closely with the staff of the Department of Transportation, Harbors Division to determine the various options available for transporting fuel from the harbor to the project site. Discussions with DOT concerning routing and easements are still being conducted. We are considering using the existing facilities or providing similar new facilities to meet our requirements. Either option will require extending underground lines to the project site. The new lines will be designed using a double containment system and in accordance with applicable standards and regulations. We will continue working with Harbors Division in developing an integrated plan that will be compatible with the future use of the harbor facilities. The cost of transporting the fuel including building new facilities if necessary, will be born by KCP.

We appreciate the opportunity to address your comments and concerns. We will be providing additional information in the Final EA that will further address some of the questions raised by the various responders. Please feel free to contact us if you have any other questions or concerns regarding the proposed project.

Sincerely,

Rodney Kaulupali

JOHN WAIHEE
GOVERNOR OF HAWAII

RECEIVED
OCT 05 1993
Ans'd.....

KEITH W. AHUE
CHAIRPERSON

JOHN C. LEWIN, M.D.
ROBERT S. NAKATA
J. DOUGLAS ING, ESQ.
RICHARD H. COX, P.E.
GUY K. FUJIMURA

RAE M. LOUI, P.E.
DEPUTY

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

OCT -4 1993

Mr. Rodney Kaulupali, Assistant Project Manager
Kawaihae Cogeneration Partners
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Thank you for a copy of the "Draft Environmental Assessment for the Kawaihae Cogeneration Project" for review and comments.

Well construction and pump installation permits processed through this office are required for all wells drilled for the project.

Sincerely,

RAE M. LOUI
Deputy Director

PH:ko

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Ms. Rae M. Loui, Deputy Director
Department of Land and Natural Resources
Commission on Water Resource Management
P.O. Box 621
Honolulu, Hawaii 96809

Dear Ms. Loui,

Thank you for your review of the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. All applicable permits including pump installation and well drilling permits will be obtained by the project.

Sincerely,

Rodney Kaulupali

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
711 KAPIOLANI BOULEVARD, SUITE 500
HONOLULU, HAWAII 96813-5249
PHONE (808) 586-3777
FAX (808) 586-3799

August 31, 1993

Mrs. Hoaliku Drake, Director
Hawaiian Home Lands
Old Federal Building
335 Merchant Street
Honolulu, Hawai'i 96813

Dear Mrs. Drake:

We have received the document entitled, "Kawaihae Cogeneration Plant Draft Environmental Assessment" (EA). Thank you for the opportunity to review this document. The Office of Hawaiian Affairs (OHA) agrees with DHHL"s proposed development plans for the Kawaihae area. We do however, have some concerns with the preparation of the EA for the project.

As described, the proposed Kawaihae Congeneration Plant (KCP) is a dual project aimed to produce electricity and desalinated water for the Kawaihae area, on the west side of the island of Hawai'i. The general area for the location of the KCP contains a high concentration of culturally and historically significant features. Because of this concentration of sites, the siting of the project must be carefully considered.

Recent amendments to federal historic preservation laws now require the collaberation of Native Hawaiian organizations when cultural sites are impacted by projects which receive any amount of federal funds. OHA is explicitly named in the law. In order to address this requirement, we suggest the DHHL and OHA jointly review the impact of this project on historic sites and prepare a Memorandum of Agreement.

In addition, the project area is part of a low rainfall ecosystem comprising rugged landscapes, young, shallow, coarse-textured, steep, highly erodible soils, and scanty vegetation (mostly grasses and

shrubs). The present ecosystem is one of high fragility with several potential hazards (i.e., soil erosion, waterlogging and/or salinity) if earth-moving operations take place and the present soil-water balance is disrupted. Because of these potential hazards, additional baseline information is required, particularly for those areas where the plant wastewater systems will be located. Data on soil physical properties determining water and pollutant movement within and out the soil profile, plus some kind of simulation of sediment and pollutant transport and loading through the soil profile are needed to forecast potential land degradation.

Shortages of electricity in the Kawaihae area may justify the establishment of a power plant, however, no statistics are included in the EA to support the premise that such shortages exist. The potential health hazards associated with the establishment of a major source of pollutants, such as the KCP power plant, raise special concern.

The EA describes a methodology to assess potential contributions of air pollutants by the KCP. The EA also states that KCP has a monitoring site and is already collecting weather (one year) and air pollutant (six months) data for air quality assessment. However, there are two constraints associated with the methodology: (i) the KCP monitoring site is only one point in the area and the period of data collection (particularly for the air pollutant data) is too short to provide a representative profile of temporal and spatial variations of air pollutants in the area, and (ii) the estimated contribution of air pollutants by the KCP is based upon equipment manufacturer's data. Hence, there is virtually no way of knowing how much pollution will be produced by the KCP until it is fully operational.

The EA report broadly describes the groundwater sources in the Kawaihae area but does not provide enough detail to justify the establishment of a desalination plant. Again the report does not provide baseline information on (i) sources of drinking water (i.e., capacity, quality, and availability of surface and underground water bodies) in the area, (ii) demographics of the area present population and expected growth, and (iii) current and potential water uses. This information is vital to assess whether there is a shortage of sources of drinking water and whether desalinated water is the best available alternative to meet current and future drinking water needs in the area.

In view of the above, there are potential on-site and off-site adverse effects associated with the development of this project. These potential adverse effects warrant a careful and thorough examination of possible environmental impacts. Areas of serious concerns include potential health hazards to the resident population, land degradation, and disturbance of highly significant archeological sites. Therefore, we urge the preparation of a full Environmental Impact Statement to address these remaining questions.

If you have any questions or concerns. please contact Linda Delaney, Land Officer or Lynn Lee, Land Planner at 586-3777.

Sincerely yours,

RICHARD PAGLINAWAN
Administrator

RG:sk

cc: Duk Hee Murabayashi
DHM Inc.
1188 Bishop St., Ste. 2405
Honolulu, HI 96813

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Richard Paglinawan
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 600
Honolulu, Hawaii 96813-5249

Dear Mr. Paglinawan,

Thank you for your review and comments on the Environment Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

Response

A mitigation plan was developed by Cultural Survey Hawaii which addresses all the archaeological sites within the Department of Hawaiian Home Lands (DHHL) initial development of their Kawaihae Ten Year Master Plan. The mitigation plan was approved by the State Historic and Preservation Office and will be implemented on all identified sites within the 40-acre study area. A mitigation plan addressing relocation of impacted burial sites is being developed by DHHL with the assistance of the Big Island Burial Council. The appropriate Hawaiian Organizations, which will include the Office of Hawaiian Affairs and Hui Malama I Na Kupuna O Hawai'i Nei, will be consulted during the development of the plan for relocating burial sites. While the project is not utilizing federal funds, all applicable laws and regulations will be met including the Native American Graves and Repatriation Act (NAGPRA). The project will implement the mitigation plans to address all sites identified within the study area.

A description of existing conditions is provided in the DHHL's Kawaihae Ten-Year Master Plan EIS. A copy is provided in appendix D of the Final Environmental Assessment which includes the geotechnical survey by Geolabs-Hawaii. While existing soil conditions are characterized by moderate permeability and a moderate to high susceptibility to erosion, standard construction techniques will be used to minimize fugitive dust. Additional surface runoff generated by the project will be prevented from entering the harbor.

HELCO's Resource Plan has shown a need for more than 50 MW of new generation capacity by 1997. Plant emissions are regulated by the Department of Health through the permit for Prevention of Significant Deterioration (PSD). It was determined that the project will be subject to the PSD permit process. Maximum project emissions must be maintained below the levels set by federal and state

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regulations or the project will not be allowed to operate. The maximum allowable levels of emissions are designed to protect public health and welfare and to prevent the significant deterioration of air quality with an adequate margin of safety thereby minimizing impact to the environment.

The need for water is identified in DHHL's Ten-Year Master Plan EIS. Currently there is no County water system or other sources of water to support the Master Plan. KCP will provide a secure source of water by desalination.

The DHHL EIS was accepted in March 1993. While not addressing the specific impacts, the EIS included development of the power plant which is being proposed. The EIS also addresses the broad impacts of development of the area. The Final EA addresses the specific impacts related to the power plant project.

We appreciate the opportunity to address your comments and concerns. We will be providing additional information in the Final EA that will further address some of the questions raised by the various respondents. Please feel free to contact us if you have any other questions or concerns regarding the proposed project.

Sincerely,

Rodney Kaulupali

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JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS DIVISION
79 SO NIMITZ HWY • HONOLULU HAWAII 96813-4898

REX D JOHNSON
DIRECTOR
DEPUTY DIRECTORS
JOYCE T OMINE
AL PANG
CALVIN M TSUDA
HOLT
IN REPLY REFER TO

August 31, 1993

HAR-EP 1325.94

RECEIVED
LAND MANAGEMENT
DIVISION
SEP 9 33 AM '93

Mr. Rodney Kaulupali
Assistant Project Manager
Kawaihae Cogeneration Partners
1001 Bishop Street, Suite 1520
Honolulu, Hawaii 96813

Dear Mr. Kaulupali:

Subject: Draft Environmental Assessment (EA)
Kawaihae Cogeneration Project

Thank you for the opportunity to comment on the subject EA.

Our comments are as follows:

1. Page 19, C. Fuel and Fuel Handling

The assessment indicates that fuel will be transported bi-monthly by ocean tanker or barge at Kawaihae Harbor. Berthing requirements need to be coordinated and approved by the Harbors Division.

We continue to be interested in the issue of how the fuel will be transported from the pier to the property. Your continuing dialogue with us on this is requested.

2. Page 74 (paragraph 2), 2. Economic Characteristics and Page 81 (paragraph 3), Potential Impacts

The assessment indicates that the harbor is being expanded. As of July of this year, the 550-foot pier extension and 10-acre landside improvement projects were completed.

3. Page 80 (paragraph 2), 2. Transportation

The assessment indicates that the military "extensively" uses the harbor. It is more accurate to state that the military "periodically" uses the harbor. Cargo handled at Kawaihae Harbor should also include petroleum products.

If you have any questions, please call Robert Nagao of the Harbors Planning Office at 587-1880.

Very truly yours,

Calvin M. Tsuda
Deputy Director for Harbors

c: Department of Hawaiian Home Lands
DHM, Inc.

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Calvin Tsuda, Deputy
Department of Transportation
Harbors Division
79 South Nimitz Highway
Honolulu, Hawaii 96813-4898

Dear Mr. Tsuda,

Thank you for your review and comments on the Environmental Assessment (EA) for the proposed Kawaihae Cogeneration Power Plant. As stated in the Assessment, the project intends to pump fuel from fuel barges directly to our storage tanks. KCP will coordinate with you our unloading plan efforts and will continue the dialogue already established. The Final EA will be corrected to state that the pier expansion is completed. Page 80 of the EA will also be corrected accordingly.

Sincerely,

Rodney Kaulupali

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JOHN WAIHEE
GOVERNOR
STATE OF HAWAII

HOALIKU L. DRAKE
CHAIRMAN
HAWAIIAN HOMES COMMISSION

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P O BOX 1879
HONOLULU, HAWAII 96805

August 2, 1993

Mr. Brian J.J. Choy, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Choy:

SUBJECT: Draft Environmental Assessment (EA) for Kawaihae Cogeneration Plant, Kawaihae, Hawaii

Thank you for your letter of July 15, 1993, requesting that the Department of Hawaiian Home Lands (DHHL) reconsider its anticipated negative declaration determination for the Kawaihae Cogeneration Plant project.

Our decision is based in part on the following reasons:

1. A complete Environmental Impact Statement (EIS) was prepared for our Kawaihae ten-year Master Plan and submitted to your office and made available to the general public in December, 1992. This EIS covered the major impacts of developing the first 2,115 acres of our lands in Kawaihae, Hawaii, including the 227 acres designated for industrial uses. While not going into detail, the EIS contains a possible desalination plant to supply water needs (pg. 2-33, 5-3), and a power plant which will supply electricity for West Hawaii (pg 2-34, 5-21).

2. The intensive permitting which must be obtained from various Federal and State agencies to complete development of a power plant allows numerous opportunities for the general public to comment on the proposed project. These permits are designed to adequately protect the environment and public's right to comment on the proposed action.

DHHL is very concerned with utilizing our lands in an appropriate manner and are especially concerned with protecting the public's right to comment. In this regards we are

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Mr. Brian J.J. Choy
[illegible]

appreciative of your concerns and we will definitely consider your comments in making the final determination.

Should you have any questions, please call Linda Chinn, our Hawaii Island Land Agent, at 586-3823.

Warmest aloha,

Hoaliku L. Drake, Chairman
Hawaiian Homes Commission

HLD:RS:lc

4870I

COPY

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

July 15, 1993

The Honorable Healiku L. Drake, Chair
Hawaiian Home Commission
P.O. Box 1879
Honolulu, Hawaii 96805

Attention: Ms. Linda Chinn, Land Management Division

Dear Ms. Drake:

Subject: Draft Environmental Assessment for the Kawaihae Cogeneration Plant, Kawaihae, Hawaii

The Office of Environmental Quality Control cannot override your agency's anticipated decision in your July 13, 1993, letter to our office to make the determination that the subject project will have no significant impact. The notice of availability of the draft environmental assessment and your anticipated determination for the subject action will be published in the July 23, 1993, *OEQC Bulletin*.

Having reviewed the document, we believe that the proposed project may have significant impacts. The proposed project is a new major stationary source of pollutants based on the federal Clean Air Act. Estimated emissions of nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter exceed federal and state significance levels (p. 53).

Brines from the reverse osmosis process may meet the toxicity characteristic for hazardous waste under the federal Resource Conservation and Recovery Act.

Depending on the requirements of the air quality permits, the power plant's exhaust stack will be 50 to 150 feet tall. Also, during periods of particularly high humidity and/or low temperatures a white plume is expected to appear within a few hundred feet of the power plant's cooling tower. As a result, the project may have significant visual impact.

Therefore, we believe that the preparation of an environmental impact statement is necessary. The environmental impact statement would assure adequate consultation with all affected parties and sufficient disclosure of all potential impacts.

If you have any questions, please call Jeyan Thirugnanam at 586-4185. Thank you.

Sincerely,

Brian J. J. Choy
Director

Stephen K. Yamashiro
Mayor

Donna Fay K. Kiyosaki
Chief Engineer

Riley W. Smith
Deputy Chief Engineer

County of Hawaii

DEPARTMENT OF PUBLIC WORKS

25 Aupuni Street, Room 202 • Hilo, Hawaii 96720-4252
(808) 961-8321 • Fax (808) 969-7138

August 30, 1993

MR RODNEY KAULUPALI
KAWAIHAE COGENERATION PARTNERS
1001 BISHOP STREET SUITE 1520
HONOLULU HI 96813

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
Kawaihae Cogeneration Plant
Location: Kawaihae 1st, South Kohala, Hawaii
TMK: 6-1-01: 3

We have reviewed the subject report and our comments are as follows:

1. Building shall conform to all requirements of code and statutes pertaining to building construction.

2. All development generated runoff shall be disposed of on site and shall not be directed toward any adjacent properties.

3. Applicant shall be informed that if drywells are included in the subject improvements, Chapter 23, Underground Injection Control (UIC), Administrative Rules, Department of Health, prohibit any person from operating, constructing or modifying an injection well (drywell) unless authorized by a permit issued by the Director of Health, State of Hawaii.

4. All earthwork and grading shall be in conformance with Chapter 10, Erosion and Sedimentation Control, of the Hawaii County Code.

5. Kawaihae Road is under the jurisdiction of the State Department of Transportation (SDOT). Access requirements shall meet with SDOT.

Should there be any questions concerning this matter, please feel free to contact Mr. Casey Yanagihara in our Engineering Division at 961-8327.

GALEN M. KUBA, Acting Division Chief
Engineering Division

CKY:byf

cc: ENG-KON

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Galen M. Kuba
County of Hawaii
Department of Public Works
25 Aupuni Street, Room 202
Hilo, Hawaii 96720-4252

Dear Mr. Kuba,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We are currently in the process of determining the requirements for all permits that will be applicable to the project. Your comments are noted and will be referenced to assure that the project meets are applicable laws and regulations during construction and operation of the power plant and appurtenant facilities. Construction will be performed in accordance with approved procedures for sedimentation and erosion control, storm water discharges related to construction activities, and construction dewatering activities.

Sincerely,

Rodney Kaulupali

ealette2

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

John M. Kerr III
Chairman, Kawaihae Advisory Council
P.O. Box 1830
Kamuela, Hawaii 96743

Mrs. Hoaliku Drake
Chairman, Hawaiian Homelands
P.O. Box 1879
Honolulu, Hawaii 96805

Dear Mrs. Drake,

The Kawaihae Community Council wishes to inform you that we feel that the Kawaihae Cogeneration Plant Draft Environmental Assessment is inadequate. It leaves too many questions unanswered to make us feel comfortable with accepting its conclusion that no adverse environmental effects will be forthcoming as the result of this powerplants construction and operation.

Please find attached several contentious issues which our council wishes to have addressed.

We strongly urge that your department move to require a full EIS before allowing construction of this plant to proceed.

Sincerely,

John M. Kerr III

John M. Kerr III
Acting Chairman, Kawaihae Community Council

attached: "Some issues specific to the Kawaihae EA"

Current Council Membership --

Waimea Hawaiian Civic Club
Kawaihae Hawaiian Homesteads
Kawaihae Boating Association
Kohala Trollers
Main Street Waimea
Waimea Community Association
Kawaihae Shopping Center Merchants
Kawaihae Canoe Club
Waimea Hawaii Homestead Assoc.
Kawaihae Village Association

Puukohola National Park (ex officio)

✓

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SOME ISSUES SPECIFIC TO THE KAWAIHAE EA

CULTURAL/ARCHAEOLOGY

How will the project affect the Puu Kohola Heiau? Will the air emissions do anything to damage petroglyphs or any artifacts? Air pollutants are known to cause damage to significant historic sites in different parts of the world, but no discussion has been included on this issue. What will the impact be to the John Young house and its contents? What impact will there be to burial and other archaeological sites. The Kawaihae area is rich with significant Hawaiian sites, many of them within the study area. Also, within the study area, 23 sites have been designated for further data recovery which means that there has not been sufficient study of this area. Since the proposed power plant and desalination facility will have major disruption to the surface and subsurface ground, much more extensive archeological investigation of this area must be undertaken before any disturbance should be allowed. It is bad enough that a meteorological tower was erected within the study area without any permits when even this EA recognizes the need for further study before any construction is allowed.

Page 65 of the EA states that "ground disturbance resulting from the proposed generating facility will be limited to about 10 to 15 acres", however, the rationale given for a 40 acre site was for "future expansion". This is a contradiction. If ground disturbance will be limited to not more than 15 acres, then the site should be also limited to not more than 15 acres and not 40. Also, why is the study area 122 acres? Is it because the exact meets and bounds of the 40 acres have not been yet determined? If so, how can there be a reasonable evaluation of impacts when those factors which influence impacts change with the exact location of the site?

WATER

There is inadequate discussion of the impact to the underground water table when discharge from the desalination and power plant is injected into it. Page 38 states, "No data is available specifically concerning the quality of the ground water below the site". Page 39 states, "Groundwater quality varies considerably from place to place, due to variations in the extent of fresh and marine water mixing". This is a direct admission that more information is necessary but yet unavailable..

Also, while dilution of waste water to reduce the concentration of chemicals contained in it is proposed, since the volume of discharge is so high, it is possible that there will be impact to the ocean life at least at the point of discharge. Page 39 of the EA states that there is no indication that there is discharge into the Kawaihae Harbor since excavations may have disrupted the previously and naturally existing discharge points within the harbor. The EA, however, does not indicate where the discharge may be, nor how much mixing may actually occur.

Desalination of water is extremely costly when compared to conventional sources, even when taking into consideration the need to

build pipelines. If Waimana/KCP is true to their word and will sell electricity cheaper than HELCO (meaning they will not be making much money from that sale) and if the cost to produce desalinated water is higher than the cost for County water, how can the project pay for itself? If the desalinated water is to be sold to Hawaiian Homes lessees from 1996, and considering the volume that is supposed to be produced, the supply will exceed the demand. What will happen to the excess water? If desalination is to be phased in according to demand, how will that affect waste disposal and power plant operations? Will there be water lines from the property off site? If so, where will they be?

AIR QUALITY

How has the stack height been determined? With a range from 50 to 150 feet it appears to be only a guess with no scientific basis. "Good Engineering Practices" suggest that stack height be at least 2.5 times the highest structure. If the highest structure is the 50 feet high fuel storage tank, then the stack must be at least 150 feet, unless that (and other structures) are to be partially or totally buried. If they are to be buried, then more extensive archeological and soils information is necessary.

There are residences and businesses near the site. There are also businesses and residences at intermediate distances as well as upslope. Has there been any air modeling done? If not, how can there be a good indication of what impacts air emissions would have on the surrounding area and what height the smoke stack should be? What impacts would result to water catchment systems in the area? What impact will there be due to the combination of the power plant emissions and vog? How often, and of what duration, will Kawaihae experience a cloud of emissions from the power plant because there are little/no winds to carry away the pollutants? What impact would those no/low wind periods have? How will the new residential area (and yet unbuilt homes) and other Hawaiian Homes developments planned to the north and west of the power plant site be affected? A monitoring tower was set up only recently. Without long term data, how can anyone know if the site will accommodate even one power plant? How can an EIS, much less and EA, be accepted without that information? Has any power plant in the nation been permitted which has so little air quality information?

VISUAL

Without a firm determination of stack height, how can a good determination be made of the impacts to visual planes? What are the elevations and structure heights involved. What will be done to block the view of the plant for higher elevations when looking down? What will be done to mitigate the visual impact of a 50-150 feet smokestack when there is nothing around which is even close to that height?

NOISE

While the EA suggests that a noise level of 70 dBA is the appropriate guideline level, this figure is for industrial/agricultural districts. There are 4 residential units directly adjacent to the

proposed site as well as the historic John Young house. In addition, there are three proposed preservation areas within the study area. For residential and preservation districts, the appropriate DOH noise level guidelines are 55 dBA (daytime), and not 70 dBA. Even the Federal HUD noise guidelines uses 65 Ldn (average of day and night levels which would realistically be less than 70 dBA) as the appropriate level at residential units.

FUEL STORAGE/TRANSPORT/HANDLING
If fuel oil is to be piped underground to the facility, what measures will be taken to insure that oil spills or leaks do not occur? If an oil leak from a pipeline does occur, what are the plans for dealing with that. How will aquatic life and personal property (boats) be protected from leaks? Where will the pipeline route be? What are the monitoring plans for detecting leaks? How will the pipelines be protected from earthquakes, tsunamis, and other natural disasters? What is the total construction and operating cost of the pipelines? Who will pay for this? Have any easements been granted yet for these?

TRANSMISSION OF ELECTRICITY
HELCO does not have a transmission line to/from Kawaihae which is adequate to carry the amount of power to be produced. Where will the necessary transmission line be?

EMF
What are the health impacts due to EMF, which will result from the power plant and additional transmission lines? What will the EMF readings be around the power plant and transmission line?

ALTERNATIVES
There needs to be a discussion on alternatives as far as site location, fuels, technology, and for not building the plant at all. What other sites have been considered by Waimana...where is that report? What other fuels/technology have been considered...ethanol, biomass, solar, wind, OTEC, coal, hydrogen, natural gas, conservation, geothermal, etc...where is that report? Why must a power plant at Kawaihae be built? What's wrong with the "no build" option? HELCO has stated that they will submit an Integrated Resources Plan to the PUC for approval in September 1993. This plan is supposed to include energy savings through conservation and increasing the efficiency of electricity use. This, combined with HELCO's own plans for power facilities at Keahole and Puu Anahulu, plus the statements by Puna Geothermal Venture that they can produce another 25 megawatts of power, would be more than enough to meet present and future demand past year 2000.

Page 87 states that "Power from the project will be sold to HELCO". Waimana/KCP has also said that it does not have a contract with HELCO for the sale of electricity. What will happen if the PUC does not allow HELCO to buy power from Waimana/KCP because there is an oversupply of power? What is the relationship between a power plant at Kawaihae and those planned at Keahole, Puu Anahulu, additional PGV power, additional power from Hilo Coast Processing, and power

from True/Mid-Pacific Geothermal? What is the status of projects by Enserch and Hui Enekenia? HELCO has said that they're immediate need is 20 megawatts. There is no explanation in the EA as to why 20 megawatts cannot be produced at Kawaihae with any additional capacity coming from elsewhere. HELCO already has land, infrastructure, environmental data, and a nearly complete EIS for Keahole. HELCO also has a nearly complete EIS for Puu Anahulu and has stated that by building at Keahole by 1995 and at Puu Anahulu by 1997 their needs will be met. Since this is the case, and with HELCO's permitting closer to completion, why is there a need for a plant at Kawaihae? There should be a schedule and a complete discussion which shows load growth versus retirement of old HELCO units versus the need for new generation, which includes all producers of electricity, and their future plans as well.

If Waimana/KCP must pay over $1M a year to Hawaiian Home Lands for the land lease, how will that additional cost affect our electricity bill, especially since HELCO is not paying $1M in lease rental at Keahole?

Waimana has stated that they will sell electricity at a price lower than HELCO's "avoided cost". Public records also show that HELCO has been approached by other private companies with offers to sell power (e.g., PGV, HCPC, etc.). There should be a discussion of who all of these companies are, what price they have offered (including Waimana), and the status of these negotiations so that a comparison of these alternatives can be made.

Is it not more economical to develop ground water sources (e.g., Kehena Ditch), even with pipelines, than to desalinate?

LONG TERM PLAN

The total land area is 40 acres, but only about 15 acres are needed for the power plant. What is the "maximum build out" of the site? Why is that maximum build out plan not described in this EA if it is already stated that the additional 25 acres will be used for future expansion? Over the 40 acres, will there be one smoke stack, two, three, ten? How many buildings will we be faced with down the line? What will the 40 acres eventually/ultimately be like?

The Hawaiian Homes RFP which was issued relative to this proposed project, and the "Character of Use" section of the Qualification Criteria, clearly stated that the use would be "limited" to a power generation facility. This project includes a desalination plant which is clearly beyond what is allowed by the RFP. It cannot be considered as an ancillary facility while at the same time being the qualifying component of a cogeneration operation.

RELATIONSHIP WITH KAWAIHAE MASTER PLAN

There should be discussion of the Hawaiian Home Lands Master Plan for Kawaihae, and the relationship/impacts of the power plant with it.

OTHER

Page 8 of the EA states that the desalination plant will be "owned and operated separately". If this is the case, the desalination facility should be subject to its own environmental and permitting requirements, and should not be allowed as part of this EA. To allow the desalination plant to "piggyback" with the power plant environmental/permitting requirement usurps the intent and spirit of the permitting and regulatory laws and rules.

CONCLUSION

It is very clear that the information contained in this EA is insufficient to give a good indication of potential impacts. Further, the conclusion that, "The proposed project will have no significant adverse effects on ground water resources, marine environment, flora, fauna, archaeological resource, or public facilities and services" clearly cannot be substantiated. On the contrary, the evidence provide in this EA would suggest exactly the opposite... that there will be significant adverse impact.

Based on the foregoing discussion, it is clear also that in the very least, a full EIS is required, in addition to additional studies related to various air, water, archeological/cultural, economic, and biological issues. It is plainly obvious that a negative declaration cannot be issued.

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. John M. Kerr III, Acting Chairman
Kawaihae Community Council
P.O. Box 1830
Kamuela, Hawaii 96743

Dear Mr. Kerr,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

Cultural/Archaeology

Plant emissions are regulated by the Department of Health through the permit for Prevention of Significant Deterioration (PSD). Based on preliminary analyses using emissions data for an LM2500 combustion turbine the project will be subject to the PSD permit process. Total pollutants emitted by the project are limited to levels that are designed to protect public health and welfare and to prevent the significant deterioration of air quality with an adequate margin of safety thereby minimizing impact to the environment. The pollutants, such as sulfur dioxide emissions, which are primarily responsible for the deterioration of historical sites in other areas are strictly limited and monitored continuously to assure regulated levels are not exceeded.

A detailed mitigation plan addressing impacts on archaeological sites was developed for the Department of Hawaiian Home Lands (DHHL) as part of their Ten-Year Master Plan EIS and approved by the State Historic Preservation Office. The survey included all of the study area designated for industrial development. KCP will implement the data recovery plan on all sites identified in the project area. A mitigation plan that addresses impacts on burial sites is being developed with the assistance of the Big Island Burial Council and will be implemented prior to the start of construction.

DHHL's Kawaihae Ten-Year Master Plan EIS, which was accepted in March 1993, designated more than 200 acres for industrial development. While not addressing the specific impacts or a specific site location, the EIS included development of a power plant. A specific site location for the 40-acre leased parcel will be provided in the Final EA and the impacts evaluated accordingly. The project does not have a firm commitment for use of the remaining area and will not be

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considered in this assessment. Any future developments will be subject to the same government regulations and permitting processes.

Water

It is anticipated that the underground geology and hydrology are similar to nearby areas where the available data show that the geologic formation consists of highly porous basalt formations and the groundwater quality is saline. Also, based on the Ghyben-Herzberg principle, groundwater quality is expected to be highly saline due to the proximity of the project to the shoreline. Water quality and dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and whether additional mitigative measures will be required. At full desalination plant operation, the chemical makeup of the injected waste water will consist mainly of a concentration of the minerals found in the groundwater. Injected waste water is regulated by the Underground Injection Control (UIC) permit which requires monitoring and reporting of the quality and quantity of injected water.

As part of the master lease with Department of Hawaiian Home Lands (DHHL), the desalinated water will be made available for use by DHHL. The cost of the water has not been determined at this time, but will be similar to other privately supplied water systems on the island. Flexibility in the design of the desalination plant allows production to be either increased or reduced to meet required demands. DHHL's Kawaihae Ten-Year Master Plan identified the need for securing a source of water before their development could be implemented. Until a source of water is found, Kawaihae cannot be developed and Hawaiians will not be able to return to the area. KCP will continue to investigate other potential users of the water. DHHL will develop the required infrastructure for their master plan which will include the necessary water distribution systems.

Air Quality

The final stack height will be 100' based on the most current meteorological data collected from the meteorological tower. Neither the fuel storage tank nor other structures will be buried.

Air modeling is being performed as part of the air quality permit application required by the Hawaii Department of Health (DOH). This modeling analysis is based on a protocol which has been reviewed and approved by DOH. The analysis being conducted for the proposed project will indicate worst case air quality impacts, at any location, due to plant operation. These worst case conditions will include calm weather conditions; however, worst case impacts are more likely to be associated with higher wind speeds. Since the analysis will identify worst case impacts at any location, impacts at nearby houses and businesses will be addressed. These impacts

will have to be below levels established by DOH, or the project will not be approved for construction or operation.

The modeling analyses used to determine these impacts will be based on weather data collected at the Kawaihae site, as well as other representative data. Data collection will continue at the Kawaihae site for at least one year. DOH will determine when sufficient data has been collected to conservatively estimate worst case air quality impacts associated with the project. The 180 MW Kalaeloa Cogeneration Plant on Oahu and Maui Electric's 56 MW Maalaea power plant are two most recent examples of power plants constructed without Environmental Impact Statements.

Visual

Further studies have limited the stack height to 100 feet. Computer generated simulations of the project will be overlaid on pictures of the site taken from various vantage points and provided in the Final EA. Various methods of visual mitigation are being investigated which include painting to match the landscape, berming and landscaping. The fuel storage tanks will be approximately 50 feet high and ancillary buildings not more than 40 feet high. The future industrial development of the surrounding area will further mitigate the visual impact of the project.

Noise

The area of concern is zoned commercial village and industrial thus would be subject to the 70 dBA limitations on Oahu. The four homesteaders currently residing in the area will be relocated before the start of construction. The areas designated for preservation are for relocating burials impacted by development.

Fuel Storage/Transport/Handling

KCP is working closely with the staff of the Department of Transportation, Harbors Division to determine the various options available for transporting fuel from the harbor to the project site. Discussions with Harbors Division concerning routing and easements are still being conducted. We are considering using the existing facilities or providing similar new facilities to meet our requirements. Either option will require extending underground lines to the project site. The new lines will be designed using a double containment system and in accordance with applicable standards and regulations. The lines will be pressure tested periodically for leaks. Generally the lines will contain fuel only during off loading operations thus minimizing the possibility of a leak. Exact details and cost of the pipeline are still being discussed with Harbors Division to assure that our requirements are integrated with the future uses of the harbor facilities.

Transmission of Electricity

The location of the transmission lines are currently being negotiated with HELCO. The project intends to use existing transmission facilities and rights-of-way to minimize cost and environmental impacts. The lines will be routed away from future residential areas in DHHL planned development.

EMF

Research into the investigation of whether electric and magnetic fields produce harmful health effects have proven to be inconclusive. This is reflected in a policy statement by the State Department of Health noting that "the existing research data are inconclusive and not sufficient for adequate, accurate risk assessment." Typical magnetic field readings under a single 69 kV line is on the order of 1 to 6 milliGauss. As a comparison a fluorescent desk lamp generates a magnetic field of 6 to 20 milliGauss at 12" away. Although research cannot show a correlation to EMF caused health effects the transmission lines will be located away from areas designated for residential development by DHHL.

Alternatives

The site study report "West Hawaii Site Study" by CH2MHill for HELCO identified Kawaihae as the optimal location for a new power plant. The location of the project is consistent with DHHL's proposed industrial development of their lands and the State's long term development plans for the Kawaihae Harbor facilities. Due to the close proximity to the harbor the area is well situated for industrial development.

According to HELCO's Resource Plan more than 50 MW of new generation capacity will be required by 1997. This forecast includes Design Side Management programs for conserving energy. To meet the 1997 time frame and capacity requirement a power plant site in West Hawaii utilizing combustion turbine technology was identified by HELCO as the least-cost alternative.

The final decision as to the amount of new power generation that will be allowed to be constructed rests with the Public Utility Commission. Should the Commission allow the KCP project to go forward, the affect on HELCO's proposed project would probably be to defer their need to a later date.

The utility is responsible for determining the need for future generating capacity. As a privately owned Non Utility Generator (NUG) our goal is to meet those needs at a cost that will be less than it would cost the utility to provide the same capacity. The NUG assumes all development risks and guarantees the cost of the project to be less

than the avoided cost of the utility. If the capacity can be provided by another NUG at less than our cost but in the same time frame then the KCP project will probably not be allowed to proceed.

A coal fired plant was considered and proposed by KCP as a cost effective alternative. This alternative was eventually rejected because of protracted negotiations with HELCO and the long lead time required for construction. KCP through Waimana Enterprises, Inc. was involved with the Wailuku River Hydroelectric Project which became fully operational in May 1993. While additional hydro projects can be developed all potential river sources are located on the east side of the island. Other alternative energy sources such as wind and ocean technology are not technologically advanced enough to provide power generation on a utility scale. While geothermal power proves promising it is uncertain that they will be able to meet the time frame of new capacity requirements.

The NUG industry is a highly competitive business which greatly benefits the rate payer by providing competition with the utility resulting in lower electric rates and improved reliability of generating units. Because of the competitive nature of the business, negotiations between the utility and the NUG cannot be discussed publicly. However, we feel that KCP is the only NUG capable of constructing a power plant by 1997 for the following reasons: we are the only NUG who has acquired a site in West Hawaii, started the air permitting process, started the EIS process and performed extensive engineering analyses toward the development of a power plant. We also feel that Kawaihae is the most appropriate site to locate a new power plant and has a realistic schedule for completion. The Board of Water Supply is studying a proposal to bring water from Hawi to the South Kohala District. The estimated cost to transport 20 mgd is more than 70 million dollars.

While the alternatives discussed above shows a justification for the proposed project, the goals and benefits that this project is attempting to achieve cannot be met by any other proposal. The first goal is to meet the need for power generation, which the utility has identified, by providing a reliable source of electricity. The second goal of the project is to provide significant benefits to Native Hawaiians through leasing and building the project on DHHL lands in Kawaihae. A secure source of water from desalination will be made available to the DHHL to support their Master Plan for Kawaihae. Without water, DHHL's plans to develop Kawaihae so Beneficiaries can return to the land will not be possible. This project will also provide employment for Native Hawaiians who decide to make their home in Kawaihae and will also provide a significant source of income for DHHL to use toward development of all their lands. The lease revenues from this project alone will provide more than a quarter of all the lease revenues generated throughout the State. As a Native Hawaiian owned company, we feel that the goals we are attempting to achieve are of equal importance. With this in mind there are no other alternatives concerning site location or generation technology that will feasibly meet the goals of this project.

Long Term Plan

The project does not have a firm commitment for use of the remaining area and will not be included in the assessment. KCP will assure that any future development will be in keeping with DHHL's designation of industrial use for the area. Any future developments will be subject to applicable government regulations and permitting processes.

The Hawaiian Homes RFP stated that the use be limited to power plant and appurtenant facilities of sufficient detail that a determination can be made that a proposal will meet EPA and PURPA requirements. In order to meet PURPA requirements a steam host facility, such as a desalination plant is necessary.

Relationship With Kawaihae Master Plan

The Department of Hawaiian Home Lands EIS was accepted in March 1993. While not addressing the specific impacts, the EIS included an area for the development of the power pant which we are proposing. The Final EA addresses the specific impacts of the project. The master plan designated more than 200 acres for industrial development. One of the concerns identified in their EIS as an unresolved issue is the necessity to secure a source of water to make the master plan a viable one. Currently there is no County water system or sources to support the master plan area. KCP will provide a secure source of water through desalination. A copy of the EIS is provided in appendix A.

Other

The Environmental Assessment, as required by HRS 343, identifies all the potential impacts and mitigative measures associated with operation of the desalination plant. The desalination plant will be designed as an integral part of the power plant and addressed accordingly.

We appreciate the opportunity to address your comments and concerns. Please feel free to contact us if you have any other questions or concerns regarding the proposed project.

Sincerely,

Rodney Kaulupali

J. Tanimoto

TEL 1.808-326-7182 Aug 19,93 15:52 P.01

XC: JR
Ben
Ray

KAWAIHAE HAWAIIAN HOMES HOMEOWNERS
COMMUNITY ASSOCIATION
P. O. BOX 44337
KAWAIHAE, HI 96743
PHONE: 326-7182 (O)

TO: ENVIRONMENTAL PLANNING QUALITY CONTROL
220 S. King St.
Suite 400
Honolulu, HI 96813

DATE:August 19, 1993

REGARDING: OBJECTION TO KAWAIHAE COGENERATION PARTNERS, INC.
DRAFT ENVIRONMENTAL ASSESSMENT

Our membership hereby objects strongly to building an Energy Plant/ Desalinization Water Facility and all ancillary facilities which are planned to be built on Hawaiian Homes Lands in Kawaihae.

1. We request the Department of Hawaiian Homes Lands make a formal presentation to the leasees and community impacted entities before approving any kind of Environmental Impact Statement/Draft Environmental Assessment Report.

2. We request that Kawaihae Cogeneration Partners and Waimana Enterprises, Inc. prepare a new EIS/EA report as the present report fails to include:

Responsibility for the History of Kawaihae.
Responsibility for the Culture of Kawaihae.
Responsibility for the Religious practices that continue today.
Responsibility for the traffic safety, which will involve the Ironman Triathlon which monopolizes the vehicle accesses in Kawaihae.

Traffic safety regarding the community recreational parking needed seasonally.

Traffic safety in case of an emergency. Kawaihae has only one artery through Kawaihae past the Harbor and to the homestead residential lots.

Responsibility for interim safety and welfare of residents in the community such as: fire, monitoring, law enforcement, security, etc.

What happens in case this Development fails to do what it predicts it will do?

3. We are concerned with the visual effects this facility will provide.

The question of how high the smoke stacks will be?
The Hawaiian Homes "Draft" Master Plan presently reveals an assortment of residential lots, community park, community shopping Plaza, etc.

/2

3. (Continued)

Just as topsoil and coral are easily blown across the highway so will the smoke provide a screen of fog adding to the unsafeness of vehicular traffic, both on the present highway and the planned by-pass road noted in the Draft Environmental Assessment Report.

We are concerned with the visual effect from the hotels along the coast where Tourism will be a factor.

4. We are concerned with the environmental complications this Development will create.

The residential leasees of the future Kawaihae will include peoples who gather from the ocean for food sustenance. We are concerned for the food chain and the effects of injection of heat, wastes, etc.

How much responsibility will be given toward the protection of the spawning areas in Kawaihae?

5. We request that the BENEFICIARIES, both in Kawaihae and the State of Hawaii, be informed and made to understand what BENEFITS will be provided.

We are concerned that this plan, which will be a financial source of revenue, may be used to provide more infra-structure not only in Kawaihae but throughout the State; per the representation of DHHL.

The Kawaihae Hawaiian Homes Homeowners Community Association would appreciate the opportunity to make individual comments regarding this Energy Plant.

Mahalo a nui loa,

Jojo Tanimoto
President

cc: Governor John Waihee
Senator Malama Solomon
Representative Larry Tanimoto

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 24, 1993

Ms. Jojo Tanimoto
President
Kawaihae Hawaiian Homes Homeowners Community Association
P.O. Box 44337
Kawaihae, Hawaii 96743

Dear Ms. Tanimoto,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

1. Kawaihae Cogeneration Partners (KCP) has been meeting with many community groups to discuss questions and concerns with our project. We have already had a very informative meeting with your group. If you would like to hold a follow-up meeting, please call us to schedule a time.

2. The Environmental Assessment discusses the historic and archaeological resources in Kawaihae and the potential impacts on public facilities. Additional information is provided in the Department of Hawaiian Home Lands' (DHHL) "Kawaihae Ten-Year Master Plan EIS" which was accepted in March 1993. The DHHL's EIS addresses the impacts of developing over 2000 acres for residential and commercial/industrial use. While not addressing the specific impacts, the EIS included development of the power plant which we are proposing. The Final EA addresses the specific impacts of the project. The proposed site location will be away from Puu Kohola Heiau and will not impact any religious activities that may take place at the heiau.

   The construction and operation of a power plant is highly regulated and monitored by a variety of Federal, State and local agencies. Should the project fail to meet any permitted conditions the project will be subject to possible financial penalties and closure of plant operations.

3. We have developed as an aid in visual assessment, a computer generated simulation of the project overlaid on pictures of the site which were taken from various vantage points and provided in the Final EA. The views from the various hotels are dominated by the existing white colored harbor facilities and will not be significantly impacted by the plant. Based on the most current

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meteorological data the height of the exhaust stack will be 100'. The emissions generated by the plant will not create any fog that may affect vehicular traffic.

4. The waste water generated by the plant will be injected and regulated by the Underground Injection Control (UIC) program which requires monitoring and reporting of the quality and quantity of injected waste. The UIC permit is issued by the DOH, whose purpose is to assure water quality. Mitigative measures will be taken to minimize the impact of the injected waste water on the groundwater and the marine environment. A cooling tower will be used to reduce waste water temperatures. The waste water temperatures and salinity concentrations will be further reduced by dispersion in the saline aquifer. Dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and whether additional mitigative measures will be required. With the mitigative measures in place we expect the impact on the marine environment to be insignificant.

5. Since the DHHL awarded to Waimana the right to lease 40 acres for the development of a power plant, we have been actively meeting with community groups from Waimea, Kawaihae and Kona to answer questions and concerns about the project. This project will benefit all native Hawaiian Beneficiaries not only by the financial revenue generated but also by providing employment and by serving as an example of the potential benefits that can be derived from DHHL lands and most importantly by working with a Native Hawaiian owned company. The actual disposition of the lease revenues are determined by the DHHL.

We would like to thank you again for your review of the Environmental Assessment. Please feel free to contact us if you have any more questions concerning the proposed project.

Sincerely,

Rodney Kaulupali

LIFE OF THE LAND

att: Linda Chinn
Dept. of Hawaiian Home Lands
335 Merchant Street
Honolulu, HI 96813

Aug 7, 1993

Dear Ms. Chinn;

We have reviewed the Draft Environmental Assessment for the proposed Kawaihae Cogeneration Plant on the Big Island. Whereas the document is instructive and readable, we are amazed that it does not recognize any potential for significant environmental impact. Does your department know of any major fossil fuel power plant projects in the state of Hawaii which have triggered HRS 343, but which were deemed to have no significant environmental impact?

Here are a few areas where the assessment is deficient, and where we believe there is a substantial likelihood of environmental impacts.

1) Fuel supply: Page 19 of the draft EA indicates that fuel will be pumped directly from barges to the storage tanks at the facility via underground fuel piping. This may well be a good idea, but there is no description in detail of how or where this fuel piping system will be constructed. Obviously there is a very real element of environmental concern about such a proposal.

2) Visual aspect of the stack: Page 70 of the draft EA concedes that the visual impact of the stack from both Kawaihae Road and Akoni Pule Highway "would be brief but probably dominant". Are we to believe that a dominant smokestack is not a significant environmental effect? Note that the Puukohola National Historic Site is within a mile of the proposed smokestack.

3) Airborne pollutants: Page 53 if the draft EA states that preliminary data qualifies the proposed facility as a "new major stationary source" of pollutants, based on the federal Clean Air Act. Now how can such a facility not qualify for an EIS?

4) Injection wells: We have seen the very real environmental impacts associated with injection wells on Maui. In this project the injected fluids are described on page 43 of the draft EA. "All wastewater will be certified non-hazardous prior to injection." How is this certification of ALL wastewater to be accomplished? Does

19 Niolopa Place, Honolulu, Hawaii 96817. Tel. 595-3903

the author of the EA realize that "non-hazardous" is not the same criteria as environmentally insignificant?

5) The desalination plant: This plant must also be environmentally evaluated since its operation is clearly a secondary impact of the cogeneration plant. Page 8 of the draft EA indicates that the desalination plant "will be built as a part of the project, but owned and operated separately." *According to HRS343 the potential* environmental impacts of the proposed desalination plant must also be evaluated thoroughly. This has not been done.

6) Use of the groundwater aquifer: Page 12 of the draft EA tells us that 10.4 million gallons per day will be pumped from the ground water aquifer. There is clearly a potential for impact from such a large withdrawal of water.

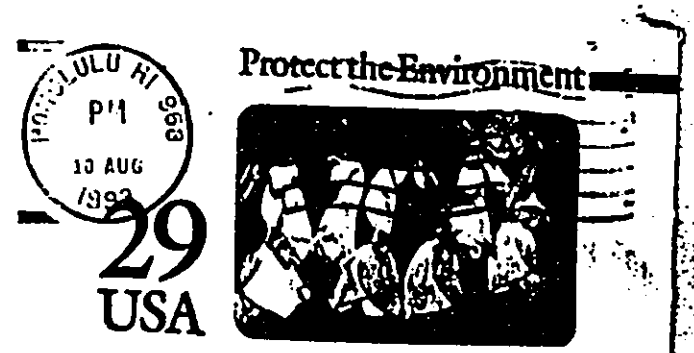
We ask you to please recognize that an EIS preparation notice is appropriate for this project, not a negative declaration. We also hope you are aware of the rising community interest and concern about this project.

Sincerely,

Bill Graham 884-5557

Bill Graham, Big Island director
Life of the Land

LOL - Graham
Box 155
Hawi, HI 96719



Linda Chow
Dept of Hawn Home Lands
335 Merchant St.
Honolulu, HI 96813

Save the Rain Forests

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

August 17, 1993

Mr. Bill Graham
Life of the Land
P.O. Box 155
Hawi, Hawaii 96719

Dear Mr. Graham,

Thank you for submitting your comments on the Draft Environmental Assessment for the proposed cogeneration power plant project at Kawaihae. We would like to take this opportunity to respond to your specific comments.

1. " Does the Department know of any major fossil fuel power plant projects in the state of Hawaii which have triggered HRS 343, but which were deemed to have no significant environmental impact?"

   Response: Most of the power plants currently in operation were constructed before HRS 343 was enacted. However, one example of a power plant constructed after the enactment of HRS 343 and which received a negative declaration is the expansion of Maui Electric's Maalaea Power Generation Facility in March, 1988. The Maui Planning Commission determined the project would not have a significant impact on the environment and an EIS would not be required. The project involved increasing the number of diesel generators by at least 8 more units adding 100 MW of new generating capacity (see attached drawing). More recently, on Oahu the Kalaeloa Cogeneration Power Plant, a 180 MW oil fired combustion turbine plant, was constructed without an EIS.

2. "Fuel supply.....there is no description in detail of how or where this fuel piping system will be constructed. Obviously there is a very real element of environmental concern about such a proposal."

   Response: Fuel will be transferred to the site utilizing either the existing fuel transfer system from fuel barges; or the existing fuel transfer method with updated and improved equipment. Either option will require extending underground fuel lines from the harbor to the site. The present fuel transfer system utilizing underground fuel pipes have been and continue to be used successfully at all harbor facilities throughout the state. Fuel barges are regularly off loaded at Kawaihae Harbor utilizing this method. The alternative to using direct pumping to the site is to truck fuel from fuel storage facilities. This

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alternative is more costly and potentially more hazardous to the public by increased exposure to potential fuel truck accidents and spills.

3. "Visual aspect of the stack....."

Response: We are currently developing overlay pictures of the project onto photos taken from various view points. As stated at the bottom of page 70 the stack and auxiliary buildings will be painted to blend in with the existing landscape. With these mitigative measures in place the view from Puukohola Heiau is expected to be dominated by the existing Kawaihae Harbor facilities. Other methods of visual screening will be investigated such as landscaping and berming along the perimeter of the site. Further more the project is in keeping with future development plans for the area. The Department of Hawaiian Home Land's (DHHL) Final EIS for the development of the Kawaihae area was recently accepted by the Office of the Governor. The EIS designated more than 200 acres mauka of Kawaihae Road for industrial development which included possible development of a power plant.

4. "Airborne pollutants: .....preliminary data qualifies the proposed facility as a "new major stationary source" of pollutants, based on the federal Clean Air Act. Now how can such a facility not qualify for an EIS?"

Response: Plant emissions are regulated by the Department of Health through the permit for Prevention of Significant Deterioration (PSD). The criteria was established by the Clean Air Act and implemented by Federal and State agencies. Maximum project emissions must be maintained below the levels set by federal and state regulations or the project will not be allowed. The maximum allowable levels of emissions are designed to protect public health with an adequate margin of safety thereby minimizing impact to the environment. If the project exceeds the allowable levels the PSD permit and the project will not be approved. The requirement for complying with HRS 343 is the use of State land.

5. " Injection wells: ....How is this certification of all waste water to be accomplished? Does the author of the EA realize that "non-hazardous" is not the same criteria as environmentally insignificant?"

Response: Monitoring and reporting requirements will be required by the Department of Health for the use of an injection well. A daily record of the quantity of injected fluids will be maintained. Samples of injection fluids will be routinely collected for analysis and determination of chemical make-up. The waste water injected will be a concentrated form of the water withdrawn from the supply wells.

6. "The desalination plant: This plant must also be environmentally evaluated since its operation is clearly a secondary impact of the Cogeneration plant.....According to HRS 343 the potential environmental impacts of the proposed desalination plant must also be evaluated thoroughly."

   Response: The design of the desalination plant must be integrated with the design of the power plant to optimize overall plant performance. The operation and impacts of the desalination plant are discussed on pages 12, 15, 23 to 26, and 43. The by-product of desalinating water is brine consisting of concentrated minerals already found in the groundwater. The brine will be diluted with supply water before re-injection.

7. "Use of the groundwater aquifer:....10.4 million gallons per day will be pumped from the ground water aquifer. There is clearly a potential for impact from such a large withdrawal of water."

   Response: As stated on page 40 the supply wells will be drilled into the saline groundwater aquifer which consist mainly of ocean water. The brackish basal water (which is not suitable for drinking) is expected to be a thin lens overlying the saline groundwater.

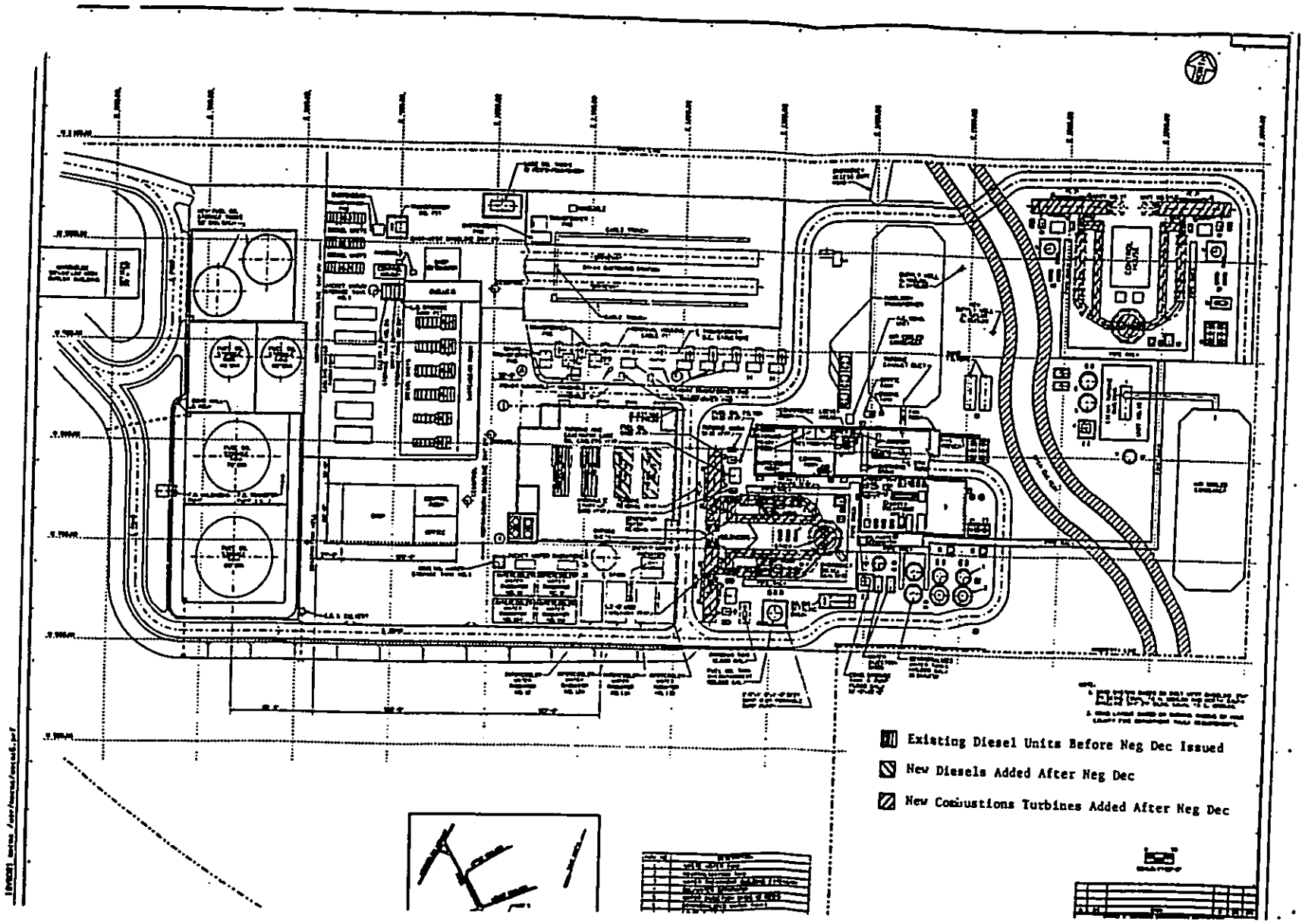
There appears to be some confusion with the usage of "significant impact" or "not significant impact". In preparing the Environmental Assessment we use the quidelines prescribed by the Office of Environmental Quality Control (OEQC) in determining whether an impact is significant. Our interpretation of the requirements is that if the project meets the regulatory limitations set by the permitting process as in the PSD permit the action will not have a significant impact on the environment.

Thank you again for taking the time to review the Draft EA. Please feel free to contact us if you have any other questions or comments regarding the proposed project.

Sincerely,

Rodney Kaulupali

w/attachment
cc: Ms. Linda Chinn (DHHL) w/attachment
cc: Mr. Brian Choy (OEQC) w/attachment


Existing Diesel Units Before Neg Dec Issued
New Diesels Added After Neg Dec
New Combustions Turbines Added After Neg Dec

Richard Prohoroff
BOX 44611
Kawaihae Hi 96743

Aloha

With sincere interest I learn of late become aware of Hawaiian Homes lease for a co-generation plant at Kawaihae. The waiving of an E.I.S. seems an unconscionable position as the reinjection of millions of gallons of water in such close proximity the sea surely poses a potentional threat to marine life.

The Kawaihae harbor area is a nursery ground for numerous species of fish. Halalu, Nehu, Oio mullet, awa, are some of the more important. Many fish also breed here. The currents near Kawaihae are often weak or nonexistant. The same water remains in the area on occasions for weeks at a time. The fish breed and bear young here because the oftimes reduced salinity provides eggs and juviniles an easier enviorment at the most vulnerable time of their lives.

I would appreciate being informed of how OHA is addressing the impact of the waste water on the ocean.

Your Truly
Richard Prohoroff

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Richard Prohoroff
P.O. Box 44611
Kawaihae, Hawaii 96743

Dear Mr. Prohoroff,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

Response

The project intends to inject wastewater and will be regulated by the Underground Injection Control (UIC) program which is administered by the Department of Health and has as a requirement continuous monitoring and reporting of the quality and quantity of injected wastewater. Mitigative measures will be taken to minimize the impact of the injected waste water on the groundwater and the marine environment. A cooling tower will be used to substantially reduced waste water temperature to near harbor water temperature. The waste water temperatures and salinity concentrations will be further reduced by dispersion in the saline aquifer. Dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and whether additional mitigative measures will be required such as further dilution with additional supply water.

We would like to thank you again for your review of the Environmental Assessment. Please feel free to contact us should you have any other questions concerning the proposed project.

Sincerely,

Rodney Kaulupali

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DEPT. OF HAWAIIAN
HOME LANDS
AUG 25 8 08 AM '93

ARTHUR F. KEPO'O
P.O. BX 2685
KAMUELA, HI. 96743

DEPARTMENT OF HAWAIIAN HOME LANDS
335 MERCHANT ST
HONOLULU, HAWAII 96813
ATTENTION: LINDA CHINN (586-3820)

RE: KAWAIHAE COGENERATION PLANT DRAFT ENVIRONMENTAL ASSESSMENT

DEAR LINDA CHINN,

MY NAME IS ARTHUR F. KEPO'O, ADVISOR TO HUI MAKA KILO INC., WHO IS A NATIVE HAWAIIAN NON-PROFIT COOPERATION, WHOSE PURPOSE, OF WHICH ARE MANY IS TO "MALAMA KA AINA."

IN BEHALF OF IT'S 150 MEMBERS, WE SPEAK AGAINST THE CONSTRUCTION OF THE POWER PLANT AS SO SUBMITTED BY KAWAIHAE COGENERATION PARTNERS.

IN REVIEWING THE KAWAIHAI COGENERATION PLANT DRAFT ENVIRONMENTAL ASSESSMENT DATED JUL 23 1993, WE ARE DEMANDING THAT MORE STUDIES BE MADE BY THE APPLICANT AND ANSWERS BE GIVEN TO US ABOUT OUR CONCERNS, FOR THE PERSEVERATION AND THE PERPETUATION OF OUR HAWAIIAN CULTURE, NOW AND EVERMORE.

THE QUESTIONS ARE AS SO LISTED BELOW.

1. PAGE 3, WHY 40 ACRES? WHY 122 ACRES OF STUDY, WHILE THEY ARE SPEAKING OF 15 ACRES? (A NOTE OF INTEREST HERE IS THAT, THE 40 AND 122 ACRES ARE FIGURELY WRITTEN, WHILE 15 ACRES ARE WRITTEN.)

2. PAGE 3 WHY IS THE NAME (KCP) KAWAIHAE COGENERATION PARTNERS IS NOW USED,

WHILE JUST LESS THAN FOUR WEEKS AGO, MR. HEE PRESENTED HIS COMPANY AS BEING WAIMANA?

3. PAGE 6. ACCODING TO THIS MAP THE BULL'S EYE OR THE CENTER OF THE STUDY SITE AND AT WHERE THE PLANT IS TO BE BUILD IS ABOUT 1,000 FEET AWAY FROM THE PROPOSED SMALL BOAT HARBOR OFF-SHORE FACILITY SITE AND ABOUT 2,000 FT SOUTH OF AND AWAY FROM PUU KOHOLA HEIAU, WHAT ARE THEIR PLANS OF PREVENTING DESTRUCTION OF THE HEIAU NOW OR IN THE FUTURE?

4. PAGE 10. IN THIS EXHIBIT III-6 AND IN THE SECOND SKETCH FROM THE RIGHT AT WHERE THE CONTROL BLDG IS LOCATED. TOWARDS THE RIGHT AND ON THE LOWER RIGHT OF THIS SKETCH, THERE IS MENTIONED OR SKETCH "AMMONIUM". WHAT IS THIS? FOR WE KNOW "AMMONIA ENCLOSED IS EXPLOSIVE, PLEASE EXPLAIN.

5. PAGE 16 AND 21. ACCORDINGLY TO THE DIAGRAM ON PAGE 16 AND AS SO STATED ON PAGE 21, THE PLANT WASTEWATER SYSTEMS THE MAXIMUM WASTEWATER OF APPROXIMATELY 7.5 MILLION GALLONS PER DAY, AND ON PAGE 23, OF 6 MILLION GALLONS PER DAY OF DESALINATION BLOWDOWN WILL BE

DISCHARGED INTO THE REINJECTION WELL. THE QUESTION IS HOW CAN THIS BE DONE. IT IS LIKE FORCING A PIPE BACK INTO THE GROUND WHICH IS NEAR THE WATER TABLE AND OVER A PERIOD OF ONE (1) WEEK, THAT WOULD MEAN SOME MORE THAN 42 MILLION TO 49 MILLION GALLONS OF WATER TRYING TO GET BACK INTO WHERE? THE OCEAN. THE QUESTION IS, HOW IS THIS POSSIBLE? WON'T THEY BE BUILDING HOLDING TANKS OR PONDS OR EVEN TRENCHING AND LAYING LARGE PIPES TO FACILITATE THIS VOLUME OF WATER?

6. PAGE 6. THE SAME QUESTION AS IN THE ABOVE, THIS TIME THE VOLUME INCREASES.

7. PAGE 23. PLANT AND EQUIPMENT DRAINS. IN THE LATTER YEARS OF 1980, WE HULIMAKA KILO INC., QUESTIONED CHEVRON INC, AND PRRI REGARDING THIS SAME QUESTION. BUT YOU MUST REMEMBER THESE TWO COMPANIES WERE IN EXISTANCE AND THEY HAD BUILT CONCRETE PADS AND HOLDING TANKS TO DO WHAT (KKCP) IS TRYING TO SAY BUT THEY HAVE NOTHING TO SHOW HOW BE IT BUILT OF ON THEIR PLANS. THE QUESTION THEREFORE

IS, HOW WILL THEY COLLECT THE CITY RESIDUE, AND HOW WILL THEY GET IT INTO THE TRUCKS TO BE HAULED AWAY?

8. PAGE 23. PLANT AND EQUIPMENT DRAINS, SAME QUESTION AS ABOVE MENTIONED. HERE WE WOULD LIKE TO INTERJECT, THAT WITH CHEMON AND PIRI, WE WERE TAKEN TO THE SITES AND SHOWN OF THEIR METHODS. BUT WITH THIS DRAFT NOTHING SHOWN NOR FURTHER EXPLAINED, ARE THEY TAKING FOR GRANTED THAT NOTHING IS ASKED CRITIC THEY BUILD THE PLANT AND THE PROBLEMS OCCURES AND THAN THEY WILL CORRECT IT.

9. PAGE 33. SURFACE RUNOFF ARE THEY PLANNING OF THROWING THESE RUNOFFS BACK INTO THE OCEAN? FROM OUR COOPERATION'S EXPERIENCE WE HAVE ASKED AND DIRECTED THAT THESE RUN-OFF BE CAPTURED AND SENT BACK TO THE SEWAGE SYSTEM, PREVENTING FURTHER POLLUTING OUR FISHING AREA AT KAUMAHAE.

10. PAGE 31. THE HAWAIIAN TEMPLE AND JOHN YOUNG'S HOUSE REMAINS, BEING THAT THEY SO CLOSE TO THE PLANT, ARE PLANNING TO PREVENT POLLUTION'S

DESTRUCTION OF THESE?

PAGE 42. SAME QUESTION ASKED EARLIER ABOUT THE INJECTION WELLS, HOW CAN IT BE POSSIBLE?

PAGE 42. SAME QUESTION AS ASKED EARLIER ABOUT THE CAPTURING AND THE STORAGE OILY WASTES

PAGE 45 SAME QUESTION AS ASKED ABOUT THE CAPTURING AND THE STORAGE OF OILY WASTE TO TRUCKED AWAY?

PAGE 72 ACCORDING TO THE LAST SENTENCE AND THE ONE PRIOR TO THAT OF THE SECOND PARAGRAPH IN WHERE IT READS "AREA THERE ARE FOUR HAWAIIAN HOMESTEAD HOUSING UNITS, THE QUESTION IS: "IS THE LEASE INCLUDED OF THESE FOUR? AND WHERE THESE PEOPLE GIVEN A NEW LEASE? ARE THEY BE PUT OUT OR DISPLACED

PAGE 87. THE SECOND TO THE LAST PARAGRAPH STATES THAT "THE PROPOSED PROJECT WILL HAVE NO SIGNIFICANT ADVERSE EFFECTS ON GROUND WATER RESOURCES, MARINE ENVIRONMENT THIS IS WHAT WE QUESTION. HAS THERE STUDIES BEEN MADE REGARDING THE ADVERSE IMPACTS IT WILL MAKE ON THE "NEHU" POPULATION AT THE SHORELINE NEAREST THE END OF THE HARBOUR CORNER?

PAGE 67 According to the lower or second photo on this page. The question, with the increase of power (electrical) put out by the plant, would not the visual conditions changed as to the placing of more or even large transmission lines at that area? would not the increase affect the culture of the native Hawaiians, less to mentioned the beauty of the area.

PAGE 19 and page 20. According to written statements as so printed on page 20 contradicts the statement as printed on page 19. The question is on one page (page 19) it is written that the storage tanks, made of carbon steel, will be 50 feet tall, while on page 20, it is printed, that equipment enclosures and buildings will not exceed 40 feet in height. How can this be? can this people be trusted in their endeavor? If the highest structure is 50 feet, than the stack must be no lesser than 150 ft. Now, because of the fact that the elevation towards the mountain's side increases very sharply, the question than is, would a stack of 150 feet be suffice to lessen the pollutants? Also, being that there is a village situated south of the study area at the present time, what impact would it be on that village?

AND WHAT ABOUT THE NOISES? SURE, THE EA SAYS DIFFERENT, BUT WHAT HAPPENS, WHEN THE PLANT BEGINS TO OPERATE?

BECOUSE OF THE SHORTEST OF TIME FOR US TO ~~SEEK~~ MANY QUESTIONS AND CONCERNS, WE ARE PUSHED FOR TIME. GIVEN THE EA IN LESS THAN A WEEK TO REVIEW IS AN INJUSTICE TO THE INHABITANTS AROUND THE AREA AND THE FUTURE INHABITANTS.

THEREFORE, IT IS HERE AND PRAYED THAT THIS WILL BE ACCEPTED.

MAHALO,

[signature]
ADVISOR
HUI MAKA KILO INC.

23 AUG 1993

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Arthur F. Kepo'o
P.O. Box 2685
Kamuela, Hawaii 96743

Dear Mr. Kepo'o,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

1. A proposed 40-acre site location will be provided in the Final EA and the impacts assessed based on the proposed site location. While the project does not have a firm commitment to expand beyond the proposed 58 megawatt (MW) plant, any future developments will be subject to applicable government regulations and permitting processes.

2. Waimana Enterprises, Inc. and Diamond Energy, Inc. joined resources to form a limited partnership under the name of Kawaihae Cogeneration Partners (KCP). The sole purpose of the partnership is to develop the proposed cogeneration facility at Kawaihae. The 40 acre lease was awarded to Waimana for the purpose of developing a power plant.

3. The proposed 40-acre site location is approximately 3000 ft. from Puu Kohola heiau. The potential physical impacts from the project on the heiau are from plant emissions and construction operations. Plant emissions are regulated and limited to levels that are designed to protect public health and welfare which includes such considerations as impacts to vegetation, animals, visibility, and comfort. KCP has taken steps to design this power plant with additional pollution control devices which are not required by the permitting agencies. This power plant will be the cleanest operating fossil fuel plant on the island. The emissions generated by the plant will be maintained at levels that will prevent significant impact to the heiau and surrounding areas.

   Vibration can be a major cause of problems at a power plant. Due to the close tolerances under which equipment operate, power plant facilities are designed to minimize and/or eliminate vibration.

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4. The plant will use ammonia for the control of nitrogen oxide emissions. A detailed review of emissions control technology is part of the Department of Health's and EPA's permit requirement and involves determination of the best available control technology (BACT) for all pollutants. The BACT for nitrogen oxide emissions is considered to be the use of steam or water injection together with selective catalytic reduction (SCR). The use of SCR requires ammonia injection. The project will require facilities for the handling and storage of ammonia and will be required to file a Chemical Inventory report with the Office of Hazard Evaluation & Emergency Response of the Department of Health.

   Ammonia is used with many applications in industry and for that reason there are procedures for handling, storage and design considerations for a safe and reliable operation. Ammonia is extremely difficult to ignite and is a relatively stable compound. Conditions favorable for ignition are seldom encountered during normal operations. An automatic deluge sprinkler system will be provided as well as other safety features to prevent overheating and overpressurization and to contain potential leaks.

5. The capacity of supply and injection wells depend on the dispersal properties of the subsurface geology and hydrology. It is anticipated that the geology will be similar to nearby areas where data is available that show the geologic formation consists of highly porous basalt formations. Supply/injection well capacities will be verified during well installation and testing.

6. It is not clear what the question is.

7. All plant areas that can be contaminated with oil will be segregated from the rest of the plant by berms or dikes. Drains from these areas will also be segregated from other plant drains and routed to an oily waste separator. Separators will contain a coalescing medium that improves separation by coalescing small oil droplets into larger ones. Periodic disposal of the oil waste will be contracted out to a private disposal company who will remove the oil waste by pumping into transport trucks.

8. Oil separators, as described in the EA, are commonly used at many industrial facilities throughout the state. KCP intends to comply with all applicable government regulations concerning the disposal of industrial waste products. We have, however, described the design considerations taken to assure a safe and environmentally clean and acceptable operation. The methods described in the EA are considered proven and acceptable designs.

9. Surface runoff from the site will be minimized by limiting the amount of paved area which tends to increase runoff. All storm water runoff will be regulated in accordance with the requirements of the National Pollutant Discharge

Elimination System (NPDES) permit, issued by DOH. As previously discussed, all plant areas that can be contaminated with oil, will be segregated from the rest of the plant by berms or dikes. Water accumulated in these areas will be tested and either routed to the oily waste separator or to the storm water disposal system. Drains from these areas will also be segregated from other plant drains and routed to an oily waste separator.

10. The process to meet the requirements of the permit for Prevention of Significant Deterioration (PSD) addresses the levels of allowable plant emissions which are designed to protect public health and welfare and to prevent the significant deterioration of air quality. If the project exceeds the allowable levels set by the national ambient air quality standards, the project will not be approved for construction or operation. The air permits will recognize and take into account the existence of a National Historic Site.

11. As discussed earlier, the capacity of supply and injection wells depends on the dispersal properties of the subsurface geology and hydrology. Well capacities will be verified during well installation and testing.

12. As discussed earlier, all water contaminated with oil will be collected in the oily waste separator and disposed of properly.

13. It is not certain what this question refers to on page 45.

14. Relocation plans of any homesteaders will be developed inconjunction with DHHL's Master Plan.

15. The injected waste water is regulated by the Underground Injection Control (UIC) permit which requires monitoring and reporting of the quality and quantity of injected water. Mitigative measures will be taken to minimize the impact of the injected waste water on the groundwater and the marine environment. A cooling tower will be used to reduce waste water temperatures. The waste water temperatures and salinity concentrations will be further reduced by dispersion in the saline aquifer. The aquifer that the waste water will be injected into is unsuitable for either drinking or irrigation purposes and will not be significantly impacted by the salinity concentrations of the waste water. Actual dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and whether additional mitigative measures will be required. With the mitigative measures in place the potential impact on the marine environment will be insignificant.

16. The location, configuration and cost of the transmission lines are currently being negotiated with HELCO. The project intends to use existing transmission facilities and right-of-ways to minimize cost and impact on the environment.

Using the same transmission corridor will also minimize the visual impact if additional lines are required. Use of the same transmission corridor will minimize any impact from the heiau.

17. The maximum height of 40' apply only to buildings. The statement will be revised to include the 50' high fuel storage tank. Based on the most current meteorological data, the exhaust stack height will be 100'. Simulations of the project will be overlaid on pictures of the site taken from various vantage points and provided in the Final EA.

The permit for Prevention of Significant Deterioration (PSD) addresses the levels of allowable emissions. As one of the requirements of the PSD permit one year of air data must be collected to be used in air quality modelling analyses. The air quality modelling analyses addresses actual terrain conditions and nearby structures.

18. There are many methods to mitigate noise transmission some of which were mentioned in the EA. A noise transmission study will be performed by our engineering staff to determine the level of mitigation required to achieve 70 dBA at the property line during plant operation. Buffer zones with landscaping and berming will also be investigated as methods to mitigate both noise and visual impacts.

We appreciate having the opportunity to address your comments and concerns. Please feel free to contact us if you have any other questions regarding the proposed project.

Sincerely,

Rodney Kaulupali

DEPT. OF HAWAIIAN HOMES
AUG 25 8 09 AM '93

ARTHUR F. KEPO'O
P.O. BX 2685
KAMUELA, HI. 96743

DEPT. OF HAWAIIAN HOMES LANDS
335 MERCHANT ST.
HON. HI. 96813
ATT: LINDA CHINN (586-3820)

ALOHA LINDA CHINN,

MY NAME IS ARTHUR F. KEPO'O. I WAS THE COMMANDER OF "NA KOA O PU'U KOHOLA" A YEAR AGO, BUT AS AUGUST 13, 1993 I WAS PROMOTED TO THE RANK OF "ALII O NA KOA" THE CHIEF OF ALL WARRIORS, BOTH LAND AND SEA. AS SUCH, THE "NA KOA O PU'U KOHOLA" COMES UNDER ME.

ALSO, A YEAR OR MORE AGO, WHILE COMMANDING THE "NA KOA" I TESTIFIED AT SENATOR HOLT'S HEARING ON THE KAWAIHAE SMALL BOAT HARBOR, DUE MY PARTICIPATING AT THAT HEARING, THE "NA KOA" BECAME AN OFFICIAL MEMBER OF THE KAWAIHAE DEVOLPING TASK FORCE ASSICLED BY SENATOR SOLOMON. THIS ALSO MADE THE "NA KOA O PU'U KOHOLA" A MEMBE OF THE KAWAIHAE COMMUNITY COUNCIL, CONSISTING OF MORE THAN ONE DOZEN COMMUNITY ORGANIZATIONS AND OTHER CLUBS OF THE COMMUNITY.

THE PURPOSE OR THE MISSION OF "NA KOA O PU'U KOHOLA" IS TO MALAMA THE HEIAU AND ALL IT STANDS, AND TO PERPETUATE THE CULTURE AS WAS DURING THE DAYS OF KAMEHAMEHA THE GREAT.

THEREFORE, WE SPEAK AGAINST THE POWER PLANT. WE HAVE QUESTIONS PERTAINING TO CULTURAL AND ARCHAEOLOGY. PAGE 65 OF THE EA STATES THAT 'GROUND DISTURBANCE RESULTING FROM THE PROPOSED GENERATING FACILITY WILL BE LIMITED TO ABOUT 10 TO 15 ACRES, HOWEVER, THE RATIONALE GIVEN FOR A 40 ACRE SITE WAS FOR "FUTURE EXPANSION." THIS IS A CONTRADICTION. IF GROUND

DISTRUBANCE WILL BE LIMITED TO NOT MORE THAN 15 ACRES, THEN THE SIZE SHOULD BE ALSO BE LIMITED TO NO MORE THAN 15 ACRES AND NOT 40. ALSO, WHY IS THE STUDY AREA 122 ACRES? IS IT BECAUSE THE EXACT METES AND BOUNDS OF THE 40 ACRES HAVE NOT YET BEEN DETERMINED? IF SO, HOW CAN THERE BE A REASONABLE EVALUATION OF IMPACTS WHEN THOSE FACTORS WHICH INFLUENCE IMPACTS CHANGE WITH THE EXACT LOCATION OF THE SITE?

ALSO, BECAUSE OF THE DISTANCE OF SOME 2,000 FT OF WHICH THE SITE IS FROM THE HEIAU, WON'T THERE BE VIBRATION DURING THE CONSTRUCTION STAGE AND EVEN THEREAFTER, DURING THE BLOW-OUTS, THE RELEASING OF PRESSURE? THE NATIONAL PARK STOPPED AIR ACTIVITIES ON, ABOVE, AT, NEAR OR AROUND THE HEIAU, DUE TO THE VIBRATION THAT THEY WILL CAUSED. WHAT ABOUT THE POWER PLANT'S VIBRATION? THERE IS NO WHERES IN THE EA ANSWERS THIS QUESTION.

WE KNOW FOR SURE, THAT OVER A PERIOD OF TIME, OUR HEIAU WILL CRUMBLE.

WHAT ABOUT THE EMISSIONS DO ANYTHING TO DAMAGE THE PETROGLYPHS OR ANY ARTIFACTS? WHAT ABOUT THE POLLUTANTS WILL THEY CAUSE DAMAGE TO THE HEIAU OR OTHER SIGNIFICANT HISTORICAL SITES.

THESE PEOPLE, ALTHOUGH NATIVE SEEMS AS THOUGH THEY CARE LESS FOR THE MAINTAINING AND THE PERPETUATING THE CULTURE THAT MAKES HAWAIIANS, HAWAIIANS KANAKA MAOLI.

WE PRAY THAT AS CUSTODIANS OF PU'U KOHOLA HEIAU, THAT YOU PEOPLE WILL HEAR US OUT, "NO POWER PLANT IN KAWAIHAE, TOO CLOSE TO THE HEIAU AND IT'S SUPPORTING HISTORY.

MAHALO NUI LOA,

[signature]

'ALII O NA KOA

PU'U KOHOLA HEIAU"

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Arthur F. Kepo'o
P.O. Box 2685
Kamuela, Hawaii 96743

Dear Mr. Kepo'o,

This is in response to your second letter as the Commander of Na Koa O Pu'u Kohola. We would like to respond to your comments as follows:

Response

A proposed site location for the 40 acre of leased parcel will be provided in the Final Environmental Assessment. The project does not have a firm commit for the entire use of the 40 acres and will not be considered in the assessment at this time. KCP will assure that any future development will be in keeping with the Department of Hawaiian Home Lands designation for industrial use for the area. Any future developments will be subject to applicable government regulations and permitting processes. The general arrangement of the plant and the proposed site location will be provided in the Final EA.

The proposed site location is approximately 3000 ft from Puu Kohola Heiau. The location was chosen to provide the maximum distance from the heiau, a low elevation to minimize visual impact and impact on cultural sites, and an adequate buffer zone from the present and future commercial development area. The proposed site location is at such a distance from the heiau that will preclude any impacts from construction or plant activities.

The allowable levels of pollutants emitted by the plant are designed to protect public health and welfare and to prevent the significant deterioration of air quality which includes such considerations as impacts to vegetation, animals, visibility, and comfort. If the project exceeds the allowable levels set by the national ambient air quality standards the project will not be approved for construction of operation. KCP has taken steps to design this power plant with additional pollution control devices which are not required by the permitting agencies. This power plant will be the cleanest operating fossil fuel plant on the island. The emissions generated by the plant will be maintained at levels that will prevent significant impact to the heiau.

Vibration can be a major cause of problems at a power plant. Due to the close tolerances under which equipment operate, power plant facilities are designed to

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minimize and/or eliminate vibration.

Waimana, as a native Hawaiian owned company, sees tremendous opportunity in Kawaihae to provide land for native Hawaiians to build their homes on and to develop industries that will provide jobs for the families that make Kawaihae their home. We believe that malama aina includes making it possible for Hawaiians to return to and live on the land. Doing so will significantly contribute to the preservation and the perpetuation of the Hawaiian culture in Kawaihae.

Thank you again for your review of the Environmental Assessment. Please feel free to contact us if you have any other questions concerning the proposed project.

Sincerely,

Rodney Kaulupali

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

August 20, 1993

Department of Hawaiian Home Lands
335 Merchant Street
Honolulu, Hawaii 96813

Attention: Ms. Linda Chinn

Subject: *Kawaihae Cogeneration Plant Draft Environmental Assessment*

Dear Ms. Chinn:

The announcement concerning the *Kawaihae Cogeneration Plant Draft Environmental Assessment* that appeared in the July 23, 1993, edition of the *OEQC Bulletin* indicated that the Department of Hawaiian Home Lands (DHHL) anticipated that it would issue a Negative Declaration for the project. Our review of the applicant's own Environmental Assessment indicates that such a determination is unsupported by the facts presented in this very general and unscientific document, especially for siting a major new power generation facility.

Our specific comments on the document are attached for your consideration. They raise many important issues relative to the project and the alternatives to it that are not addressed in the Draft Environmental Assessment. We believe that the thorough consideration of environmental effects mandated by Subchapter 6 of the Department of Health's Environmental Impact Statement Rules (§11-200-9 through 13) would show that the project has many potentially significant effects and that an Environmental Impact Statement should be prepared pursuant to the requirements of Chapter 343, Hawaii Revised Statutes.

These impacts include, but are not limited to:

- An irrevocable commitment to loss or destruction of any natural or cultural resource.
- Curtailment of the range of beneficial uses of the environment.
- Potential conflicts with the State's long-term environmental policies, goals, and guidelines as expressed in Chapter 344, Hawaii Revised Statutes.
- Substantial effects on the social welfare of the Kawaihae community.

- Air, water and noise emissions, with the potential to substantially affect public health and degrade environmental quality.

- Inducement of associated actions (e.g., the construction of electrical power transmission lines and fuel off-loading facilities and pipelines) that have cumulative effects on the environment not disclosed in the document.

- Possible effects on the rare, threatened, or endangered species (or their habitat) that previous surveys conducted on behalf of DHHL and others have identified in the region.

- Potentially significant impacts in the environmentally sensitive Kawaihae Harbor area resulting from fuel spills caused by off-loading accidents.

- Potentially significant impacts on the integrity to archaeological and cultural resources in Kawaihae.

- Detrimental effects on air and water quality and on ambient noise levels.

In view of the foregoing, we believe the only reasonable course of action is for the applicant to prepare and process a Chapter 343 Environmental Impact Statement for the proposed project. This would be consistent with the Department of Land and Natural Resource's requirement that an Environmental Impact Statement be prepared for a virtually identical project adjacent to the Keahole Airport. It would also insure that all reasonable alternatives to the proposed action, including development of power generation facilities elsewhere on the island, be given full and complete consideration before a decision is made.

If you have any questions concerning these comments, please call me at (714) 662-4091.

Sincerely,

Jody Allione

cc: Rodney Kauiupali, Kawaiha Cogeneration Partners
Wendle McAllister, DHM, Inc.
Brian J. J. Choy, OEQC

KAWCOGEN

COMMENTS ON KAWAIHAE COGENERATION PLANT
DRAFT ENVIRONMENTAL ASSESSMENT

(1) **Page 3, Paragraph 1, Last Line**. The document indicates an intention to expand the facility in the future, which is the justification for acquiring more than the 15 acres that the document indicates is needed for the 58 megawatt power plant that is proposed. The cumulative impacts of full development of the leased area are not addressed in the document.

(2) **Page 3, Paragraph 2, Line 4**. This states that the location of the proposed facility will be "influenced by the findings of the Environmental Assessment." Since this statement is contained in the environmental assessment being referred to, it is inappropriate. The document should identify the 15 acre area that will be used or, even better address the potential impacts of developing the entire site, since the document suggests that this is the eventual intent of the project's proponent.

(3) **Page 5, Figure III-2**. The labels on this graphic are inconsistent and confusing. For example, the reader is left to guess what the label "DHHL Ten Year Master Plan" refers to. *Queen Ka'ahumanu Highway* appears as a label, but not as a distinguishable route. There is no indication as to what the terms "Industrial", "Business," "Light Industrial," and "Residential" refer to. There are labels for "Kohala Estates," Golf Course," and "Kohala Ranch" without boundaries between them; moreover, some seem to indicate ownership, whereas others refer to use.

(4) **Page 6, Figure III-3**. This figure does not indicate the meaning of "Preservation."

(5) **Page 8, Paragraph 1, Line 1**. "Power" is not a form of energy, and it is certainly not distinguishable from heat.

(6) **Page 8, Paragraph 1, First Full Sentence**. This states that the electrical power from the facility will be sold to HELCO. Waimana Enterprises does not have a power sales agreement with HELCO. In fact, HELCO is attempting to develop its own power source at Keahole, and it is quite possible that the Public Utilities Commission may award the right to construct and operate additional generating facilities to other independent power producers (IPPs). Consequently, the statement is incorrect and misleading.

(7) **Page 8, Paragraph 1, Line 8**. This states that the desalination plant will be built as part of the project but operated separately, thus making it a "qualifying facility." The document does not demonstrate that there is a market for the product of a desalination plant. Neither does it demonstrate that the proposed relationship between power generation and desalination/water manufacture is the kind of "hands-off" relationship that was envisioned by PURPA. Thus, it is questionable whether it will truly be a qualifying facility.

(8) **Page 8, Paragraph 2, Line 4**. The *Draft EIS, Keahole Generating Station Expansion* is identified as the source of the statement that dual train combustion turbines are the most economical type of unit. This documentation is inappropriate, since it is based on a unit which does not envision desalination, has a different situation with respect to transmission facilities interconnections, and is otherwise materially different from the facilities that are proposed at Kawaihae.

(9) **Page 10, Figure III-6**. The figure is floating in space, making it impossible to judge effects that are dependent upon the relationship of the specific elements (e.g., cooling tower, fuel oil storage tanks, etc.) to existing features and adjacent uses. Since this is the only environmental document that will be required, it should be based on a final site plan, or on alternative plans, if several are under consideration.

(10) **Page 12, Paragraph 2**. The stack height range given (50 to 150 feet) is far too broad. The vagueness makes it impossible to ascertain the visual impacts of the facility. It also precludes meaningful analysis of the air quality effects of the proposed project, a limitation which is readily apparent in the overly general discussion of the project's effects on air quality.

(11) **Page 12, "Water Systems"**. The way in which the discussion of the water system has been split between this chapter and the impact analysis presented later in the report makes it difficult to understand. It should be presented in one place, or at least cross-referenced. The many figures relating to the water balance, which should be helpful, are not because they present a fragmented picture. The absence of quantitative information about flow rates in each stream further limits their usefulness.

(12) **Page 15, Paragraph 1, First Sentence**. The report says that the water will be made available to a third party. It does not indicate who that might be, how the water would be delivered to it, where it would be stored pending delivery, or the reasons why such a sale are believed to be economically viable. Neither does it discuss the permits and approvals that would be required for such a water system nor document any discussions that may have been had with the operator of such a system. If water supply is a principle objective of the proposed project, the alternatives to it need to be discussed as well.

(13) **Page 15, Last Line**. What is meant by the statement that "water is circulated to the desalination plant and back"? What is the purpose of the exchange? Is this a closed loop, or is there an exchange?

(14) **Page 19, Paragraph c., Line 1**. The figure quoted is for baseload operation. Was this figure chosen because it represents the highest fuel consumption rate or because there is an agreement with HELCO that the utility will use it as a base load unit?

(15) **Page 19, Paragraph c., Last Line**. What route will be followed by the line? Are there existing fuel oil offloading facilities or are new offloading facilities required? Who will own it? Has a right-of-way been granted by the Department of Transportation? What kind of design will be used? What provisions will be made to prevent leakage? What clean-up equipment will be on-site? What provision for preventing fuel offloading accidents and cleanup? Because of the sensitivity of the coastal area, a risk analysis for fuel oil offloading accidents is required.

(16) **Page 19, Paragraph 3**. What kind of impermeable membrane will be used to prevent spilled or leaking fuel from reaching the water table and, hence, the ocean?

(17) **Pages 21 through 24**. The introduction to the this section indicates that it will characterize the amount and composition of each wastewater stream. However, the subsections do not describe the specific chemicals that are involved. The discussion of storm runoff is very vague, stating simply that it will be "minimized." Given the nature of

the facility, the relatively steep slopes, and the fact that the discharge will be into the harbor, where water circulation may be slow, a fuller discussion of this is warranted.

(18) **Page 24, Section 6, Second Paragraph**. The routes that would be followed by the new transmission lines are not described. Neither are the kinds of poles that would be used. Transmission facilities are an integral part of all power plants, and they should be described and evaluated in the same level of detail as the other components of the proposed facility. The report should indicate the point at which HELCO has agreed to accept the power into its system.

(19) **Page 27, Last Paragraph**. This paragraph tends towards the self-promotional. In fact, if HELCO agrees to purchase power from the proposed facility, it will assume significant risk in the event the project is not brought to a timely completion. One need look only at the Puna Geothermal project to see the potential effects of a failure to complete the project on time.

The discussion in the previous paragraph indicates that construction will begin in May 1995. Does this mean that construction will be initiated before the air permits are issued by the Department of Health? If so, what parts of the facility must await DOH approval, and when are they scheduled to begin?

(20) **Page 37, Last Two Paragraphs in Section 4**. While not critical, the statement that temperatures at Kawaihae are comfortable throughout the year cannot have been written by someone working outdoors or in an un-air conditioned place during the summer; it is hot.

(21) **Page 38, Last Paragraph, Lines 5-7**. What is the depth at which these tests measured the chloride levels. Immediately before this, the EA indicates that there is a thin lens of brackish water. The description should be clarified.

(22) **Page 39, Last Paragraph, Line 5**. Using groundwater discharge rates determined for the area between Kona and Waikoloa to characterize the situation at Kawaihae is totally inappropriate. If it reflects the authors' true understanding of the groundwater situation, it call the entire analysis into question.

(23) **Page 40, Last Paragraph**. The EA states that groundwater withdrawal at the rate of "...21,000 gpm is sustainable from supply wells" at the site. It further states that "The KCP project withdrawal is less than 9,500 gpm." Page 12 states that the maximum withdrawal rate will be 10.4 mgd; 9,500 gpm is equivalent to 13.68 mgd. Why are they different?

(24) **Page 40, Last Paragraph, Second Sentence**. The document states that the wells will be approximately 150 feet deep. What portion of the depth will be screened for intake? What evidence is there that this will be sufficient to meet the capacity requirements of the proposed project?

(25) **Page 42, Second Paragraph**. No analytical support is offered for the claim that water withdrawals would "..have an insignificant impact on the basal aquifer." What evidence is there that this is true? How large an area (expressed as a radius from the well locations) might the proposed withdrawal affect?

(26) **Page 45, Third Paragraph**. No analysis is offered in support of this conclusion. For example, "significance" is not quantitatively defined, there is no demonstration that the injection will not interact wit the withdrawal (the examples given are in different types of geological formations), etc.

(27) **Page 49, "Potential Impact" Paragraph**. This single paragraph follows four pages of descriptive material, none of which is used in the discussion of impacts. No effort is made to estimate the temperature of the groundwater which would reach the embayment, to discuss the circulation within it, or to show that the organisms present would not be affected. Equally important, there is no discussion of the potential effects that storm runoff from the site would have on water quality and/or marine organisms within the embayment. This aspect of the project, during both the construction and operational periods, appears to be potentially more significant than the items which are discussed.

(28) **Page 50, Second Full Paragraph**. The study on which this discussion was based covered a sizeable area and may, therefore, have been of limited intensity. Is it likely that the *'apapane* and the *'amakihi* are present in the study area? Is it possible that *Partulina physa*, the rare land snail that is mentioned, may be present on the study area. If the answers to these questions are in the affirmative, additional investigation designed to better delineate their range and abundance is necessary before drawing a conclusion as to the significance of the project's impact on biota. The last sentence on page 50 does not make sense.

(29) **Section 8., Air Quality, Page 51, General**. It is not at all appropriate to base the discussion of the air quality impacts of a proposed power plant on a study that was done for DHHL's entire Kawaihae Master Plan. Instead, the environmental assessment should have provided a comprehensive air quality impact analysis comparable to that which has been included in the environmental documentation for other power plants in Hawaii.

The environmental assessment does not present existing (baseline) air quality data, include the results of modeling, or otherwise describe potential impacts. It relies solely on DOH's permit review process as a forum for discussion of these important effects. It does not allow decision makers to determine whether or not the project may have a significant effect; consequently, it does not serve the purpose mandated by Chapter 343, Hawaii Revised Statutes.

(30) **Page 55, First Partial Paragraph**. Since DOH had not approved the monitoring protocol at the time the EA was published, what was the basis of the claim that the meteorological monitoring plan is consistent with EPA's applicable guidelines? Is DOH aware that the site is a "floating" one?

(31) **Page 58, Last Paragraph**. How can the EA conclude that noise levels will not exceed 70 dB(A) at the property line when the location of the equipment relative to the property lines have not been established? The last line of this paragraph says that significant adverse effects can be reduced, but it does nor indicate that they can be eliminated. The presence of significant adverse effects is justification for requiring a full Chapter 343 Environmental Impact Statement for the project.

(32) **Page 59, Third Paragraph**. In this paragraph, as elsewhere in the report, the authors conclude that there is time to mitigate adverse effects later in the project development process by sliding shifting equipment and buildings around within the "study area."

However, since shifting facilities to avoid one adverse effect can cause it to adversely affect some other aspect of the environment, this is an unconvincing argument. The applicant should carry its analysis to the point where it can identify a specific location and site location that it prefers and then evaluate the potential effects of that configuration. Where uncertainty exists, the document could discuss alternatives.

Such an approach would also allow the consideration of cumulative effects as required by the regulations.

(33) **Page 65, Second Full Paragraph**. Once again the EA's failure to identify a specific project site makes it difficult to fully understand the project's potential effects on archeological and cultural resources including burial sites. As previously stated, the data that has been assembled as part of the Kawaihae Master Plan and other studies should be used to identify one or more potential sites. The impacts of developing the proposed facilities on each of them should then be evaluated. Chapter 343, HRS, did not envision postponing all decision-making concerning the project until after the environmental processing is completed.

(34) **Page 70, Potential Visual Impacts**. This discussion does not accurately convey the potential visual effects of the proposed project. No attempt is made to show the appearance of the proposed facilities within the context of the existing environment. There is no evaluation of the visual effects of developing the proposed facilities along the upper side of the "study area" (which reaches elevations of 250 feet) as compared to its impact if the higher structures were developed along the lower side of the property. The section states that the enclosures and buildings will be at most 40 feet high, while the project description lists the height of the fuel storage tanks as 50 feet (page 19).

The stack diameter is listed as 8 feet. This is very small compared to the stacks at similar facilities elsewhere in Hawaii, which have internal flues 8 feet in diameter, but much larger supporting structures. Is the diameter listed correct? Are there, as it appears from the drawings, two stacks of this height? How can the claims for the effectiveness of various mitigation measures (see the last paragraph on page 70) be substantiated without a specific design?

(35) **Page 82, Entire "Water" Discussion**. This discussion assumes that the preesence of a water transmission system to deliver the water that is produced, but does not evaluate the impacts of constructing and operating such a system. Neither does it indicate the cost of the water that would be produced by the desalination system; this makes it impossible to determine if it is economically viable relative to other options which are available. In a related vein, it does not discuss the implications of allowing permanent development on Hawaiian Home Lands Property based on a facility which has a very finite life span. What would happen to water users at the end of the project's useful life? Why were not other alternatives considered?

(36) **Page 84, Last Paragraph**. This cursory discussion of the impacts of site runoff on the water quality of Kawaihae Harbor is completely qualitative and does not adequately address the project's potential effects. Again, the absence of definitive plans for the project show that it is impossible to adequately address potential adverse effects. This, in turn, makes the issuance of a negative declaration inappropriate.

(37) General. §11-200-9 of DOH's Environmental Impact Statement Rules implementing Chapter 343, Hawaii Revised Statutes states:

Early assessment: agency actions, applicant actions. (b) for applicant actions, the approving agency shall assess and determine the need for an EIS.... In the assessment process, the agency shall:

(1) Identify potential impacts;
(2) Evaluate the potential significance of each impact;
(3) Indicate which areas require further study;
(4) Determine the need for a statement; and....

§11-200-10 provides that environmental assessments shall contain:

(6) Identification and summary of major impacts and alternatives considered, if any;
(7) Proposed mitigation measures, if any;
(8) Determination;
(9) Findings and the reasons supporting determination;...

§11-200-12 contains the criteria that are to be used in determining the significance of potential impacts. It states:

(a) In considering the significance of potential environmental effects, agencies shall consider the sum of effects on the quality of the environment and shall evaluate the overall and cumulative effects of an action.

(b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short and long-term effect of the action.

As indicated by the following discussion of the proposed project as it relates to each of the 11 significance criteria that are listed in the regulations, the proposed project clearly has potentially significant effects and, therefore, deserves to be further evaluated in an EIS.

(1) *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.* There are numerous archaeological and cultural resources including burial sites present on and around the study area. The EA does not demonstrate that it will be possible to avoid these or show that sufficient buffer space will be provided around those that remain following development to maintain the integrity of the individual resource and of the study area as a whole. Emissions from the project would reduce air quality and increase noise levels, thereby affecting important natural resources.

(2) *Curtails the range of beneficial uses of the environment.* The presence of a power plant within the 120 acre study area would affect the usability of adjacent parcels, as well as areas farther away from which the large industrial facilities that are proposed would be readily visible.

(3) *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, Hawaii Revised Statutes, and any revisions thereof and amendments thereto, court decisions, or executive orders.* The EA does not provide the information needed to determine consistency with this requirement; it most certainly does not discuss the extent to which it purports to accomplish these goals.

(4) *Substantially affects the economic or social welfare of the community or state.* The commitment to base a substantial portion of the region's water supply on the usually expensive desalination of seawater represents a major economic commitment that is not discussed in the EA at all. Alternatives need to be addressed before deciding on this course of action.

(5) *Substantially affects public health.* The absence of definitive air quality, water quality, and noise impact analyses makes it impossible to determine that the project will not adversely affect public health.

(6) *Substantially degrades environmental quality.* Again, the absence of definitive analyses in many areas of environmental concern makes it impossible to determine that this requirement has been met.

(7) *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.* The proposed project will require the construction of extensive water and electrical power transmission facilities, none of which are addressed in the report. Without a definitive site plan, it is impossible to determine cumulative effects. In fact, the EA does not address nor evaluate the overall and cumulative effects of the proposed power plant on the environment.

(8) *Involves a substantial degradation of environmental quality.* The limited analysis that has been performed makes it impossible to conclude that the project will not substantially degrade the environment.

(9) *Substantially affects a rare, threatened, or endangered species, or its habitat.* The regional information presented indicates that such organisms are present; they do not conclusively demonstrate that these resources are absent from the project site.

(10) *Detrimentally affects air or water quality or ambient noise levels.* As previously indicated, the proposed project would have all of these adverse effects.

(11) *Affects an environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.* The EA does not analyze potential effects of stormwater on coastal waters or provide a risk analysis for fuel off-loading accidents.

In view of the foregoing, the only reasonable course of action would be to prepare an environmental impact statement for the proposed project.

(38) <u>General</u>. The EA does not discuss alternative means of achieving the objectives of the proposed project, particularly those that might have fewer adverse effects. This is particularly relevant in view of the Department of Land and Natural Resource's recent

rejection of an EIS for its proposed Keahole Generating Station Expansion because it did not evaluate the KCP and Puna Geothermal projects as alternatives.

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

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

Dear Ms. Allione,

Thank you for your review and comments on the Environment Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

1. The project does not have a firm commitment to expand beyond the proposed 58 MW plant. Any future developments will be subject to applicable government regulations and permitting processes.

2. A final 40-acre site location will be provided in the Final EA and the potential impacts will be evaluated based on the selected site location.

3. Your comments will be reflected in the Final EA.

4. The exhibits will be revised to clarify the nomenclature.

5. The expression will be corrected to read "electrical power."

6. KCP does not have a power sales agreement with HELCO. However, the proposed project anticipates the electrical power will be sold to HELCO as properly stated in the EA.

7. The water will be made available for use by the Department of Hawaiian Home Lands. The contracts for the sale of steam and/or desalinated water have not been completed. The ownership structure and/or operating arrangements for the Desalination Plant have also not been finalized. The project will meet PURPA, FERC and Hawaii's corresponding Administrative Rules.

8. HELCO's proposed expansion at Keahole is using the same power generation configuration as proposed by KCP that consists of a dual train combined cycle unit. The addition of a desalination plant does not significantly affect the net power output of the plant or the configuration of the power generation unit.

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Heat that will otherwise be wasted in the condenser is used in the operation of the desalination plant. Other than the cost of the desalination plant, cost of operation and equipment of the Keahole DTCC unit will be comparable to the KCP configuration. The cost of interconnection and any improvements to the utility's system as a result of our project will be born by KCP. In any event, HELCO is not obligated to pay more than their avoided cost for the facility.

9. The general arrangement plan and a site location will be finalized and provided in the Final EA.

10. Further analyses has limited the stack height to 100'. The stack elevation is determined based on air quality modeling studies using the latest available meteorological tower data that is continuing to be collected at this time. For visual impact assessment pictures of the site taken from various vantage points will be overlaid with computer generated simulations of the project and provided in the final EA.

11. Your comments will be considered in preparation of the final EA. However, please note that the quantitative data you referred to is included in the water balance shown on Exhibit IV-5, page 44.

12. The goals of the project are to address two major concerns of the area and the island, that is to provide a reliable source of electrical power and to supply water. As part of the master lease with Department of Hawaiian Home Lands (DHHL) the water produced by the desalination plant will be made available for use by the DHHL. DHHL's Kawaihae Ten-Year Master Plan EIS identified as an unresolved issue the need to obtain a secure source of water before their planned development could be implemented. DHHL will develop the infrastructure as part of their master plan.

    The contracts for the sale of steam and/or desalinated water have not been completed. The ownership structure and/or operating arrangements for the Desalination Plant have also not been finalized. However, the Plant will meet PURPA, FERC and Hawaii's corresponding Administrative Rules. A list of permits applicable to the project will be included in the Final EA.

13. Cooling tower water will be circulated to the desalination plant to provide a source of cooling to be used in the distillation process. The system will be closed loop.

14. The figure represents the highest consumption rate if operated at base load.

15. KCP is working closely with the staff of the Department of Transportation, Harbors Division to determine the various options available for transporting fuel

from the harbor to the project site. Discussions with DOT concerning routing and easements are still being conducted. We are considering using the existing facilities or providing similar new facilities to meet our requirements. Either option will require extending underground lines to the project site. The new lines will be designed using a double containment system and in accordance with applicable standards and regulations. Fuel lines are pressure tested periodically for leaks. The fuel transport barges are required to have mitigative measures in place during fuel off loading in case of a spill. Fuel off loading operations are presently performed weekly at all harbor facilities throughout the state with minimal risk of spillage occurring.

16. There are several products on the market that will meet the containment requirements. These products are similar to the liners used for reservoirs and ponds but formulated to resist exposure to petroleum products like diesel fuel. One such product is Claymax. However, final selection will be based on the soils investigations performed during the final design phase.

17. Standard methods will be used to prevent additional surface runoff generated by the project from entering the harbor. Methods such as limiting the amount of paved area through the use of gravel and landscaping will allow runoff to seep into the ground and will also act as an effective control of soil erosion. All storm water runoff will be controlled in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES) permit, issued by DOH. All plant areas that can be contaminated with oil will be segregated from the rest of the plant by berms or dikes. Water accumulated in these areas will be tested for contamination and routed to either the storm water system or to the oily waste separators. Drains from these areas will also be segregated from other plant drains and routed to an oily waste separator. Contaminated surface runoff will be prevented from being discharged into the harbor. A list of chemicals used in the operation of the plant will be provided in the Final EA.

18. The location of the transmission lines are currently being negotiated with HELCO. The project intends to use existing transmission facilities and rights-of-way. The lines will be routed away from future residential areas in DHHL's planned development.

19. In the development of the proposed power generating facility, HELCO will assume the same degree of risk whether KCP or HELCO builds the power plant. The technology KCP is proposing is identical to HELCO's proposed expansion at Keahole. The Puna Geothermal project encountered unique risks associated with using a technology that is unproven in Hawaii. Some of the primary reasons why combustion turbine technology is widely used as a standard in the power generation industry is because of the reliability of the equipment, the availability of the components, and the proven track record at

numerous installations. At this time, the risks involved with development of a combustion turbine power plant are significantly less than developing a geothermal plant in Hawaii.

All necessary permits, including the PSD and ATC permits, will be obtained before any construction work is started.

20. Your opinion is noted.

21. The investigation referenced was performed by Dames and Moore for HELCO's "West Hawaii Site Study" at their Kawaihae Site B. While specific data of the study are not available, the conclusions are applicable to our project and will be verified during well drilling and water quality testing. Based on the Ghyben-Herzberg principle, groundwater quality is expected to be highly saline due to the proximity of the project to the shoreline. Groundwater quality will be verified during well drilling and water quality tests.

22. Groundwater outflow is difficult to quantify, however, because the rainfall intensity in Kawaihae is similar to that of the Kona and Waikoloa area, the outflow is anticipated to be similar and is presented as a comparison.

23. The "9500" is a typographical error and will be corrected to show "7500". The final EA will be revised accordingly.

24. Based on existing data from nearby areas with similar geology, the supply wells will be capable of sustaining the needs of the project. Well depths , depths of screening, and capacity will be determined at the time of well installation.

25. Water quality tests performed at the time of well installation will determine the depth of the saline ground water and depth required to minimize impact on the basal aquifer. Supply wells will be drilled into the saline aquifer which is virtually unlimited in supply. However, the proximity of the project to the shoreline indicates that the basal aquifer will be highly saline, unlimited in supply, and unsuitable for drinking or irrigation use.

26. For proper operation of the power plant, the injection wells must be drilled to a depth that will prevent impact on supply wells. Depth of supply and injection wells will be finalized during well installation at which time pumping capacity and water quality will be determined.

27. The dispersal properties of the subsurface geology will be verified during supply/injection well permitting and installation. The factors that will be considered in the determination of well depths include pumping/recharge capacity, impact on the supply wells from injected waste water, and impact on

the groundwater and marine environment. The tests will determine if injection wells are at a sufficient depth to allow adequate dispersal of the waste water to prevent impact on the supply wells by increasing the temperature and salinity of the ambient groundwater at the supply well head. The tests will provide dispersal properties of the geology and whether additional mitigative measures will be required such as cooling retention tanks for reducing water temperatures or further dilution with supply water. The project is providing a cooling tower rather than using once through cooling to assure that wastewater will not exceed the maximum allowable discharge temperature differential to harbor waters of 1.8° F.

The Kawaihae harbor and surrounding waters currently experience high levels of silt from surface runoff. The project design will not aggravate the present storm runoff conditions and should help mitigate them. The project will meet the requirements of the NPDES permit regulations during construction and plant operation.

28. A survey of existing flora and fauna was performed for DHHL and the results presented in their Ten-Year Master Plan EIS. The survey included all of the 122-acre industrial area and concluded that no rare plants or endangered animal species were observed or anticipated to be found in the areas designated for development.

29. The report referenced from DHHL's Ten Year Master Plan EIS provides a description of the existing conditions of the area that is applicable to the project. The project has been collecting meteorological data for the air modelling analysis that is required as part of the PSD permit process. The PSD permit process is expected to be completed by December of 1994. Data and results of the analyses based on the latest available meteorological data will be provided in the Final EA.

30. The monitoring protocol was approved in June 1993 and the specific coordinate of the exhaust stack have been provided to DOH.

31. The location of the equipment in relation to the property lines has been established and the noise levels will not exceed 70 dBA at the property lines. Engineering studies will be performed to determine the level of mitigation required to assure the limits are maintained.

32. A site location will be provided in the Final EA and the potential impacts evaluated based on the selected site location.

33. A detailed archaeological mitigation plan was developed for DHHL and approved by the State Historic Preservation Office. KCP will implement the

mitigation plan for all sites identified within the project area. The DHHL is developing a mitigation plan that addresses all the burials sites within the industrial area including the sites within the 40-acre leased parcel.

34. Computer generated simulations of the project will be overlaid on pictures of the site taken from various vantage points and provided in the Final EA. The statement will be revised to include the 50' high fuel storage tank.

The eight foot stack diameter was based on preliminary engineering that assumed a two stack configuration which was depicted in the general arrangement drawing. After further design optimization it was determined to use a configuration consisting of a single stack with dual flues and an overall outside diameter of between 18' to 20'. Simulations of the project will be provided with the revised stack dimensions.

35. As part of the master lease with DHHL, the desalinated water will be made available for use by DHHL. DHHL's Kawaihae Ten-Year Master Plan EIS identified as an unresolved issue the need for securing a source of water before their development plans can be implemented. Currently there is no County water system or other sources of water to support the master plan. KCP will supply a secure source of water by desalination. DHHL will develop the infrastructure as part of their master plan.

36. Through the use of drywells, landscaping, and graveling of graded areas the project will not increase the amount of surface runoff into the harbor. All plant areas that can be contaminated with oil will be segregated from the rest of the plant by berms or dikes.

37. (1) As discussed earlier, the mitigation plans that KCP intends to implement will prevent the loss of cultural resources by recording and archiving those resources for future generations to witness and preserving those sites that are recommended for preservation. The mitigation plans call for recovery of archaeologically significant data and for relocation of burial sites to an area that will be continually maintained and preserved. The project will not cause a loss or destruction of any natural or cultural resource.

The Ambient Air Quality Standards (AAQS) which are regulated by the Department of Health "seek to protect public health and welfare and to prevent the significant deterioration of air quality." All new power plant projects must comply with the emission limits set by the AAQS or the project will not be permitted and or allowed to be constructed. The noise levels emitted by the project will comply with DOH regulations for

industrial/agricultural districts limiting noise levels to 70 dBa at the property line.

(2) The development of the industrial area is a key element to making DHHL's Master Plan viable by providing income and a source of employment. The project is consistent with DHHL's proposed industrial development of their lands and the State's long term development plans for the Kawaihae Harbor area. The project will also provide the needed water for DHHL to continue with their development plans. Due to the close proximity to the harbor, the area is well situated for industrial development of this nature. A visual simulation of the plant will be provided in the Final EA. The project is a beneficial use and will not curtail the range of other beneficial uses of the environment.

(3) Chapter 344, HRS is a policy statement reflecting concerns and goals in general terms and does not carry a mandate for adoption of the guidelines. However, KCP recognizes a need for a balance between development and concerns for the environment which is why the project will use the best available technology to control plant emissions. The EA describes all the potential impacts of the project such as visual impact and discusses methods to mitigate these impacts on the environment. The project promotes a more efficient and cleaner use of fossil fuels and therefore does not conflict with the State long term policies and goals.

(4) This project is part of the DHHL's Ten Year Master Plan which will substantially affect the economic and social welfare of their planned community. The impacts associated with the development of the industrial area including this project were addressed in DHHL's Ten Year Master Plan EIS and was accepted in March 1993.

(5) The limits of allowable project emissions such as air pollutants, injected wastewater and plant generated noise are set and regulated by the Department of Health. The limits are designed to protect public health. Meteorological data is being collected for the air quality analysis which is required for the permit for Prevention of Significant Deterioration. The permit must be obtained before any construction will be allowed to start. A makeup of the injected wastewater will be provided in the Final EA. Both quantity and quality of the injected wastewater must be provided before an Underground Injection Control permit can be obtained. The plant generated noise levels, while not regulated on the Big Island, will be maintained at the regulated limits DOH requires for similar districts on the island of Oahu. All project related impacts will not substantially affect public health.

(6) The proposed project will utilize technology and methods that are widely used in the industry throughout the islands and the mainland to mitigate potential impacts on the environment. The project will meet all the regulatory limits imposed by State and Federal laws which are designed to prevent significant impact and degradation to the environment.

(7) The water system will be part of DHHL's infrastructure development which was discussed in their EIS. The transmission lines will follow existing transmission corridors and right of ways and routed away from proposed residential development. A project site location will be provided in the Final EA and the impacts evaluated based on the proposed site location. The actions of the project do not have a cumulative effect on the environment and the actions do not involve a commitment for a larger action.

(8) As previously discussed the actions proposed by the project will not have a significant impact on the environment with the proposed mitigation plans in place. The plans include the best available control technology to prevent significant deterioration of the air quality, sound attenuators to limit noise emissions, water treatment and cooling processes to mitigate potential impact to the groundwater and marine environment, and other plans which are discussed in the EA. Additional information will be provided in the Final EA that demonstrates a substantial degradation of environmental quality will not occur.

(9) A survey of the existing flora and fauna was performed for DHHL for their Ten Year Master Plan EIS. The survey included the 40 acre study area and concluded that existence of rare, threatened or endangered species are not expected within project site.

(10) The regulated limits of plant generated emissions are set by State and Federal laws which are designed to protect public health and prevent significant deterioration of the environment. The project will meet all regulated limits imposed by State and Federal laws and will not detrimentally affect air or water quality or ambient noise levels.

(11) The project area is not an environmentally sensitive area, however the project will take appropriate mitigative measures to prevent significant impact to the environment. As discussed early and also in the EA, additional stormwater or surface runoff will be prevented from entering directly into the harbor. Fuel off loading operations similar to the proposed actions at Kawaihae occur at all major harbor facilities throughout the State. Fuel transporters are required to have a mitigation plan in place that addresses containment and cleanup of fuel spills

preventing further contamination of the surrounding waters.

As required by Chapter 343 of the HRS and the Department of Health Administrative Rules for the EIS process, the EA provides a description of the project and identifies all potential impacts. The EA further describes mitigative measures to limit the impacts to regulated limits such as the limits imposed by the PSD permit. A mitigation plan has been approved for handling archaeological sites and a plan to address burial sites is being developed with the assistance of the Hawaii Burial Council.

The development of the power plant may enhance future industrial development such as a cold storage facility or other industrial uses that require process steam made available from the power plant. The project is consistent with DHHL's proposed industrial development of their lands and the State's long term development plans for the Kawaihae Harbor facilities. Due to the close proximity to the harbor the area is well situated for industrial development.

The desalination plant is provided as a solution to one of DHHL's unresolved problems, that is a guaranteed source of water without which development would not be possible. The operation of the desalination plant increases the efficiency of the power plant by using the waste heat which would otherwise be lost to the atmosphere.

The construction and operation of an electric generating power plant is one of the highest regulated industries. Air emissions and injected waste water will be monitored to assure permitted levels are not exceeded thereby limiting the impact on public health and the environment.

The Department of Hawaiian Home Lands' Kawaihae Ten-Year Master Plan EIS, which was accepted in March 1993, addresses the impacts of developing over 2000 acres which includes the 40-acre study area. While not addressing the specific impacts, the EIS included development of the power plant which we are proposing. The draft and final EA addresses the specific impacts of the project. The EIS is included in appendix A.

38. KCP has two goals for the proposed power plant project. The first goal is to meet the need for power generation, which the utility has identified, by providing a reliable source of electricity. The second goal of the project is to provide significant benefits to Native Hawaiians through leasing and building the project on DHHL lands in Kawaihae. A secure source of water from desalination will be made available to the DHHL to support their Master Plan for Kawaihae. Without water, DHHL's plans to develop Kawaihae so Beneficiaries can return to the land will not be possible. This project will also provide employment for

Native Hawaiians who decide to make their home in Kawaihae and will also provide a significant source of income for DHHL to use toward development of all their lands. The lease revenues from this project alone will provide more than a quarter of all the lease revenues generated throughout the State. As a Native Hawaiian owned company, we feel that the goals we are attempting to achieve are of equal importance. With this in mind there are no other alternatives concerning site location or generation technology that will feasibly meet the goals of this project.

We appreciate the time you have spent to review and comment on the Environmental Assessment for the proposed power plant project. Although Enserch is a direct competitor to KCP, your comments have been constructive and helpful in identifying areas of concern. Should you have any more questions or concerns with the project please feel free to contact us.

Sincerely,

Rodney Kaulupali

Kohala Coast Resort Association
HC02 Box 5300, Kohala Coast, Island of Hawaii 96743 • Telephone (808) 885-4915, Facsimile (808) 885-1044

August 16, 1993

Hoaliku Drake
Chairman
Hawaiian Homes Commission
P.O. Box 1879
Honolulu, HI 96805

Re: Kawaihae Cogeneration Plant Draft Environmental Assessment

Dear Mrs. Drake:

This draft copy prepared for Kawaihae Cogeneration Partners is well-prepared. However, there appears a lack of communication with nearby residents and businesses as to the effects of this project.

We suggest the applicant prepare a complete environmental impact statement in compliance with Chapter 343 HRS, and describe the potential environmental effects of the cogeneration plant.

This project has the potential for affecting:

- archaeological and cultural sites
- air quality
- ground and nearshore water quality
- visual aesthetics, with its stacks and auxiliary buildings (which may affect the future development of Kawaihae Harbor as a cruise ship docking point)
- County of Hawaii water supply plans, and the
- overall electrical generation mix of the island

Thank you for the opportunity to comment.

Sincerely,

Noelani Whittington
Executive Director

cc: Rodney Kaulupali, Kawaihae Cogeneration Partners
Brian Choy, Director, Office of Environmental Quality Control
Kohala Coast Resort Association, Board of Directors
Gordon Chapman, Mauna Lani Resort
Virginia Goldstein, Planning Director, County of Hawaii
Bill Sewake, Director, Hawaii County Water Supply

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Ms. Noelani Whittington
Executive Director
Kohala Coast Resort Association
HC02 Box 5300
Kohala Coast, Hawaii 96743

Dear Ms. Whittington,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. Kawaihae Cogeneration Partners has been actively meeting with many of the community groups within the area to address their questions and concerns with out project. Additional information will be provided in the Final Environmental Assessment that will further address the concerns that you have listed in your letter.

Please feel free to call me should you have any additional concerns or questions.

Sincerely,

Rodney Kaulupali

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Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

Mrs. Hoaliku Drake, Director
Department of Hawaiian Homes
P.O. Box 1879
Honolulu, Hawaii
96813

Dear Mrs. Drake: August 18, 1993

I have reviewed the draft environmental assessment for the Kawaihae Cogeneration Plant and find it lacking in detail and would urge your agency to require an EIS for this project. I represent the partners of Kawaihae Mali'e, all of whom are of Hawaiian ancestry, which is developing the property at the intersection of Kawaihae Road and Akoni Pule Hwy (the location of the former Doi gas station). Since our property is located within 500 yards of the proposed power facility, we are compelled to respond to the inadequacies of the EA. To allow a project of this size and impact to move forward in this small community without thoroughly informing the people of all aspects of the project is unwise and unfair. Too often the report states that all requirements of DOH or EPA or OSHA will be met and therefore it is OK and there will be no problems. Also, the report relies heavily on many other studies and EIS reports to draw conclusions. I suggest that your agency not rely solely on the work of others, but require Waimana to prepare an independent EIS so that the project may stand on its own merit. DHHL may find that an EIS might uncover aspects of the project that the EA has overlooked or not fully addressed. It may be expedient for this project to receive a negative declaration as it will save money and time, but it is not in the best interest of the Hawaiian community nor North Hawaii to move rapidly. Legal challenges will surely be the results of a hasty acceptance of this project. Again, we urge you to require an EIS and keep the community informed.

Best regards,

Alan Lowrey Brown

cc: Rep. Larry Tanimoto, Senator Malama Salomon, Office of Environmental Quality Control

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Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 24, 1993

Mr. Alan Lowrey Brown
Kawaihae Mali'e
Kawaihae Service
P.O. Box 44400
Kawaihae, Hawaii 96743

Dear Mr. Brown,

Thank you for your review and comment on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We would like to respond to your comments as follows:

Response

The Department of Hawaiian Home Lands (DHHL) awarded Waimana Enterprises, Inc. (WEI) the right to lease 40 acres for the purpose of developing a power plant. Since the lease award WEI has been actively meeting with community groups from Waimea, Kawaihae and Kona to address questions and concerns about the project. WEI will continue to meet with interested parties and is committed to keeping the community informed as new developments occur with the project.

The Department of Hawaiian Home Lands' Kawaihae Ten-Year Master Plan EIS, which was accepted in March 1993, addresses the impacts of developing over 2000 acres which includes the 40-acre study area. While not addressing the specific impacts, the EIS includes development of the power plant which we are proposing.

The Draft and Final Environmental Assessment addresses the specific impacts and mitigative measures of the project. The Department of Hawaiian Home Lands' Kawaihae Ten-Year Master Plan EIS is included in appendix A.

The construction and operation of an electric generating power plant is one of highest regulated industries. The responsibility to assure that plant generated emissions such as air emissions and injected waste water are maintained at the regulated limits falls under the purview of the State Agencies such as the Department of Health Clean Air Branch. Plant operations are continuously monitored to assure permitted levels are not exceeded thereby limiting the impact on public health and the environment.

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We have received a number of comments from interested parties which we appreciate because it gives us the opportunity to address the concerns with the project. The comments we have received on the Draft EA have been helpful in identifying aspects of the project that are a concern and will be considered and implemented in the Final EA.

We would like to thank you again for your review of the Environmental Assessment. Please feel free to contact us for any other questions you may have concerning the proposed project.

Sincerely,

Rodney Kaulupali

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RANDALL Y. IWASE
JAMES H. SEKI
R. BRIAN TSUJIMURA

August 23, 1993

Mrs. Hoaliku L. Drake, Chairperson
Hawaiian Homes Commission
Department of Hawaiian Home Lands
335 Merchant Street
Honolulu, Hawaii 96813

HAND DELIVERED

Re: Kawaihae Cogeneration Plant Draft Environmental Assessment

Dear Mrs. Drake:

On behalf of Hawaii Electric Light Company, Inc. (HELCO) we have reviewed the Draft Environmental Assessment (Draft EA) for the Kawaihae Cogeneration Plant proposed by Kawaihae Cogeneration Partners and believe that the proposed project would have a significant effect on the environment so as to trigger an environmental impact statement ("EIS") under applicable law.

It is our understanding that the project would be located at Kawaihae on land held in trust and administered by the Hawaiian Homes Commission. The project proposes to develop a cogeneration power plant and desalination facility which will provide up to 58 megawatts (MW) of power to the Island of Hawaii and 2.6 million gallons per day (mgd) of desalinated water. The desalinated water would be chemically treated to meet State drinking water standards and to provide potable water to the local area.

It is our opinion that information on the proposed project and contained within the draft EA is preliminary in nature as to the project's siting, planning and design. Adequate review of the project's potential environmental impacts and mitigating measures are not possible without more definitive information being provided through an EIS. In the absence of more accurate and detailed information of the project's siting, planning and design, any review and determination of potential impacts cannot be reasonably accomplished.

In addition, we note that industrial uses like a power plant should be assessed from the standpoint of its impacts to archaeological resources, marine life, groundwater, noise and a community's socioeconomic makeup.

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In addition to the above general concerns, we offer the following specific examples of where impacts of the proposed project should be discussed more fully:

IMPACT ON BIG ISLAND's ELECTRICAL SYSTEM

The Draft EA does not identify where interconnecting transmission lines from the proposed facility and to existing HELCO 69 kV transmission lines would be located. If new transmission lines will be required, the route and any environmental conditions along the route must be identified before the project's impact can be determined.

Detailed heat and energy balance should be included as part of the environmental information. In order to meet the proposed project's 58 MW net generation goal (in terms of PURPA efficiency standards), additional information should be provided on fuel consumption levels; amount and energy content of steam being used for desalination; temperature of the exhaust and waste water; power needs for the mechanical draft cooling towers and other types of auxiliary equipment (including air chilling, fuel oil pumping, deep saline water wells, and injection well pumps).

We understand that the proposed project will utilize water from a desalination facility and draw your attention to the fact that the project cannot operate a desalination facility if it is operated in a simple cycle mode. Similarly, it is not clear if steam injection, which is used for NOx control, can be produced if the proposed facility is operated in a simple cycle mode. If the facility is operated in a simple cycle mode, annual PURPA efficiency may be affected.

PROJECT LOCATION

The Draft EA covers a 122 acre area under the assumption that a specific 40-acre site will be determined through further study and refinement of engineering design. The impacts of the proposed facility to the environment, however, cannot be adequately assessed until the building improvements are specifically located and the engineering design and layout are refined. If, for instance, only a portion of the 40 acre site will be used for the building improvements, what will the remainder of the site be used for?

PROJECT FACILITIES

1. POWER GENERATION. While it is noted that 58 MW of power is proposed to be generated, there is no indication what proportion of the power will be required to produce the 2.6 mgd of desalinated water.

2. WASTEWATER. The amount of wastewater to be reinjected may be in error. We believe more accurate figures to be as follows:

1.4 mgd	Cooling Tower Blowdown
6.0 mgd	Desalination Plant Blowdown
0.2 mgd	Miscellaneous Plant Wastewater
7.6 mgd	Total Wastewater to be Reinjected

Disposal of the wastewater may potentially result in a substantial degradation of environmental quality.

3. AMMONIA STORAGE TANK. The drawing in Exhibit III-6 includes an ammonia storage tank. Ammonia is a hazardous chemical requiring certain safety measures in its use and storage. The Draft EA does not disclose the purpose, amount and treatment of this hazardous chemical.

4. DESALINATION BLOWDOWN. Based on the Draft EA, the temperature difference between the supply water and the brine water to be reinjected is expected to be only 5-7 degrees fahrenheit. This does not appear to have enough heat transfer available, therefore, extremely large amounts of supply water may be required. Additional supporting data is needed to evaluate the cooling water requirements. The elevated water temperature may cause a degradation of environmental quality which should be addressed in an EIS.

5. RELATED FACILITIES. The applicant should describe how and where the fuel pipeline will be developed, a description of the size of the pumps that will be used and a mitigation plan in the event of a fuel oil spill.

PHYSICAL ENVIRONMENT

1. GROUNDWATER RESOURCES. The supply water requirements as stated in the Draft EA are extremely low. The blowdown temperature and salinity and mineral concentration is expected to be reduced by adding supply water prior to injection. The proposed supply water source is expected to be only slightly lower in salinity than the injected wastewater. The 1.4 mgd of cooling tower blowdown is a significant volume of water to be diluted to any extent, even if the applicant were using a fresh water source. This does not appear to be reflected in the determination of supply water quantities. Additional information should be provided in order to determine the actual requirement of the power plant for supply water.

Wastewater will be injected into a reinjection well. No information is provided in the Draft EA to evaluate the impacts to the groundwater and the marine environment from the injection of wastewater into a reinjection well. The Draft EA does not describe the quality of the wastewater to be injected or the estimated rate of migration of the wastewater plume to the coastline. Modeling studies of impacts to the groundwater and marine waters should be considered. The Draft EA indicates that the basaltic formation will behave as a confined aquifer. Has the applicant conducted a hydrogeological study to support this conclusion?

2. MARINE ENVIRONMENT. The Draft EA does not indicate what measures will be employed in order to protect the marine environment from accidental spills of fuel oil from fuel tanks and fuel pipelines. This may present a significant impact which your agency should obtain more information on through an EIS.

3. NOISE. The operating period noise impacts of the power plant and desalination plant should be shown on a noise contour map in terms of decibel levels. Noise impacts during construction should also be analyzed. Will any neighboring uses or property owners be affected by the power plant's operation?

4. VISUAL RESOURCES. The exhaust stack dimension, 8-feet in diameter , from 50 to 150 feet in height, does not provide sufficient information to determine visual impacts. A visual simulation of the facility and all related structures should be provided for the assessment of visual impacts. In addition, immediately south of the study area are the Pu'ukohola and Mailekini Heiau and the adjacent John Young homestead which are part of a Federal National Park facility. The project may have a significant adverse impact on these sites from a visual standpoint.

SOCIAL/CULTURAL/ECONOMIC CHARACTERISTICS

1. HISTORIC AND ARCHAEOLOGICAL RESOURCES. It is our understanding that a large number of archaeological and cultural sites, including pre-contact and post-contact period burials may be located within the 122 acre study area. The Draft EA's preliminary conclusion indicates that the project would involve an irrevocable commitment to loss or destruction of natural or cultural resources within the study area. Will an archaeological and burial mitigation plan be submitted to the appropriate state agencies for approval? In light of the foregoing, the proposed project may have a significant adverse impact on historic and archaeological resources.

2. ECONOMIC CHARACTERISTICS. The Draft EA describes the production of desalinated water as a benefit but does not disclose what the estimated cost to the consumer will be for the desalinated water. The Draft EA does not indicate the cost per 1,000 gallons of desalinated water compared to the current cost of potable water on the Island of Hawaii. It does not indicate if the water will be distributed through the County's water distribution system, or if it will be transmitted through a separate system.

CONCLUSION

Based on the information contained within the Draft EA, the power plant, desalination facility, interconnecting transmission lines, and fuel pipeline may have significant effect on the environment.

We believe that proceeding without a more complete and adequate disclosure of the reasonably anticipated impacts of the project is not in the public's interest. We also believe that in order to assess impacts more completely, your department will need to receive additional information and studies as discussed above.

HELCO and its consumers have in the recent past suffered from delays in the development of a non-utility entity (i.e., geothermal energy) at least in part because of deficiencies incurred in its regulatory processing of permits and approvals. We wish to avoid a similiar situation arising with proposed non-utility projects as the effect of such delays affects the cost and delivery of electrical service to our customers on the island.

Respectfully Submitted,

DWYER IMANAKA SCHRAFF KUDO
MEYER & FUJIMOTO

Benjamin A. Kudo

BAK:st

Kawaihae Cogeneration Partners

A PARTNERSHIP OF WAIMANA ENTERPRISES, INC. AND DIAMOND ENERGY, INC.

November 25, 1993

Mr. Benjamin A. Kudo
Dwyer, Imanaka, Schraff, Kudo, Meyer & Fujimoto
Attorneys at Law, A Law Corporation
900 Fort Street Mall, Suite 1800
Honolulu, Hawaii 96813

Dear Mr. Kudo,

Thank you for your review and comments on the Environmental Assessment for the proposed Kawaihae Cogeneration Power Plant. We have responded to your specific comments on the project which will also address your general concerns.

Impact on Big Island's Electrical System

The final location of the transmission lines are dependant on negotiations with HELCO. Because HELCO has caused negotiations to continue since 1991, the project intends to use existing transmission facilities and right of ways. The lines will be routed away from future residential areas in DHHL's planned development.

The EA contains sufficient information on heat and energy balance to adequately disclose all impacts from the power plant. As HELCO is well aware, detailed heat and energy balance information is proprietary and could be used by competing companies. As HELCO has refused to include detailed heat and energy balance information for their Keahole Power Plant Expansion in their EIS, HELCO must concur with our conclusion that this information is not needed to adequately disclose potential environmental impacts.

The project filed an application, which was approved, with the Federal Energy Regulatory Commission (FERC) in 1992 for certification that the plant is a qualifying facility. The gas turbine exhaust gases will be routed directly to the Heat Recovery Steam Generators (HRSG's), even during simple cycle operation. Therefore, steam generation will result during any operating scenario. The steam generated, during simple cycle operation, will bypass the steam turbine generator and will be utilized only for steam injection and in the desalination plant process thereby meeting all environmental and/or PURPA requirements.

Pauahi Tower • Suite 1520 • 1001 Bishop Street • Honolulu, Hawaii 96813 • (808) 599-4441 • Facsimile (808) 599-4653

Project Location

The Final EA addresses the potential impacts based on a specific 40-acre study area. Any future development will be in keeping with Department of Hawaiian Home Lands designation for industrial use of the area. All future developments will be subject to applicable laws and regulations. A supplemental EA will be prepared for future developments, if necessary.

Project Facilities

1. When generating 2.6 MGD the desalination plant will consume approximately 600 kilowatts.

2. The EA will be revised accordingly to show a maximum of 7.6 mgd rather than approximately 7.5 mgd.

Waste water injection is regulated by the Underground Injection Control (UIC) permit which requires monitoring and reporting of the quality and quantity of injected waste. Mitigative measures will be taken to minimize the impact of the injected waste water on the groundwater and the marine environment. A cooling tower will be used to reduce waste water temperatures. The waste water temperature and salinity concentrations will be further reduced by dispersion in the saline aquifer. Dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and whether additional mitigative measures will be required.

3. The plant will use ammonia for the control of nitrogen oxide emissions. A detailed review of emissions control technology is part of the Department of Health's and EPA's permit requirement and involves determination of the best available control technology (BACT) for all pollutants. The BACT for nitrogen oxide emissions is considered to be the use of steam or water injection together with selective catalytic reduction (SCR). The use of SCR requires ammonia injection. The project will require facilities for the handling and storage of ammonia and will be required to file a Chemical Inventory report with the Office of Hazard Evaluation & Emergency Response of the Department of Health. The appropriate agencies will be notified of the projects intent to store and use ammonia.

4. The brine will be cooled by mixing with cooling tower blowdown and further cooled by the supply water to near harbor water temperature prior to reinjection. Based on the anticipated subsurface geology, the injected wastewater will enter the surrounding waters as non-point discharge. The discharge temperature at the harbor will not exceed the allowable temperature of 1.8° above ambient water temperature that is imposed by the Department of Health. Dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and

whether additional mitigative measures will be required to meet the requirements of the Underground Injection Control (UIC) permit process.

5. KCP is working closely with the staff of the Department of Transportation, Harbors Division to determine the various options available for transporting fuel from the harbor to the project site. Discussions with DOT concerning routing and easements are still being conducted. We are considering using the existing facilities or providing similar new facilities to meet our requirements. Either option will require extending underground lines to the project site. The new lines will be designed using a double containment system and in accordance with applicable standards and regulations. The pumps on the fuel barges are capable of transporting fuel to the project site without the use of booster pumps. The fuel barges are required to have a mitigation plan in place to address any potential spills.

Physical Environment

1. The water requirements for the project are based on maximum desalination plant operation and the power plant being operated at base load. The actual quantities will probably be less. However, the project will be drawing supply water from the saline aquifer which is essentially unlimited in supply. It is anticipated that the cooling tower will be sufficient to reduce waste water temperatures to permittable levels. The brine temperature will be further reduced with the supply water. The aquifer that the waste water will be injected into is unsuitable for either drinking or irrigation purposes and will not be significantly impacted by the salinity concentrations of the waste water. Actual dispersal properties of the subsurface geology will be verified during well installation to determine final well depths and whether additional mitigative measures will be required. With the mitigative measures in place, the impact on the marine environment will be insignificant. Injected waste water is regulated by the Underground Injection Control (UIC) permit which requires monitoring and reporting of the quality and quantity of injected water. The mitigative measures taken will minimize the impact of the injected waste water on the groundwater and the marine environment.

2. Mitigation measures in case of fuel spills during fuel barge off loading are the responsibility of the barge operator. Fuel barge operators are regulated by U.S. Coast Guard and are required to have a mitigation plan in place in case of a fuel spill. The mitigation plan will address containment and cleanup of any fuel spills. Underground fuel lines are pressure tested periodically for leaks preventing the minimizing the potential for one to occur. The fuel storage tanks will be built inside a containment area lined with an impermeable membrane to prevent leaks to the subsurface.

3. A relocation plan for relocating the homesteaders to alternate residential sites is being developed in conjunction with DHHL's Master Plan. Although the Department of Health noise regulations are not applicable to the Big Island, the standards will be

used for the project during construction and operation. Plant generated noise emissions will be limited to the allowable level for industrial use of 70 db at the project boundary.

4. The eight foot stack diameter was based on preliminary engineering that assumed a two stack configuration which is depicted in the general arrangement drawing. After further design optimization it was determined that a better configuration would consist of a single stack with dual flues and an overall outside diameter of between 18' to 20'. The height of the stack will be 100' based on the most current meteorological data. Computer generated simulations of the project overlaid on pictures of the site taken from various vantage points are provided in the Final EA.

Social/Cultural/Economic Characteristics

1. A detailed archaeological mitigation plan was developed for DHHL and their Ten-Year Master Plan EIS and approved by the State Historic Preservation Office. The survey included all of the study area designated for industrial development. KCP will implement the plan on all identified sites within the project area. A mitigation plan to handle burials is being developed with the assistance of the Big Island Burial Council.

2. As part of the master lease with DHHL the desalinated water will be made available for use by DHHL. The cost of the water cannot be conclusively determined at this time but will be similar to other privately supplied water systems on the island. DHHL's Kawaihae Ten-Year Master Plan identified the need for securing a source of water before development can be implemented. At this time the DHHL does not have any water to carry out its development plans. KCP will supply a secure source of water through desalination. DHHL will be responsible for developing the required infrastructure for their development which will included the necessary water distribution systems.

Conclusion

We believe the Final EA adequately identifies all potential impacts and mitigative measures to minimize those impacts. The governing agencies and their rules and regulations that administer the design, construction and operation of the power plant provides assurances that plant emissions such as air pollutants and injected wastewater do not exceed permitted levels. The project is consistent with DHHL's proposed industrial development of their lands and the State's long term development plans for the Kawaihae Harbor facilities. Due to the close proximity to the harbor the area is well situated for industrial development.

The project will benefit the Big Island community by providing additional electrical power capacity from a reliable generating source. DHHL will benefit from the income generated from the lease of the land and from the water provided to allow for implementation of their 10 year master plan for Kawaihae.

We have committed a substantial amount of resources toward completion of the project and we intend to fully comply with all regulatory processing of permits and approvals. The project is using proven methods of construction and technology which are utilized on many power plants in the mainland and in Hawaii. Delays experienced by the geothermal plant are not expected to occur at this project due to the differences in technology and location.

Thank you for your review and comments of the Environment Assessment. Additional information will be provided in the Final EA that will further address the concerns that have been raised by various respondents. Please feel free to contact us if you have any other questions regarding the proposed project.

Sincerely,

Rodney Kaulupali

APPENDIX B

JULY 1993

METEOROLOGICAL MONITORING REPORT

by

Measurement Technologies

MEASUREMENT TECHNOLOGIES
ENVIRONMENTAL PRODUCTS AND SERVICES

JULY 1993

METEOROLOGICAL MONITORING REPORT

for a

PROPOSED POWER PLANT

KAWAIHAE HARBOR, HAWAII

Presented to

KAWAIHAE COGENERTION PARTNERS

Prepared by

MEASUREMENT TECHNOLOGIES

PN-0465

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1.0 Introduction

Kawaihae Cogeneration Partners (KCP) is considering construction of a cogeneration power plant on the west side of the Island of Hawaii near the Kawaihae Harbor. In preparation for the permit application, KCP has elected to install, operate and maintain a meteorological monitoring station for a period of one (1) year to collect on-site meteorological data. The data will be used for an ambient air quality modeling analysis.

KCP in conjunction with their permitting consultant, Sierra Research, Inc. (Sierra) selected a monitoring station site location. This station was sited to provide data to meet the state and federal permitting requirements. The site location description and site maps are provided in Section 2. Section 3 gives a data summary and data tables for the month.

Sierra on behalf of KCP contracted Measurement Technologies (Measurement) of San Luis Obispo, California to fabricate, install and operate the meteorological monitoring station to collect the required data. The monitoring station was installed and is operated consistent with requirements typically contained in authority to Construct (ATC) permits. The monitoring station collects meteorological data at 2, 10, 30, and 60 meters. Table 1-1 lists the parameters monitored at the different levels.

The following report summarizes the data obtained in the third month of meteorological monitoring, July 1993.

Table 1-1. Monitored Parameters

PARAMETERS	HEIGHTS			
	2.0	10	30	60
Wind Direction (WD)		X	X	X
Wind Speed (WS)		X	X	X
Sigma Theta (SD)		X	X	X
Vertical Wind Speed (VWS)		X	X	X
Sigma W (SW)		X	X	X
Temperature (TEMP)	X	X	X	X
Differential Temperature (DIFT)	X	Ref	X	X

2.0 Source Environment Description

This section describes the land use, area meteorology, and the monitoring site for the KCP Monitoring Project.

2.1 Land Use Description

The monitoring site is located on the west side of the island of Hawaii (see Figure 2-1), directly across Kawaihae Road from the main entrance to Kawaihae Harbor on Hawaiian Home Lands property. Figure 2-2 provides a more detailed map of the area around the Kawaihae Harbor with the monitoring site identified.

The terrain in the area of the proposed cogeneration power plant slopes upward to the east with the power station area being approximately 15 meters above mean sea level. Vegetation in the vicinity is predominately mixed grassland with small to medium size Kiawe trees (1.5 to 4.5 meters). The power plant site is located in an area designated for industrial development. Presently very few homes exist in the area, however future residential lots are to be developed north of the proposed site.

2.2 Climatological and Meteorological Description

The Island of Hawaii is located within a belt predominated by northeasterly trade winds generated by the semi-stationary permanent Pacific High, with an anticyclone pressure cell to the north and east.

The Island of Hawaii's terrain influences the climate with rainfall amounts varying with elevation, location and the effect of the persistent northeasterly trade winds. Sea breezes created by daytime heating of the land move onshore and upslope, causing afternoon and evening cloudiness and occasional showers.

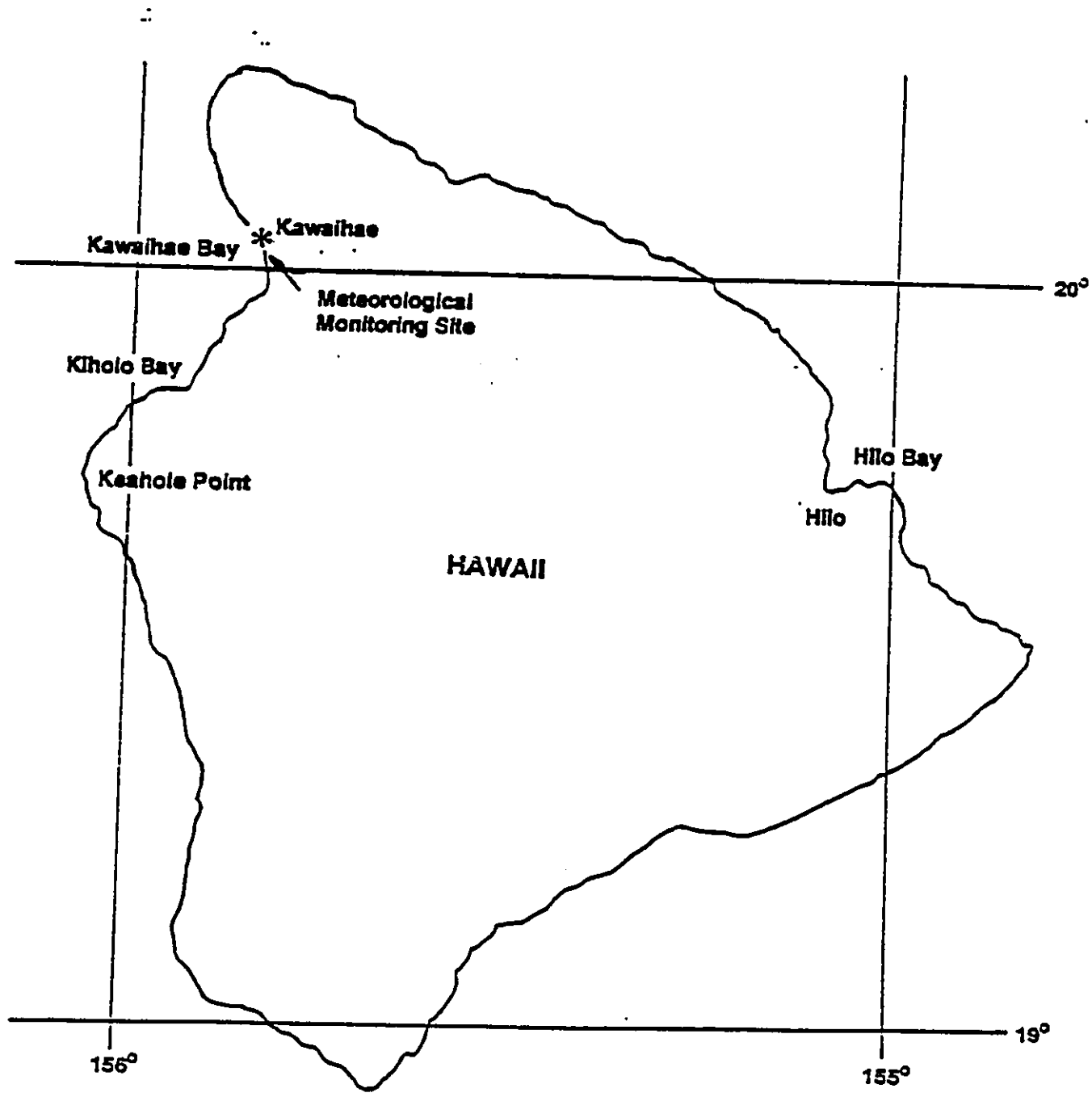

Figure 2-1. Map of the Island of Hawaii

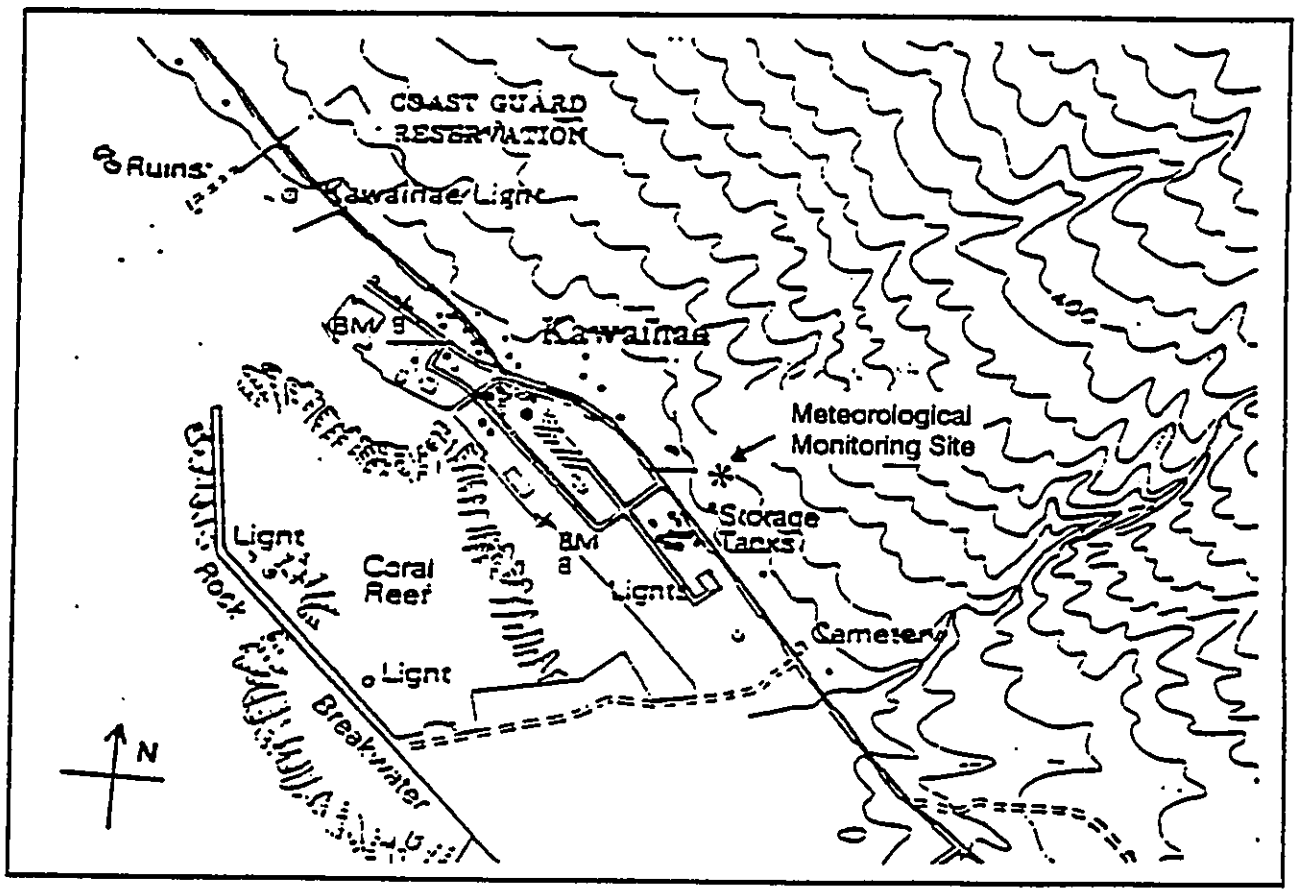

Figure 2-2. Kawaihae Harbor Area

Temperatures are generally uniform from day to day and season to season at or near sea level elevations.

Meteorological data shows the prevailing trade winds occurring approximately 80 percent of the time on an annual basis. There are occasional diurnal profiles in the area where daytime onshore flow is followed by nighttime drainage.

2.3 Monitoring Site Description

The KCP meteorological monitoring station will be located across Kawaihae Road from Kawaihae Harbor. This monitoring site location is at approximately 20° 02' 25" N latitude and 155° 49' 45" W longitude. The monitoring site elevation is approximately 15 meters above mean level.

The location of the monitoring site was previously discussed in Section 2-1 and shown in Figure 2-2. The monitoring site has good exposure in all directions with no topographical feature affecting wind flow between the monitoring site and the proposed location of the generating equipment. The 60 meter tower is expected to be higher than the turbine stacks thus rendering the meteorological data at this height to be representative of stack top conditions.

As previously stated, the meteorological tower will be sited to provide data to meet the requirements for a permit application for a new cogeneration power station. The monitoring site provides background meteorological data for the surrounding area.

3.0 Data Summary

The data obtained from the KCP meteorological station begins on July 1, 1993. The meteorological parameters and the height at which each parameter is measured are identified in Table 1-1. All meteorological instrumentation was calibrated prior to the initial data collection.

The processed meteorological data and summary statistics for July, 1993 are presented in Tables 3-1 through 3-22. The summary statistics for each parameter include: total monitoring hours, total good hours, percent data capture, highest/lowest values, arithmetic mean and standard deviation.

Downtime was zero, with data capture rates of 100% for all parameters.

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR WD10M in DEG

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	71	50	35	34	70	345	35	331	305	280	281	286	265	258	244	240	240	241	240	280	283	305	296	88	213
2	15	59	42	25	38	37	32	135	229	275	278	263	265	247	242	235	241	264	225	283	116	243	87	101	166
3	80	42	19	350	50	359	23	44	286	268	250	252	234	232	233	234	240	254	265	248	233	262	287	281	209
4	280	141	66	47	25	353	13	307	220	230	278	270	263	239	232	225	250	276	284	285	200	108	35	3	193
5	21	34	31	29	51	42	35	300	274	291	267	235	237	237	241	249	281	278	251	258	273	260	81	40	179
6	52	49	38	28	41	61	68	356	290	249	282	258	243	237	240	241	249	245	260	242	258	116	66	59	176
7	78	49	8	24	61	22	26	9	290	284	281	247	241	243	239	246	252	269	239	244	298	264	231	90	177
8	42	47	48	46	36	47	64	20	278	283	283	263	244	247	244	243	241	240	268	310	344	350	1	313	188
9	307	348	12	34	33	53	36	344	272	281	281	282	257	283	268	250	243	279	257	242	268	265	286	285	228
10	282	234	248	13	86	46	61	151	274	288	282	280	263	246	245	241	257	256	259	269	303	290	107	59	210
11	26	62	44	20	23	39	51	200	280	289	297	288	280	288	287	272	260	246	254	254	205	242	240	106	190
12	75	85	94	98	93	107	120	186	226	234	259	280	268	239	231	235	230	283	276	261	15	226	91	70	178
13	81	101	96	98	97	94	88	161	238	285	291	285	280	257	236	237	222	211	222	198	115	15	36	39	166
14	24	25	30	24	46	38	74	227	277	269	250	275	266	276	243	269	269	242	277	261	225	276	123	341	193
15	313	71	38	58	84	68	77	358	283	274	248	276	280	280	257	232	230	166	313	331	142	116	103	7	192
16	7	55	21	31	34	36	31	330	293	301	293	280	275	280	286	286	286	269	267	292	327	22	125	42	186
17	47	27	34	349	26	32	38	339	288	284	283	287	260	241	241	252	265	244	262	50	329	26	65	55	180
18	27	348	47	93	92	78	68	247	267	282	274	281	286	279	277	256	264	255	270	274	261	252	5	53	201
19	24	350	47	25	14	52	44	307	258	268	289	234	264	239	241	221	215	314	281	260	228	269	269	218	205
20	112	106	73	125	109	46	13	305	287	286	287	257	258	271	260	263	267	279	260	264	330	6	332	242	210
21	293	11	20	327	337	356	28	333	280	287	289	274	248	166	102	145	292	222	308	301	18	300	180	106	218
22	177	116	119	101	345	260	9	286	282	269	322	310	304	307	298	297	290	267	190	163	143	162	60	34	213
23	333	347	12	357	14	321	340	317	310	276	281	282	283	266	321	1	87	67	70	183	217	265	288	220	227
24	353	158	181	282	340	354	359	358	347	333	259	238	260	282	284	274	299	310	220	179	324	325	334	241	287
25	355	205	281	301	339	111	236	191	237	358	269	265	251	231	250	237	233	235	278	216	131	258	248	263	249
26	355	165	163	130	146	166	181	176	217	269	300	276	266	230	236	234	247	238	231	276	317	294	255	138	230
27	135	134	135	131	27	97	102	124	313	284	260	285	272	262	257	251	243	256	244	274	349	32	31	37	189
28	51	26	31	66	69	21	270	266	237	284	289	271	267	280	252	239	231	247	283	298	286	169	19	34	187
29	25	24	30	22	13	31	53	340	280	285	293	283	281	268	268	264	260	267	245	237	257	346	51	29	185
30	69	22	44	20	32	39	44	348	283	277	288	286	239	238	237	237	234	246	277	325	350	5	34	60	176
31	62	66	51	38	43	56	57	312	278	292	283	247	226	225	231	253	266	258	275	308	304	308	328	326	212

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 359 07/03/93 05:00:00 2ND MAX. 1 HR AVG 359 07/24/93 06:00:00

MIN. 1HR AVG 1 07/08/93 22:00:00 ARITHMETIC MEAN 200 STANDARD DEV. 106

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR WD30M in DEG

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	87	49	9	12	32	11	15	333	307	279	281	276	265	258	251	244	245	245	244	272	261	293	269	101	193
2	354	328	32	9	23	26	17	138	230	270	271	262	261	250	247	241	247	260	229	288	117	247	89	101	189
3	93	119	6	334	341	347	2	42	281	269	253	254	238	236	237	238	243	254	265	248	235	265	280	279	223
4	277	142	65	47	31	351	350	314	224	233	270	266	266	243	235	228	249	267	281	288	208	106	25	348	222
5	1	12	16	12	43	20	14	296	276	296	270	237	242	241	245	254	276	268	253	260	269	273	93	31	175
6	47	47	10	359	2	71	84	12	290	254	280	262	248	243	245	247	252	250	259	245	255	125	75	61	176
7	88	43	354	4	61	10	13	8	297	293	283	252	247	250	245	252	257	268	243	248	298	262	231	106	192
8	26	29	38	36	17	35	77	21	278	283	280	265	248	254	250	248	245	241	269	308	345	352	356	313	201
9	308	350	11	23	20	44	21	343	271	284	281	280	261	279	264	255	248	272	257	246	267	266	289	287	226
10	281	238	264	344	75	41	61	159	284	295	283	277	263	250	249	246	259	258	257	267	307	292	105	74	226
11	6	65	48	0	6	21	33	205	285	296	300	293	280	290	289	275	262	250	258	250	209	246	230	137	189
12	100	111	116	114	118	133	129	185	224	239	258	281	267	241	233	237	232	286	277	261	3	231	110	100	187
13	111	115	117	119	117	112	107	159	239	292	298	295	288	259	241	241	225	214	226	205	116	9	27	34	174
14	4	11	15	9	22	12	60	244	276	270	258	275	268	276	245	270	271	244	281	267	236	281	133	334	190
15	305	83	27	58	112	76	83	5	276	279	248	278	285	282	258	235	232	165	316	332	154	117	115	314	193
16	24	50	14	21	25	22	16	330	298	305	299	282	270	270	276	281	280	271	266	292	322	15	121	29	183
17	45	19	25	338	15	16	21	342	293	282	287	275	260	248	246	255	265	249	266	55	328	26	73	51	178
18	273	339	34	72	91	75	68	240	268	283	273	279	285	275	271	257	262	258	265	269	259	261	0	59	209
19	4	342	28	15	0	47	46	307	259	266	288	239	263	244	245	226	221	316	282	258	234	272	270	219	204
20	106	107	33	123	115	67	357	301	289	278	276	258	260	270	260	261	264	267	260	262	331	355	326	252	237
21	285	356	9	321	339	340	26	323	279	288	299	267	250	173	94	145	296	228	309	304	29	293	195	121	232
22	185	120	132	259	335	263	17	286	277	273	323	312	310	314	305	304	297	273	192	169	141	164	55	27	222
23	341	340	4	351	3	316	330	322	312	276	280	280	277	261	326	5	87	70	88	183	214	258	297	302	230
24	340	158	188	273	337	355	0	5	352	335	260	242	264	277	288	285	303	307	235	190	313	317	327	224	257
25	343	209	282	299	338	277	228	190	241	0	270	267	249	235	252	242	237	241	290	211	125	260	254	271	242
26	347	195	202	130	144	165	180	176	214	271	299	276	262	235	240	238	251	241	236	269	312	290	253	139	232
27	135	133	134	124	19	131	105	123	313	285	257	277	266	259	257	249	245	255	250	269	347	7	23	21	187
28	40	9	10	79	103	9	298	269	248	285	292	271	266	276	255	244	232	249	280	299	279	182	10	15	188
29	8	6	14	9	359	12	45	346	284	287	296	282	275	266	262	264	261	266	247	239	259	342	52	20	196
30	82	340	32	8	20	24	57	347	280	274	294	290	245	243	241	242	238	247	273	326	354	4	24	48	189
31	79	48	50	22	23	29	48	287	280	299	287	250	227	230	233	257	266	259	273	308	306	309	334	333	210

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 359 07/06/93 03:00:00 2ND MAX. 1 HR AVG 359 07/29/93 04:00:00

MIN. 1HR AVG 0 07/18/93 22:00:00 ARITHMETIC MEAN 205 STANDARD DEV. 108

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR WD60H in DEG

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
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2	330	323	16	355	9	16	359	234	228	265	268	260	258	252	248	241	247	261	229	290	116	250	88	100	218
3	8	160	357	316	313	336	352	47	275	269	254	255	238	235	236	239	245	256	266	249	237	305	276	276	250
4	274	143	63	41	28	346	339	317	228	233	267	264	264	241	236	229	251	264	279	291	216	109	22	331	220
5	339	0	7	4	40	354	3	291	275	299	270	239	241	241	245	255	273	263	255	258	266	278	101	20	201
6	35	45	346	338	293	186	108	17	286	255	276	264	252	246	248	249	255	252	261	245	256	139	102	58	209
7	93	32	341	348	59	2	0	2	301	295	278	252	249	254	247	257	260	268	245	248	296	263	229	125	206
8	17	23	45	31	1	25	112	28	277	280	277	264	250	260	257	255	249	245	263	306	344	348	345	299	200
9	315	349	6	13	6	35	14	344	268	284	280	277	262	276	264	257	252	271	259	246	267	266	287	286	224
10	279	239	236	322	36	72	74	156	286	300	280	269	259	252	250	252	260	260	255	266	309	292	112	88	225
11	349	75	50	342	357	7	19	210	288	298	302	293	275	291	288	274	258	259	262	249	205	241	228	160	232
12	140	123	128	127	131	145	147	183	216	239	257	277	266	243	234	237	235	287	274	259	348	244	132	143	209
13	124	127	131	132	126	122	120	160	238	291	299	297	293	263	247	248	226	214	226	206	117	5	17	11	177
14	352	0	5	355	356	355	46	238	275	267	261	267	265	272	245	266	265	243	281	271	237	283	146	325	245
15	297	102	111	56	155	85	90	10	268	281	249	276	287	279	260	236	234	164	318	328	157	120	120	294	199
16	20	38	7	12	15	7	5	330	303	312	303	278	263	267	270	276	272	266	265	292	317	2	120	17	177
17	39	17	13	327	2	5	347	337	295	280	288	272	259	251	248	258	265	251	266	55	325	27	86	55	190
18	261	323	25	79	92	68	67	236	268	284	273	278	284	274	270	258	261	260	263	268	256	258	353	237	229
19	316	335	2	355	348	39	51	306	258	265	286	241	261	244	248	227	225	313	283	258	237	271	260	215	244
20	108	110	26	119	124	51	348	296	289	277	273	258	260	270	262	261	263	269	260	261	220	344	317	265	230
21	281	341	0	315	338	318	348	310	275	289	304	262	250	184	76	158	305	232	313	306	72	288	202	135	246
22	191	111	109	255	330	268	36	285	271	277	322	315	314	318	311	309	300	279	197	171	140	163	52	15	222
23	337	330	354	343	350	311	322	317	314	275	279	278	267	257	329	11	87	74	82	178	206	253	297	278	255
24	330	157	192	259	319	351	0	5	352	337	257	239	266	277	288	290	306	306	244	257	306	294	329	209	257
25	328	219	282	289	335	270	218	187	160	2	271	266	253	236	251	242	237	240	213	205	114	260	255	269	233
26	264	206	214	129	141	163	180	175	215	274	296	276	259	236	239	238	251	244	238	267	308	287	251	138	229
27	134	133	133	30	16	104	109	123	314	285	259	271	259	255	256	252	247	257	252	267	349	347	15	14	195
28	36	359	355	97	143	344	308	274	241	284	292	267	261	270	257	246	232	248	275	296	279	199	0	1	232
29	355	350	2	0	346	359	41	343	284	286	298	278	270	264	262	263	262	266	250	238	253	329	59	102	240
30	92	342	23	359	6	10	319	345	282	271	296	291	248	244	241	244	240	245	270	328	353	358	12	30	227
31	113	326	95	11	2	8	28	292	280	303	285	247	225	229	232	256	266	259	269	303	311	311	336	337	222

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 359 07/30/93 03:00:00 2ND MAX. 1 HR AVG 359 07/28/93 01:00:00

MIN. 1HR AVG 0 07/05/93 01:00:00 ARITHMETIC MEAN 221 STANDARD DEV. 101

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR WS10M in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	6.4	4.9	5.5	6.1	6.1	4.9	6.4	3.9	5.7	7.2	8.3	9.5	7.5	7.9	10.9	11.6	10.3	8.0	7.8	5.6	3.1	3.8	2.4	4.7	6.6
2	4.1	5.1	6.3	5.8	6.7	7.1	5.1	2.9	4.9	7.5	9.4	9.0	9.0	12.2	11.9	11.2	9.2	5.5	5.1	5.0	4.7	5.1	16.1	17.7	7.8
3	6.7	4.2	6.5	4.8	3.8	7.7	5.4	3.2	5.7	5.7	9.2	9.8	13.5	11.8	10.7	8.5	8.5	7.1	4.7	4.1	4.4	6.2	6.5	7.0	6.9
4	6.0	5.8	8.1	5.7	5.7	6.6	2.1	5.4	5.4	6.8	6.5	7.4	7.5	9.1	11.8	11.0	9.4	6.1	9.8	7.3	5.7	5.3	3.7	5.3	6.8
5	4.2	6.3	8.2	7.8	8.6	6.8	6.1	3.0	4.8	7.0	6.0	8.3	10.9	11.6	10.9	8.8	7.6	6.4	7.8	6.6	5.9	5.0	6.3	4.3	7.0
6	5.8	6.4	5.1	5.4	3.3	3.9	4.9	2.8	4.6	5.0	6.1	8.1	9.6	9.8	10.8	10.9	8.1	7.6	5.0	3.1	3.1	3.9	4.0	4.6	5.9
7	5.6	4.7	3.3	6.0	6.9	8.5	7.7	5.3	6.3	9.2	7.5	8.4	9.3	8.3	9.5	8.8	7.6	6.7	7.0	4.6	2.8	2.8	2.2	2.3	6.3
8	4.3	5.7	6.4	7.1	6.8	7.7	6.0	2.8	5.6	6.4	7.0	6.2	6.6	6.8	6.5	6.2	5.6	5.2	4.1	3.7	4.7	4.5	4.2	2.4	5.5
9	4.8	7.0	5.2	4.5	4.3	6.5	4.9	2.9	4.8	6.5	7.2	7.4	7.2	9.3	7.4	6.5	7.2	5.9	4.6	4.4	4.1	3.2	2.7	3.5	5.5
10	4.8	4.4	1.8	2.9	2.3	4.3	3.8	2.8	5.0	6.4	6.1	5.0	4.8	5.6	5.8	5.6	4.7	5.1	4.7	4.3	4.6	3.9	4.7	4.7	4.5
11	5.0	6.4	6.6	6.5	6.8	6.9	5.6	2.8	5.1	7.3	7.9	6.4	5.8	7.0	5.4	5.0	4.7	5.0	4.5	2.9	1.9	2.2	2.5	2.0	5.1
12	4.1	6.6	7.3	6.5	7.2	4.8	6.7	4.8	5.5	4.0	6.2	7.7	7.5	8.0	7.8	6.9	5.7	5.4	3.9	3.5	2.4	2.1	3.9	5.5	5.6
13	6.4	6.7	7.2	6.1	6.6	7.4	6.4	4.6	5.2	6.3	7.7	7.6	6.7	4.9	5.8	7.0	8.1	8.2	6.1	4.2	2.4	1.9	3.8	5.5	5.9
14	4.7	7.5	6.0	6.9	6.6	6.3	5.2	2.8	4.1	5.2	6.3	6.0	6.6	5.9	5.6	5.7	5.6	4.1	2.9	2.4	2.2	2.9	3.4	5.8	5.0
15	6.4	5.9	4.6	7.4	4.2	6.2	9.6	9.0	6.9	6.5	7.2	6.9	7.2	7.4	5.8	5.5	5.6	6.4	5.3	3.6	4.7	10.2	4.5	6.0	6.4
16	6.3	3.5	9.2	9.8	8.4	6.7	4.5	3.6	5.9	9.6	9.5	6.7	6.8	7.2	7.7	6.1	6.7	5.0	3.9	3.4	3.6	3.4	4.8	5.1	6.2
17	5.0	6.4	5.9	6.4	7.4	6.6	3.6	4.4	7.2	7.8	11.0	10.9	8.1	10.0	9.7	7.8	7.0	7.1	5.3	4.2	3.6	3.0	4.2	4.3	6.5
18	3.3	6.2	7.4	11.5	15.2	6.6	7.4	4.9	7.8	7.2	9.9	13.6	12.2	11.1	8.4	8.5	6.7	6.2	5.7	5.0	5.5	3.8	2.9	2.8	7.5
19	5.1	5.4	5.3	6.7	5.9	5.1	5.4	4.6	6.2	5.3	7.0	8.8	8.8	12.3	7.8	8.1	5.0	5.0	2.7	3.8	5.2	4.3	5.8	10.5	6.2
20	8.3	11.9	7.6	11.6	7.8	6.7	4.3	4.1	9.1	10.7	10.0	9.6	8.3	9.1	8.4	8.2	8.7	7.5	6.1	5.3	2.9	6.7	4.0	5.6	7.6
21	7.8	5.9	6.3	9.5	5.0	5.8	4.7	5.0	8.0	7.8	8.4	9.3	8.9	4.2	3.8	2.4	4.1	3.1	7.6	4.8	4.1	5.2	2.7	3.7	5.7
22	6.1	1.8	1.8	3.2	6.9	7.0	20.3	7.9	7.8	5.0	7.1	9.2	7.2	7.6	8.9	8.6	8.6	4.7	4.2	3.9	5.3	4.7	6.2	3.5	6.6
23	3.3	6.2	7.8	8.5	6.2	6.3	2.8	5.4	6.2	4.3	7.3	7.7	6.2	7.5	9.1	9.4	9.2	15.0	10.5	11.1	8.4	10.8	9.1	7.7	7.7
24	7.7	11.5	10.9	4.4	5.5	10.3	12.0	8.9	10.8	9.6	4.3	6.0	7.2	6.0	5.4	5.3	7.9	3.9	3.7	2.7	3.3	5.6	5.3	8.5	6.9
25	9.0	6.4	7.9	5.8	9.2	6.9	4.8	11.5	11.5	10.9	8.6	12.7	11.6	14.0	15.1	12.0	11.9	8.9	6.8	6.0	6.5	8.6	10.2	6.5	9.3
26	4.4	4.5	4.7	13.3	14.7	12.7	9.9	10.8	8.1	11.7	10.3	8.8	8.6	12.8	14.3	14.1	9.5	9.5	6.6	5.8	8.0	6.8	7.2	11.3	9.5
27	17.2	14.4	15.3	6.5	3.6	8.6	10.5	14.5	9.4	10.7	7.9	10.5	9.4	8.5	8.1	7.2	4.5	4.9	6.5	3.4	2.1	3.4	4.1	6.7	8.2
28	5.4	6.2	4.8	5.1	4.6	4.0	3.1	2.2	2.7	5.6	6.5	7.5	8.2	7.8	8.2	8.9	8.7	6.6	4.9	3.1	2.6	2.8	4.3	5.5	5.4
29	6.9	7.4	8.3	9.0	8.3	7.6	5.0	4.8	5.2	6.5	9.5	9.1	8.1	7.1	6.8	7.0	6.6	5.9	4.5	3.8	2.8	2.3	2.5	4.8	6.2
30	5.6	2.8	4.9	3.9	3.6	6.6	3.5	7.1	6.3	6.7	8.9	8.7	11.5	11.4	12.1	9.9	8.4	7.0	4.6	6.1	6.8	5.6	5.1	6.5	6.8
31	3.7	2.9	4.0	6.1	6.9	4.9	6.2	2.3	5.3	6.7	6.4	6.0	8.9	10.7	10.1	7.6	6.5	6.1	5.3	3.7	4.3	3.8	5.5	3.6	5.7

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 20.3 07/22/93 06:00:00 2ND MAX. 1 HR AVG 17.7 07/02/93 23:00:00

MIN. 1HR AVG 1.8 07/22/93 02:00:00 ARITHMETIC MEAN 6.6 STANDARD DEV. 2.7

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR WS30H in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	4.1	2.2	3.3	4.3	4.4	5.6	4.8	4.1	6.2	7.9	8.5	10.2	8.5	9.0	12.1	13.0	11.6	8.8	9.1	6.2	3.4	3.9	2.7	4.4	6.6
2	3.9	4.8	4.6	4.3	4.9	5.2	3.8	2.9	5.2	8.3	11.4	11.1	10.8	14.3	13.6	12.5	10.0	5.9	5.6	5.6	4.8	5.5	21.5	23.6	8.5
3	7.8	4.4	7.3	5.4	3.8	7.8	5.1	3.4	5.9	6.0	9.9	11.2	15.7	13.4	11.7	9.1	9.0	7.8	5.0	4.3	4.7	6.8	8.0	8.3	7.6
4	7.5	7.0	10.0	7.0	6.5	8.3	2.4	6.1	5.6	7.0	7.1	8.4	8.1	9.8	13.7	13.0	10.9	7.7	12.0	8.6	6.7	6.0	4.4	5.5	7.9
5	3.6	5.1	7.6	7.0	5.9	4.7	4.8	3.0	4.9	7.7	6.1	8.8	11.8	13.0	12.1	9.5	8.2	7.3	9.1	8.0	7.2	6.1	7.5	2.8	7.2
6	3.0	4.2	2.9	3.5	1.8	2.0	2.9	2.5	4.7	5.2	6.2	8.6	10.3	10.6	11.7	11.9	8.7	8.3	5.4	3.2	3.2	4.4	3.8	4.4	5.6
7	5.5	3.2	3.2	5.0	4.8	7.8	8.0	6.0	6.7	10.1	7.8	8.6	9.8	8.6	10.0	9.4	7.8	7.7	7.5	4.9	3.0	3.0	2.3	2.5	6.4
8	3.5	3.0	3.7	3.7	4.7	5.3	3.4	2.8	5.7	6.6	7.0	6.3	6.7	6.8	6.6	6.2	5.7	5.3	4.3	4.1	5.7	5.0	5.0	2.7	5.0
9	5.6	8.3	6.7	5.2	4.5	4.5	3.3	3.0	4.8	6.7	7.3	7.3	7.2	9.6	7.5	6.6	7.4	5.9	5.1	4.6	4.2	3.4	2.9	3.7	5.6
10	5.1	4.9	1.9	2.3	1.3	1.8	2.2	2.8	5.0	6.7	5.9	5.1	4.9	5.7	6.0	5.6	4.8	5.3	5.3	4.9	5.0	4.4	5.5	3.6	4.4
11	3.5	3.4	5.0	5.5	6.9	6.1	5.6	2.7	5.3	7.8	9.1	6.5	5.7	7.2	5.7	4.9	4.7	5.2	4.8	3.0	1.7	2.1	2.8	1.9	4.9
12	2.6	6.0	7.1	8.1	7.0	5.4	8.4	5.7	5.8	3.9	6.2	7.8	7.7	8.3	8.1	7.0	5.9	5.8	3.9	3.6	2.5	1.9	2.9	3.6	5.6
13	7.4	7.6	7.6	6.5	7.5	8.5	10.1	5.1	5.3	6.3	8.2	7.7	6.7	4.9	5.8	7.1	8.7	9.2	7.3	4.7	2.5	2.0	2.1	3.8	6.4
14	4.4	7.4	5.9	6.6	4.8	4.5	3.7	2.7	4.0	5.1	6.3	5.9	6.4	5.8	5.5	5.8	5.5	4.1	2.9	2.4	2.2	3.1	3.9	6.5	4.8
15	8.0	4.2	3.6	5.4	3.0	6.2	13.9	12.3	8.1	6.8	7.4	7.0	7.3	7.5	5.7	5.6	5.8	6.9	5.7	3.8	5.6	12.3	4.6	6.6	6.8
16	9.0	5.4	11.6	12.0	9.8	3.1	4.5	3.7	6.4	11.5	10.9	6.7	6.7	7.3	7.5	9.1	6.7	5.1	3.9	3.5	4.3	3.5	5.5	5.4	6.9
17	4.8	7.1	6.1	7.4	8.2	6.4	3.6	4.8	8.0	8.3	12.0	12.2	9.2	10.7	10.3	8.6	7.5	7.3	5.7	5.0	4.0	3.3	3.6	4.1	7.0
18	3.2	6.5	8.7	15.3	20.5	7.7	9.0	5.4	9.0	8.2	11.3	15.3	13.9	12.9	9.3	9.9	7.7	6.9	6.5	5.8	6.7	4.3	3.3	2.6	8.7
19	5.2	6.1	3.9	6.1	6.2	3.1	4.1	4.9	6.7	5.1	7.3	10.2	9.7	14.7	8.4	8.8	5.2	5.4	2.8	4.2	6.3	4.5	7.1	12.3	6.6
20	9.7	14.7	9.2	14.5	9.8	8.1	4.0	4.2	11.2	12.1	11.9	11.2	9.8	10.3	9.4	9.4	9.6	8.5	7.5	6.6	3.0	7.8	4.6	6.1	8.9
21	9.1	6.4	7.4	11.9	6.1	6.4	4.8	5.7	9.6	9.1	9.6	11.5	11.2	4.6	4.2	2.4	4.5	3.3	8.6	5.8	4.2	6.4	3.2	3.9	6.7
22	7.8	1.8	1.6	3.2	8.2	8.2	28.7	9.8	10.1	5.7	7.9	10.4	7.9	8.8	10.9	10.8	10.4	5.2	4.7	4.9	7.3	6.1	7.7	3.6	7.9
23	4.1	7.4	8.9	10.3	7.2	7.9	3.4	6.3	7.1	4.3	7.6	8.1	6.7	8.3	9.9	10.8	11.0	19.5	12.5	14.7	9.7	12.9	10.5	8.6	9.1
24	9.3	15.4	14.4	5.8	6.3	13.9	15.9	11.9	12.6	11.0	4.1	6.2	7.1	5.9	5.7	5.5	8.8	4.0	3.7	2.7	3.8	5.9	6.5	9.8	8.2
25	10.8	8.0	9.2	6.6	11.0	7.9	5.4	14.6	13.8	13.2	10.1	14.5	13.6	17.7	18.9	14.4	14.2	10.1	7.5	6.9	7.5	9.8	11.8	7.8	11.0
26	5.2	5.7	5.2	16.3	20.3	16.2	12.2	14.4	9.6	12.7	12.8	10.0	10.4	15.3	16.9	16.9	10.8	10.8	7.3	6.8	9.6	8.2	8.7	14.9	11.5
27	22.2	18.2	19.9	7.3	3.7	10.9	13.4	17.4	11.7	11.8	9.1	12.2	12.0	10.7	9.0	8.3	4.8	5.4	7.5	3.6	2.1	3.1	4.0	5.3	9.7
28	3.7	5.7	5.7	3.2	2.7	3.2	3.6	2.2	2.7	5.8	6.8	8.2	9.8	8.5	8.6	9.4	9.6	7.3	5.0	3.1	2.8	2.8	4.4	4.8	5.4
29	6.3	6.6	7.8	8.9	8.1	6.2	3.3	5.3	5.4	6.7	10.7	9.9	8.5	7.7	7.1	7.1	6.6	6.0	4.8	4.0	3.0	2.4	2.5	4.8	6.2
30	4.6	2.3	3.7	3.9	3.9	6.4	3.5	7.9	7.1	7.1	10.2	9.8	13.1	12.6	13.7	10.7	8.9	7.4	5.0	6.7	7.8	7.5	6.5	5.7	7.3
31	1.9	2.0	1.8	3.8	4.2	4.1	3.7	2.1	4.9	7.4	6.4	6.1	9.5	12.0	11.5	8.3	7.4	6.5	6.0	3.9	4.7	4.2	6.1	4.2	5.5

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 28.7 07/22/93 06:00:00 2ND MAX. 1 HR AVG 23.6 07/02/93 23:00:00

MIN. 1HR AVG 1.3 07/10/93 04:00:00 ARITHMETIC MEAN 7.1 STANDARD DEV. 3.6

KEY FOR MISSING CODES
BadC - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR WS60H in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	3.4	1.4	2.7	4.1	4.1	5.3	3.9	4.1	6.7	8.8	8.9	12.7	11.2	11.3	13.5	13.8	12.2	9.7	10.0	6.8	3.5	4.2	3.3	4.2	7.1
2	3.8	4.6	3.1	3.7	3.9	3.8	2.9	2.8	5.6	10.1	15.3	13.9	14.8	16.9	15.2	13.1	10.8	7.1	6.3	5.9	4.9	5.7	25.3	27.1	9.4
3	8.3	4.6	7.5	5.6	4.5	7.6	5.0	3.6	6.6	6.8	11.2	14.2	16.6	14.2	12.2	9.3	9.3	8.7	5.5	4.7	5.2	7.0	9.5	10.5	8.3
4	9.0	7.4	10.7	7.9	7.0	9.7	3.3	6.4	5.7	7.3	8.5	10.8	10.0	10.6	14.7	14.2	12.4	10.8	14.1	9.6	7.3	6.0	4.3	5.3	8.9
5	3.1	4.2	6.4	5.8	4.3	3.6	3.8	3.0	5.0	7.6	6.1	9.1	12.6	13.9	13.1	11.4	9.4	9.2	11.0	10.3	9.2	6.6	7.1	2.2	7.4
6	1.2	3.0	2.3	3.0	1.8	1.4	2.1	2.4	4.8	5.3	6.3	9.7	11.1	11.0	12.3	12.8	9.9	9.1	5.9	3.4	3.5	4.5	2.9	3.7	5.5
7	4.6	2.3	3.1	4.7	3.4	7.0	7.0	5.8	6.9	10.4	7.9	8.8	10.2	8.9	10.3	10.2	9.0	9.0	7.9	5.0	3.2	3.4	2.6	2.2	6.4
8	2.1	1.6	2.4	2.1	3.5	3.8	2.5	2.6	5.7	6.7	7.4	6.3	6.7	7.1	6.8	6.0	5.7	5.1	4.6	4.4	6.4	5.8	5.5	3.0	4.7
9	6.2	8.9	7.0	4.8	3.7	3.2	2.4	3.1	5.0	6.8	7.5	7.6	8.2	10.4	9.0	7.0	7.6	6.7	5.7	4.9	4.8	3.4	3.2	3.8	5.9
10	5.9	5.2	2.2	2.5	1.3	1.0	1.7	2.7	5.0	6.7	6.3	5.1	5.0	5.9	6.0	5.6	4.9	5.6	5.9	5.6	5.4	4.8	4.9	3.0	4.5
11	2.6	2.4	4.0	5.0	6.5	5.5	5.3	2.9	5.6	7.9	9.7	6.5	5.9	7.4	5.8	4.9	4.8	5.2	5.2	3.1	1.9	2.2	2.8	2.2	4.8
12	2.5	5.2	6.9	7.9	7.7	6.0	9.5	6.1	5.9	4.0	6.4	8.1	8.7	8.6	8.3	7.1	5.9	6.1	4.2	3.8	2.5	2.1	2.1	3.5	5.8
13	7.2	8.6	7.8	7.4	7.7	7.7	8.2	5.1	5.4	6.5	8.5	8.0	6.9	4.8	5.6	7.1	8.9	9.6	7.9	5.0	2.7	2.1	1.8	2.8	6.4
14	4.3	6.8	5.3	5.8	3.7	4.0	2.9	2.8	4.3	5.1	6.4	6.1	6.6	6.0	5.5	5.6	5.5	4.1	2.9	2.5	2.5	3.2	3.7	6.9	4.7
15	8.5	3.3	3.2	4.2	2.6	6.1	17.0	14.6	9.5	6.8	7.9	7.3	7.4	7.6	5.6	5.5	5.8	7.0	5.6	4.2	6.2	12.7	4.3	6.6	7.1
16	10.2	7.1	11.8	11.4	9.0	5.4	3.9	4.1	6.5	11.9	11.5	6.8	7.6	8.6	8.5	8.6	7.3	5.7	4.4	3.6	4.8	3.2	5.6	4.6	7.2
17	4.2	6.9	5.6	8.2	7.7	5.6	3.4	5.0	8.4	8.7	12.2	14.9	11.3	11.4	10.8	10.0	9.0	7.8	6.6	5.2	4.2	3.2	3.0	3.7	7.4
18	3.9	6.6	9.2	19.2	25.3	8.6	9.4	6.4	9.8	9.2	13.5	16.5	14.8	16.3	11.5	12.1	10.2	8.6	8.1	6.5	8.4	5.4	3.5	2.7	10.2
19	4.9	6.1	3.3	5.6	6.0	2.4	3.2	5.3	8.0	5.5	7.7	11.5	11.3	16.8	9.7	9.6	5.0	5.7	2.9	4.5	7.3	4.8	7.7	12.8	7.0
20	10.5	16.2	10.3	16.2	10.8	8.4	3.7	4.8	13.1	14.7	15.4	14.0	12.6	11.8	12.3	12.0	11.9	11.3	9.7	9.3	3.5	8.2	5.2	6.1	10.5
21	11.0	6.9	7.0	13.1	7.6	6.9	4.9	6.4	12.3	10.0	10.1	14.8	13.7	5.0	4.3	2.4	4.9	3.6	8.6	6.5	4.4	7.6	3.6	4.0	7.5
22	8.3	2.0	2.0	3.4	8.4	8.7	34.1	9.5	12.1	7.1	8.2	10.7	8.3	8.7	11.6	11.1	10.9	5.7	4.8	5.1	8.9	6.1	7.5	3.9	8.6
23	4.4	7.9	8.9	11.4	7.5	9.9	4.1	7.0	7.4	4.4	8.3	9.0	7.1	8.5	9.7	11.4	12.5	23.2	13.0	16.2	9.7	13.8	10.7	9.2	9.8
24	10.1	17.4	16.1	7.6	7.2	15.4	17.2	13.9	13.9	11.6	3.8	6.2	6.6	6.3	6.0	5.8	9.3	4.1	3.8	2.8	4.1	6.4	7.0	10.6	8.9
25	12.4	9.4	9.2	7.4	11.3	8.4	6.6	16.7	14.7	15.5	11.4	14.9	16.3	19.1	22.1	17.0	15.2	10.9	7.9	7.0	8.4	10.2	12.8	8.2	12.2
26	5.8	7.0	6.1	17.5	23.3	16.9	12.3	15.9	9.8	13.4	15.2	12.1	13.4	16.1	18.2	18.0	12.9	11.7	7.6	8.2	10.5	10.2	9.7	17.1	12.9
27	24.5	20.0	21.9	8.0	3.4	12.8	15.8	18.9	12.7	12.4	11.1	15.3	17.3	14.3	11.2	9.9	5.2	6.9	8.8	4.7	2.3	2.7	3.3	4.5	11.2
28	2.6	5.0	5.7	2.7	2.3	2.6	3.6	2.4	3.0	6.0	6.9	9.9	13.1	10.0	9.8	9.8	10.2	7.6	5.1	3.3	3.1	2.5	4.0	4.1	5.6
29	5.4	5.8	6.6	7.7	7.5	5.4	2.8	5.5	5.7	6.9	11.3	10.6	9.7	9.5	8.3	7.9	7.0	6.2	5.0	4.1	3.2	2.5	2.2	4.0	6.3
30	3.8	1.9	3.0	3.5	3.6	5.7	3.3	8.0	7.8	7.9	10.9	10.7	14.2	13.3	14.6	11.1	9.2	7.7	5.5	7.0	8.1	8.1	6.5	4.4	7.5
31	1.4	1.9	1.5	2.9	2.9	3.4	2.9	2.1	4.5	7.4	6.2	6.1	9.7	13.0	12.0	9.8	8.9	7.6	6.9	4.0	4.9	4.4	6.3	4.4	5.6

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 34.1 07/22/93 06:00:00 2ND MAX. 1 HR AVG 27.1 07/02/93 23:00:00

MIN. 1HR AVG 1.0 07/10/93 05:00:00 ARITHMETIC MEAN 7.6 STANDARD DEV. 4.3

KEY FOR MISSING CODES
BadC - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR VWS10 in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	-0.6	-0.4	-0.3	-0.3	-0.4	0.0	-0.4	0.2	0.8	0.9	1.0	1.0	1.3	1.3	1.7	1.8	1.9	1.3	1.4	0.6	0.4	0.4	0.2	-0.2	0.6
2	-0.1	-0.1	-0.4	-0.2	-0.5	-0.4	-0.2	0.1	0.8	1.1	1.1	1.0	1.3	2.2	2.1	2.0	1.6	0.8	0.8	0.4	-0.1	0.4	-1.4	-1.6	0.4
3	-0.3	-0.2	-0.2	0.0	0.0	0.1	-0.1	0.2	0.8	1.0	1.5	1.7	2.2	2.0	1.7	1.5	1.6	1.2	0.8	0.5	0.5	0.9	1.0	0.7	0.8
4	0.7	0.0	-0.5	-0.1	0.1	0.2	-0.1	0.6	0.7	1.1	0.8	1.2	1.1	1.5	1.9	1.6	1.7	0.9	1.2	0.9	0.4	-0.3	0.0	0.0	0.7
5	0.0	-0.4	-0.5	-0.4	-0.8	-0.4	-0.4	0.3	0.8	1.1	1.0	1.3	1.7	1.9	1.8	1.5	0.9	0.9	1.3	1.0	0.8	0.1	-0.5	-0.2	0.5
6	-0.5	-0.5	-0.2	-0.3	-0.2	-0.3	-0.4	0.1	0.5	0.8	0.8	1.2	1.7	1.7	1.8	1.8	1.3	1.4	0.8	0.5	0.5	-0.1	-0.2	-0.2	0.5
7	-0.4	-0.3	0.1	-0.3	-0.7	-0.3	-0.4	-0.1	0.9	1.2	0.9	1.5	1.6	1.4	1.6	1.5	1.2	1.0	1.2	0.8	0.3	0.4	0.3	0.0	0.6
8	-0.2	-0.5	-0.5	-0.6	-0.4	-0.6	-0.5	0.1	0.6	0.8	0.7	1.1	1.1	1.3	1.1	1.1	1.0	0.8	0.6	0.5	0.3	0.2	0.1	0.3	0.3
9	0.4	0.2	-0.1	-0.2	-0.1	-0.5	-0.3	0.2	0.7	0.7	0.9	0.9	1.2	0.9	1.4	1.2	1.3	0.7	0.9	0.6	0.6	0.4	0.4	0.4	0.5
10	0.5	0.6	0.2	0.1	0.1	-0.2	-0.2	0.2	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.9	0.7	0.8	0.8	0.6	0.4	0.5	-0.2	-0.3	0.5
11	-0.2	-0.5	-0.4	-0.2	-0.2	-0.5	-0.4	0.2	0.6	0.8	1.2	0.8	0.8	0.8	0.7	0.7	0.7	1.0	0.7	0.4	0.1	0.2	0.1	0.0	0.3
12	-0.2	-0.5	-0.5	-0.3	-0.5	-0.1	-0.4	0.4	0.9	0.7	1.0	0.9	1.1	1.3	1.2	1.0	0.9	0.7	0.6	0.5	0.1	0.2	-0.2	-0.4	0.3
13	-0.4	-0.4	-0.5	-0.3	-0.4	-0.5	-0.3	0.1	0.9	1.0	1.2	1.2	1.0	0.8	1.0	1.1	1.2	1.0	1.0	0.4	0.0	0.1	-0.2	-0.4	0.4
14	-0.1	-0.3	-0.3	-0.3	-0.5	-0.4	-0.4	0.3	0.5	0.8	1.2	0.9	1.0	0.8	0.8	0.9	0.8	0.7	0.5	0.3	0.3	0.4	0.1	0.3	0.3
15	0.6	-0.5	-0.2	-0.6	-0.2	-0.5	-0.9	0.1	0.9	0.9	1.3	0.9	0.9	1.0	1.1	0.8	0.9	0.0	0.7	0.3	0.0	-0.5	0.1	-0.1	0.3
16	-0.2	0.0	-0.4	-0.6	-0.6	-0.4	-0.1	0.3	0.8	1.5	1.3	0.9	1.3	1.1	0.9	0.7	0.8	0.8	0.5	0.4	0.3	-0.1	0.1	-0.2	0.4
17	-0.2	-0.1	-0.3	0.2	-0.4	-0.3	0.0	0.3	1.0	0.8	1.1	1.3	1.2	1.6	1.6	1.2	1.1	1.1	0.8	0.2	0.3	0.0	-0.2	-0.1	0.5
18	0.0	0.1	-0.3	-1.0	-1.3	-0.3	0.0	0.6	1.0	1.1	1.5	1.4	1.2	1.5	0.9	1.3	0.8	1.0	0.7	0.6	0.7	0.5	0.1	0.0	0.5
19	0.0	0.0	-0.3	-0.2	-0.1	-0.4	-0.4	0.6	1.0	1.0	0.9	1.4	1.3	1.7	1.2	1.2	0.5	0.4	0.3	0.5	0.6	0.2	0.6	1.1	0.5
20	-0.4	-0.9	-0.3	-0.8	0.0	0.1	0.0	0.4	1.1	1.2	1.0	1.3	1.3	1.3	1.3	1.1	1.0	0.9	0.8	0.7	0.3	0.4	0.3	0.3	0.5
21	0.8	0.0	-0.1	0.8	0.4	0.1	0.0	0.2	1.0	1.1	1.0	1.0	1.2	0.2	0.1	0.1	0.7	0.3	0.5	0.1	0.2	0.7	0.2	-0.1	0.4
22	0.4	0.1	0.1	0.1	0.4	0.3	-0.9	0.7	0.9	0.7	0.7	1.2	0.9	0.9	1.4	1.3	1.2	0.6	0.3	0.1	0.0	0.0	-0.1	0.1	0.5
23	0.0	0.1	-0.1	0.1	-0.1	0.6	0.2	0.5	0.7	0.7	0.8	0.9	0.5	0.9	0.8	0.7	-0.2	-1.3	-0.1	0.2	0.8	1.2	0.6	0.8	0.4
24	0.6	-0.1	0.5	0.6	0.3	0.2	0.1	0.1	0.4	0.7	0.5	1.0	1.0	0.9	0.6	0.7	0.9	0.4	0.5	0.3	0.3	0.2	0.4	0.8	0.5
25	0.3	0.3	0.3	0.3	0.4	0.0	0.5	0.4	0.7	0.5	1.2	1.9	1.6	2.3	2.4	1.9	1.8	1.5	0.4	0.4	0.1	1.2	1.3	0.5	0.9
26	0.1	0.1	0.2	-0.8	-0.3	0.3	0.5	0.3	0.7	1.5	1.6	1.0	1.4	2.0	2.4	2.3	1.5	1.5	1.0	0.8	0.7	0.7	0.3	-0.3	0.8
27	-0.7	-0.5	-0.6	-0.1	0.1	-0.6	-0.7	-0.8	0.9	1.1	1.3	1.1	1.6	1.3	1.1	1.1	0.7	0.8	1.1	0.5	0.1	0.0	-0.2	-0.4	0.3
28	-0.2	-0.2	0.1	-0.4	-0.3	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.2	1.1	1.4	1.5	1.4	1.1	0.5	0.3	0.3	0.1	0.0	-0.3	0.4
29	-0.3	-0.3	-0.5	-0.4	-0.2	-0.4	-0.2	0.4	0.8	0.8	1.3	1.1	1.0	1.2	1.3	1.0	1.2	0.8	0.7	0.5	0.3	0.1	-0.1	-0.1	0.4
30	-0.4	0.0	-0.2	0.0	0.0	-0.4	0.0	0.4	0.8	0.9	1.1	1.2	1.8	1.9	2.0	1.6	1.4	1.3	0.7	0.5	0.3	0.0	-0.2	-0.6	0.6
31	-0.1	0.0	-0.2	-0.4	-0.5	-0.1	-0.5	0.2	0.7	0.9	0.7	1.0	1.3	1.8	1.7	1.4	1.1	0.9	0.7	0.4	0.4	0.4	0.4	0.3	0.5

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 2.4 07/26/93 14:00:00 2ND MAX. 1 HR AVG 2.4 07/25/93 14:00:00

MIN. 1HR AVG -1.6 07/02/93 23:00:00 ARITHMETIC MEAN 0.5 STANDARD DEV. 0.7

KEY FOR MISSING CODES
BadC - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR VWS30 in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	-0.2	0.0	0.1	0.0	0.0	0.5	-0.1	0.1	0.5	0.7	0.7	0.9	1.3	1.3	1.8	2.0	2.0	1.3	1.6	0.8	0.6	0.5	0.3	-0.1	0.7
2	0.1	0.1	-0.1	0.0	-0.1	-0.1	0.0	0.1	0.7	1.0	1.3	0.9	1.6	2.2	2.0	2.0	1.6	0.9	0.8	0.3	0.1	0.5	-1.5	-1.3	0.5
3	-0.2	-0.1	0.0	0.1	0.0	0.2	0.0	0.3	0.5	0.8	1.3	1.8	2.6	2.1	2.0	1.5	1.6	1.2	0.9	0.5	0.5	0.8	1.1	0.7	0.8
4	0.8	0.2	-0.3	-0.3	0.2	0.4	0.0	0.4	0.8	1.1	0.7	1.1	1.2	1.6	2.2	2.1	1.9	1.0	1.1	0.9	0.5	-0.1	0.2	0.1	0.7
5	0.2	0.0	-0.2	-0.1	-0.4	0.0	0.0	0.3	0.8	0.8	0.9	1.3	1.7	2.2	1.9	1.6	0.6	0.8	1.4	1.1	0.9	0.3	-0.4	0.0	0.7
6	-0.1	-0.2	0.1	0.1	0.1	0.0	0.0	0.2	0.2	0.7	0.5	1.0	1.6	1.6	1.8	1.7	1.2	1.3	0.8	0.7	0.4	0.0	-0.1	0.0	0.6
7	-0.2	-0.1	0.1	0.0	-0.3	-0.1	-0.1	0.0	0.7	0.8	0.6	1.5	1.6	1.5	1.5	1.5	1.2	1.0	1.3	0.8	0.3	0.5	0.4	0.1	0.6
8	0.0	0.0	-0.1	-0.1	0.0	-0.2	-0.1	0.0	0.3	0.4	0.3	1.3	1.0	1.5	1.1	1.0	1.1	0.7	0.8	0.4	0.2	0.2	0.1	0.3	0.4
9	0.5	0.2	0.0	-0.1	0.0	-0.2	0.0	0.2	0.8	0.3	0.4	0.3	1.4	0.7	1.6	1.1	1.1	0.6	1.0	0.6	0.5	0.4	0.4	0.4	0.5
10	0.5	0.8	0.4	0.1	0.1	0.1	0.1	0.3	0.6	0.6	0.5	0.9	1.1	0.9	0.8	0.8	0.7	0.8	0.8	0.6	0.4	0.4	0.0	-0.1	0.5
11	0.0	-0.1	-0.1	0.1	0.0	-0.2	-0.1	0.1	0.4	0.6	0.9	0.5	0.6	0.5	0.3	0.7	0.9	0.9	0.7	0.4	0.3	0.2	0.2	0.1	0.3
12	0.1	-0.3	-0.3	-0.1	-0.3	0.1	-0.1	0.5	0.9	0.7	0.9	0.5	1.1	1.1	1.1	0.9	0.9	0.5	0.6	0.5	0.1	0.2	0.0	0.0	0.4
13	-0.2	-0.2	-0.3	-0.1	-0.3	-0.4	-0.2	0.2	0.9	0.7	0.9	0.8	0.6	0.9	0.8	0.8	1.3	1.2	1.3	0.5	0.1	0.1	0.1	0.0	0.4
14	0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	0.3	0.4	0.7	1.2	0.7	0.9	0.7	0.7	0.8	0.6	0.8	0.4	0.2	0.5	0.4	0.1	0.2	0.4
15	0.6	-0.1	-0.1	-0.3	0.1	-0.3	-0.8	0.0	0.9	0.7	1.2	0.5	0.3	0.4	1.2	0.6	0.8	0.2	0.5	0.2	0.1	-0.3	0.2	0.1	0.3
16	0.0	0.1	-0.3	-0.5	-0.4	-0.1	0.1	0.3	0.6	1.3	0.9	0.6	1.7	1.3	0.9	0.4	0.6	0.7	0.6	0.4	0.3	0.0	0.3	-0.1	0.4
17	0.0	0.1	-0.2	0.3	-0.2	-0.2	0.1	0.2	0.6	0.5	0.8	1.0	1.5	1.5	1.5	1.2	0.9	0.9	0.8	0.3	0.3	0.1	0.0	-0.1	0.5
18	0.1	0.2	0.0	-1.0	-1.2	-0.2	0.1	0.8	1.0	0.9	1.4	1.4	1.0	1.5	1.0	1.5	0.9	0.9	0.8	0.5	0.9	0.7	0.1	0.2	0.6
19	0.1	0.1	-0.1	0.0	0.0	0.0	-0.2	0.6	1.1	1.0	0.6	1.5	1.3	2.1	1.2	1.3	0.5	0.3	0.2	0.5	0.8	0.3	1.0	1.4	0.6
20	0.0	-0.8	-0.3	-0.7	0.1	0.2	0.1	0.4	0.9	0.8	1.1	1.5	1.2	1.2	1.4	1.1	1.0	0.8	0.6	0.7	0.4	0.4	0.3	0.3	0.5
21	0.7	0.1	0.0	0.7	0.6	0.3	0.2	0.3	1.1	1.0	0.9	1.2	1.4	0.5	0.2	0.1	0.6	0.3	0.5	0.3	0.2	0.7	0.3	0.0	0.5
22	0.8	0.2	0.1	0.3	0.4	0.2	-1.1	0.6	1.2	0.6	0.6	1.3	0.9	0.7	1.0	0.9	0.9	0.7	0.4	0.3	0.1	0.1	0.0	0.1	0.5
23	0.2	0.2	0.0	0.2	0.0	0.6	0.2	0.4	0.5	0.6	0.6	0.7	0.3	0.7	0.6	0.6	-0.3	-1.3	-0.2	0.6	1.0	1.5	0.7	0.9	0.4
24	0.8	0.5	1.1	0.9	0.3	0.3	0.0	0.1	0.2	0.5	0.4	0.9	0.9	0.9	0.4	0.7	0.7	0.3	0.6	0.5	0.3	0.3	0.3	1.0	0.5
25	0.4	0.6	0.4	0.6	0.7	0.2	0.7	1.0	0.6	0.6	1.2	1.9	1.6	2.7	2.7	2.1	2.2	1.6	0.4	0.6	0.0	1.5	1.3	0.4	1.1
26	0.3	0.5	0.4	-0.6	0.0	0.6	0.7	0.6	0.8	1.4	1.2	1.0	1.4	2.5	2.8	2.8	1.8	1.8	1.1	1.0	0.7	0.9	0.3	-0.1	1.0
27	-0.3	-0.1	-0.1	0.0	0.2	-0.5	-0.6	-0.5	1.0	0.9	1.4	1.2	1.8	1.5	1.2	1.2	0.7	1.0	1.2	0.5	0.2	0.2	0.0	-0.1	0.5
28	0.2	0.1	0.3	0.0	0.0	0.1	0.2	0.2	0.4	0.2	0.5	1.1	1.2	0.9	1.4	1.4	1.5	1.0	0.4	0.5	0.4	0.3	0.0	0.0	0.5
29	0.0	-0.1	-0.1	-0.1	0.0	-0.1	0.0	0.4	0.6	0.4	0.9	0.6	0.8	1.3	1.5	1.0	1.1	0.6	0.8	0.7	0.5	0.2	0.0	0.0	0.5
30	-0.2	0.1	-0.1	0.1	0.1	-0.2	0.1	0.2	0.8	0.6	0.8	0.8	2.1	1.9	2.2	1.6	1.3	1.3	0.8	0.5	0.1	0.1	-0.1	-0.3	0.6
31	0.1	0.1	0.1	0.0	0.0	0.3	-0.1	0.4	0.4	0.8	0.3	1.0	1.4	1.9	1.8	1.6	1.2	1.0	0.6	0.3	0.5	0.4	0.3	0.2	0.6

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 2.8 07/26/93 14:00:00 2ND MAX. 1 HR AVG 2.8 07/26/93 15:00:00

MIN. 1HR AVG -1.5 07/02/93 22:00:00 ARITHMETIC MEAN 0.6 STANDARD DEV. 0.6

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR VWS60 in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	0.0	0.2	0.1	0.1	0.2	0.5	0.0	0.0	0.3	0.6	0.7	1.2	1.6	1.5	1.9	2.0	1.8	1.4	1.6	0.9	0.9	0.5	0.5	0.0	0.8
2	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.8	1.1	1.7	1.5	2.0	2.4	2.1	1.8	1.5	0.9	1.2	0.3	0.3	1.0	-0.4	-0.3	0.8
3	0.2	0.0	0.0	0.2	0.2	0.2	0.1	0.5	0.5	0.8	1.5	2.0	2.4	2.2	1.8	1.4	1.3	1.2	0.8	0.7	0.9	0.8	1.0	1.0	0.9
4	0.9	0.4	0.1	-0.1	0.4	0.4	0.1	0.3	1.0	1.0	1.0	1.3	1.4	1.6	2.3	2.3	1.7	1.3	1.4	0.9	0.8	0.2	0.4	0.1	0.9
5	0.2	0.1	0.1	0.1	0.0	0.2	0.1	0.3	0.7	0.3	0.8	1.1	1.7	2.0	1.7	1.6	0.9	1.1	1.5	1.4	1.1	0.4	0.0	0.1	0.7
6	0.2	0.1	0.2	0.2	0.1	0.1	0.2	0.3	0.2	0.5	0.4	1.0	1.4	1.4	1.6	1.7	1.3	1.2	0.9	0.9	0.5	0.3	0.1	0.1	0.6
7	0.1	0.1	0.1	0.1	0.0	0.0	0.0	-0.1	0.4	0.5	0.6	1.3	1.4	1.4	1.3	1.3	1.2	1.1	1.1	0.8	0.3	0.4	0.5	0.3	0.6
8	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.3	0.3	0.4	1.1	0.7	1.2	0.9	0.9	0.8	0.5	0.8	0.4	0.3	0.1	0.1	0.4	0.4
9	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.8	0.3	0.2	0.3	1.2	0.8	1.3	1.0	0.8	0.7	0.9	0.8	0.6	0.3	0.4	0.3	0.5
10	0.5	0.8	0.5	0.2	0.2	0.2	0.2	0.4	0.5	0.3	0.6	0.8	1.4	0.9	0.7	0.6	0.7	0.7	0.8	0.8	0.4	0.4	0.2	0.1	0.5
11	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.4	0.3	0.5	0.2	0.6	0.2	0.1	0.6	0.8	0.8	0.7	0.5	0.5	0.3	0.4	0.2	0.3
12	0.2	0.1	0.1	0.1	0.1	0.3	0.2	1.2	1.2	0.4	0.7	0.4	1.2	0.9	1.0	0.8	0.6	0.5	0.5	0.5	0.1	0.4	0.2	0.2	0.5
13	0.1	0.1	0.0	0.1	0.1	-0.1	0.0	0.7	0.8	0.5	0.3	0.5	0.4	0.5	0.7	0.7	1.5	2.0	1.6	1.2	0.3	0.3	0.2	0.2	0.5
14	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.4	0.4	0.7	1.1	0.7	0.9	0.6	0.3	0.8	0.6	0.6	0.3	0.2	0.6	0.3	0.4	0.2	0.4
15	0.5	0.1	0.1	0.0	0.2	0.0	-0.2	0.2	1.0	0.5	1.0	0.5	0.0	0.2	0.9	0.3	0.6	0.4	0.4	0.2	0.4	0.1	0.3	0.5	0.3
16	0.5	0.6	-0.1	-0.1	-0.1	0.0	0.2	0.2	0.2	0.7	0.4	0.4	1.6	1.3	1.1	0.6	0.8	0.7	0.6	0.4	0.3	0.0	0.5	0.1	0.5
17	0.2	0.2	0.0	0.4	0.0	0.0	0.2	0.2	0.4	0.5	0.6	1.5	1.6	1.4	1.3	1.3	1.1	0.8	0.7	0.6	0.2	0.2	0.2	0.1	0.6
18	0.4	0.4	0.4	-0.6	-0.3	0.2	0.2	0.9	1.0	0.5	1.5	1.2	1.0	1.8	1.3	1.5	1.4	1.0	0.9	0.5	1.0	0.8	0.2	0.3	0.7
19	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.6	1.0	0.9	0.6	1.5	1.3	2.3	1.1	1.3	0.3	0.3	0.1	0.5	1.1	0.3	1.1	1.7	0.7
20	0.4	-0.1	-0.1	-0.3	0.5	0.3	0.1	0.3	0.8	1.1	1.3	1.8	1.6	1.2	1.6	1.4	1.3	1.1	1.1	1.2	0.4	0.3	0.4	0.6	0.8
21	1.0	0.3	0.0	0.5	0.8	0.6	0.5	0.3	1.3	0.8	0.8	1.8	1.6	0.8	0.2	0.2	0.3	0.5	0.4	0.4	0.5	0.8	0.6	0.1	0.6
22	1.3	0.3	0.1	0.4	0.5	0.3	-0.1	0.4	1.3	0.7	0.5	0.8	0.6	0.3	0.5	0.4	0.5	0.5	1.3	0.7	0.3	0.6	0.2	0.3	0.5
23	0.2	0.2	0.0	0.1	0.1	0.6	0.3	0.3	0.4	0.5	0.7	0.7	0.3	0.7	0.5	0.5	-0.1	-0.5	-0.2	1.1	1.4	1.7	0.6	0.9	0.5
24	0.8	1.4	2.5	1.3	0.4	0.2	-0.1	0.2	0.2	0.2	0.6	1.0	0.9	0.6	0.1	0.7	0.5	0.2	0.7	0.6	0.3	0.5	0.4	1.0	0.6
25	0.7	1.4	0.8	0.8	1.1	0.7	1.2	1.9	1.1	0.9	1.2	1.7	1.7	2.6	2.9	2.3	2.3	1.6	0.7	0.7	0.3	1.6	1.7	0.9	1.4
26	0.5	1.3	0.9	0.2	0.5	1.7	1.7	1.5	1.2	0.8	1.0	1.3	1.4	2.3	2.6	2.7	1.8	1.8	1.2	0.9	1.0	1.2	0.5	0.7	1.3
27	0.4	0.4	0.4	-0.1	0.3	0.0	-0.2	0.4	0.8	0.9	1.4	1.3	2.3	1.9	1.4	1.3	0.6	0.9	1.2	0.6	0.3	0.3	0.1	0.1	0.7
28	0.2	0.2	0.6	0.1	0.2	0.2	0.3	0.3	0.4	0.1	0.4	1.2	1.5	1.1	1.3	1.2	1.5	1.0	0.4	0.5	0.4	0.6	0.1	0.1	0.6
29	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.5	0.6	1.0	1.5	1.4	1.2	1.1	0.6	0.8	0.7	0.6	0.3	0.2	0.2	0.5
30	0.1	0.2	0.1	0.1	0.3	0.1	0.2	0.1	0.5	0.7	0.5	0.7	2.0	1.8	2.1	1.4	1.2	1.3	0.8	0.2	0.1	0.1	0.2	0.1	0.6
31	0.1	0.2	0.2	0.2	0.2	0.4	0.1	0.5	0.3	0.4	0.3	0.9	1.5	2.0	1.6	1.5	1.1	1.0	0.8	0.4	0.3	0.3	0.2	0.1	0.6

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 2.9 07/25/93 14:00:00 2ND MAX. 1 HR AVG 2.7 07/26/93 15:00:00

MIN. 1HR AVG -0.6 07/18/93 03:00:00 ARITHMETIC MEAN 0.6 STANDARD DEV. 0.6

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR SD10H In DEG

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	6.7	10.1	9.9	10.5	50.0	50.7	11.5	25.1	20.1	21.0	12.2	17.7	23.0	19.6	14.5	9.9	8.6	13.8	15.8	53.0	54.1	59.1	51.2	48.6	25.7
2	23.2	37.9	12.8	9.7	8.1	9.5	15.6	32.4	23.6	23.1	23.7	19.4	22.1	15.4	11.0	8.8	13.7	20.9	14.3	48.0	34.0	46.4	24.6	13.7	21.3
3	61.4	57.9	26.8	53.3	60.1	13.6	16.4	52.8	17.6	24.4	16.2	19.0	8.4	9.3	8.4	8.8	11.0	19.0	21.0	19.3	20.6	31.0	21.9	22.1	25.9
4	23.6	45.5	25.6	55.3	39.8	22.2	64.2	18.1	19.2	12.0	21.9	22.6	24.0	14.7	9.1	10.3	16.2	26.7	20.1	22.2	20.7	15.6	46.8	11.5	25.3
5	32.4	7.3	6.7	8.0	5.5	6.9	6.7	33.1	23.6	14.9	18.6	12.2	10.2	10.8	10.3	17.5	16.9	23.7	17.1	21.0	21.6	48.7	10.3	11.3	16.5
6	5.1	4.7	8.7	11.9	22.4	15.4	9.0	51.1	16.8	21.4	16.3	15.3	13.4	10.2	10.2	10.7	17.0	13.7	22.4	22.9	27.4	21.6	41.1	18.5	17.8
7	25.9	22.2	17.0	10.6	7.4	8.0	8.0	12.6	16.0	11.5	12.2	16.8	12.6	16.4	9.9	15.6	18.3	21.5	10.6	22.1	22.4	20.0	42.6	20.2	16.7
8	6.6	5.7	5.3	4.2	5.0	4.7	4.8	36.7	14.0	10.9	11.7	24.0	18.0	19.6	17.0	17.0	16.7	14.9	22.2	16.5	11.3	11.1	11.0	41.4	14.6
9	38.8	9.7	9.0	9.5	10.1	7.7	6.6	34.7	18.2	11.9	12.7	12.5	22.5	14.9	22.3	19.9	12.6	17.9	20.1	16.5	17.9	16.3	39.0	12.9	17.3
10	15.1	18.8	60.7	17.7	24.7	5.2	12.2	37.0	15.5	14.0	16.1	21.4	23.7	15.1	18.9	14.1	17.6	18.9	20.9	20.7	15.9	19.0	36.3	10.4	20.4
11	7.7	6.6	7.0	8.7	8.1	7.7	9.7	30.0	15.6	14.8	15.0	14.4	17.4	16.5	16.8	23.7	21.7	17.6	18.3	25.3	37.7	27.7	50.6	25.0	18.5
12	11.9	5.5	5.9	9.9	7.5	20.4	9.6	12.4	12.9	28.9	21.1	13.8	19.9	11.5	12.0	11.4	13.7	16.4	19.0	17.9	35.9	29.5	13.5	6.1	15.3
13	9.0	10.2	8.4	10.2	10.7	7.8	8.9	14.6	15.6	14.9	15.8	14.6	16.2	24.1	13.1	10.2	11.0	11.6	14.3	14.0	36.9	43.4	15.6	15.7	15.3
14	8.8	7.4	9.0	7.7	6.3	7.2	18.1	36.3	15.8	20.4	21.8	21.9	19.8	19.5	17.7	22.0	18.6	20.9	25.4	26.5	29.3	27.1	42.8	17.8	19.5
15	21.4	14.3	38.7	10.0	32.7	16.4	17.2	21.2	21.9	17.6	16.9	18.5	12.7	11.8	20.6	16.2	14.3	30.1	16.5	44.9	46.8	27.1	53.7	43.2	24.4
16	35.3	35.7	11.6	8.7	8.0	7.5	16.1	18.5	16.1	16.1	14.9	16.0	24.1	21.6	18.2	10.1	14.7	22.9	21.2	18.4	22.9	13.8	32.9	13.3	18.3
17	27.1	32.7	16.7	19.6	8.6	8.5	37.6	31.6	13.4	10.1	7.8	16.5	21.6	10.3	10.3	18.4	21.8	12.8	23.5	32.9	21.2	37.9	18.5	32.3	20.5
18	49.9	50.7	56.8	56.3	16.0	36.5	39.1	33.5	16.3	20.5	22.2	15.2	10.7	22.2	17.9	19.6	23.1	21.9	20.7	24.6	22.8	44.5	16.1	53.5	29.6
19	34.7	34.3	17.3	11.6	12.5	11.6	19.8	27.2	23.3	24.9	19.2	16.9	20.4	12.6	20.5	13.4	25.8	28.1	35.7	26.5	30.0	21.4	65.5	54.1	25.3
20	52.4	31.6	69.0	27.7	56.3	44.9	54.4	22.7	16.4	17.3	18.9	17.0	20.0	16.9	20.4	21.5	17.7	17.2	19.8	26.6	62.5	48.9	32.2	48.5	32.5
21	20.1	20.4	18.1	20.1	44.8	18.1	41.8	51.6	25.6	26.2	29.6	26.7	17.2	41.3	58.8	54.6	22.3	43.9	41.3	52.6	43.6	27.0	40.0	19.5	33.5
22	25.4	43.4	29.6	59.7	31.3	59.3	46.2	40.4	27.8	32.1	23.8	18.8	18.1	16.0	16.2	15.2	13.9	16.7	14.5	12.5	12.4	18.9	24.5	32.6	27.0
23	48.9	31.8	12.3	9.4	14.6	16.7	17.7	28.4	17.9	26.9	17.6	13.4	50.6	46.8	27.4	46.4	74.3	26.2	68.1	41.7	24.4	42.1	46.8	50.3	33.4
24	55.5	17.5	28.8	48.0	21.7	8.9	8.1	10.8	9.6	13.6	22.7	19.9	29.2	22.9	33.5	57.0	16.4	28.3	36.8	50.9	33.2	75.5	43.7	48.6	30.9
25	33.5	41.4	38.4	53.0	54.6	52.9	61.0	44.5	49.6	47.0	40.2	17.4	19.3	13.8	17.0	15.1	10.4	10.7	54.4	50.8	66.6	39.2	43.8	67.7	39.3
26	60.0	60.1	63.6	28.9	13.6	19.3	27.2	16.7	38.8	33.4	22.5	23.1	26.9	16.7	8.9	8.7	17.0	10.4	16.3	23.9	20.3	36.0	41.0	18.7	27.2
27	9.9	10.8	9.8	68.5	28.4	44.9	20.5	14.8	34.0	10.1	22.0	18.4	26.8	24.1	19.3	19.5	21.8	20.8	17.4	30.2	23.1	29.9	34.4	9.1	23.7
28	23.7	33.3	53.0	8.8	21.5	15.0	60.0	31.7	35.9	13.8	17.1	20.8	24.6	20.1	18.0	8.5	11.3	16.5	17.4	23.0	20.9	48.9	22.5	6.9	23.9
29	6.6	8.9	6.2	8.1	7.6	7.5	20.2	18.6	16.8	12.9	15.4	13.2	17.3	23.0	24.4	20.8	25.1	17.6	20.9	15.2	24.3	16.7	21.5	12.9	15.9
30	10.1	56.6	7.4	11.1	47.2	15.3	35.4	23.8	42.3	19.2	14.3	16.3	9.8	8.7	8.0	8.3	11.5	19.8	25.7	13.4	10.9	9.5	9.5	6.7	18.4
31	54.8	45.5	11.3	6.9	5.9	40.4	5.0	47.3	9.4	15.7	13.0	16.6	12.9	12.3	12.0	21.4	23.0	21.3	21.7	26.6	19.7	15.7	11.3	12.7	20.1

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 75.5 07/24/93 21:00:00 2ND MAX. 1 HR AVG 74.3 07/23/93 16:00:00

MIN. 1HR AVG 4.2 07/08/93 03:00:00 ARITHMETIC MEAN 23.0 STANDARD DEV. 14.2

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR SD30M in DEG

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	12.3	24.2	11.9	11.3	49.3	39.1	20.8	23.8	14.2	17.9	12.8	16.3	18.9	16.3	11.0	7.7	5.2	10.7	11.9	44.3	41.5	56.7	38.4	42.5	23.3
2	31.8	30.0	22.7	12.1	11.6	14.1	19.0	34.8	20.3	18.4	17.6	16.1	19.7	11.4	8.0	5.5	14.2	16.9	12.0	40.1	35.1	48.9	23.6	11.1	20.6
3	56.3	56.9	24.6	32.9	64.7	14.4	18.9	43.8	15.3	21.6	12.9	16.0	4.6	4.8	5.2	5.5	7.7	15.1	18.4	15.2	16.3	46.0	17.5	17.2	23.0
4	18.3	43.8	14.6	51.2	32.7	18.9	48.2	15.3	15.9	8.0	20.6	20.0	20.5	12.1	4.7	6.2	12.6	21.6	17.2	20.1	16.5	14.6	50.0	12.6	21.5
5	16.6	6.2	5.6	8.9	7.1	11.5	5.4	23.5	19.4	9.9	16.3	8.7	8.4	7.6	7.2	15.0	15.2	18.9	14.6	16.9	19.4	47.2	10.0	14.4	13.9
6	10.7	8.3	18.7	13.8	42.1	49.2	19.5	50.0	12.6	18.8	14.7	13.1	10.0	6.5	7.1	8.4	14.0	11.3	18.9	21.2	23.5	20.3	44.0	24.6	20.1
7	28.3	30.6	17.8	9.4	14.8	8.8	6.8	10.0	11.1	7.6	11.0	13.8	9.5	13.1	7.6	12.9	15.3	17.0	8.6	17.6	19.7	17.1	29.1	18.5	14.8
8	10.2	12.6	9.3	8.3	7.3	5.8	10.9	35.4	11.7	9.6	12.3	18.5	14.6	16.7	15.4	15.2	14.6	11.3	18.0	14.1	9.7	9.2	8.7	44.1	14.3
9	23.3	8.1	6.2	10.5	9.3	7.6	8.0	24.7	18.0	9.4	9.8	12.1	19.2	12.9	19.2	15.9	9.7	16.2	17.1	13.8	14.1	15.4	19.0	10.9	13.8
10	13.2	17.1	47.4	19.7	35.8	15.4	13.4	30.9	13.1	9.5	14.6	18.6	21.1	12.7	14.2	10.0	18.5	15.4	17.3	15.9	12.2	17.6	35.1	15.3	18.9
11	12.2	14.0	11.6	7.1	6.8	9.6	13.2	35.2	14.5	9.1	8.9	11.3	17.0	11.7	11.5	20.3	19.5	14.7	16.3	21.9	40.9	27.5	38.6	29.3	17.6
12	24.6	4.8	4.0	5.7	5.2	17.0	8.0	10.1	10.2	24.7	18.6	11.7	18.9	7.6	8.6	9.4	10.4	13.3	16.5	14.4	43.6	21.5	17.5	16.8	14.3
13	6.5	5.5	7.1	8.0	5.8	6.9	4.6	11.1	12.8	12.6	11.3	11.3	11.6	20.4	12.5	7.7	7.2	7.4	11.2	11.7	26.7	42.6	15.7	13.5	12.1
14	8.9	6.4	9.4	8.6	12.5	8.7	12.9	40.3	13.7	16.7	17.5	19.5	17.2	18.0	13.9	18.7	15.2	18.5	21.5	23.7	25.0	24.2	37.7	16.8	17.7
15	16.1	25.1	48.1	16.9	39.0	17.3	15.5	16.8	18.6	14.3	11.9	15.2	9.6	11.9	20.1	11.8	10.4	29.7	14.4	36.7	50.0	24.2	49.1	54.1	24.0
16	18.5	32.2	9.4	6.6	7.2	10.9	13.1	17.0	10.5	9.8	9.4	12.6	22.6	20.2	18.2	10.1	13.4	18.1	19.0	15.0	18.8	16.2	35.4	13.9	15.8
17	38.7	29.7	16.6	18.3	7.4	8.3	36.6	23.3	9.2	8.5	4.9	15.6	17.8	8.1	7.1	16.0	17.9	11.8	19.4	30.6	19.9	43.2	29.0	41.2	20.0
18	41.7	50.4	58.9	51.2	13.5	32.8	37.0	25.5	11.3	15.9	19.5	10.5	6.9	16.9	16.7	16.5	19.4	18.1	17.8	15.6	17.9	36.1	13.9	64.2	26.2
19	45.6	28.0	28.8	29.5	10.6	27.5	33.4	22.7	19.2	20.8	17.3	11.2	16.1	10.9	15.4	9.3	23.4	21.1	31.9	24.6	29.8	18.4	54.6	52.3	25.1
20	50.8	24.4	60.6	29.6	55.6	53.3	48.6	23.3	11.3	12.2	16.2	14.7	17.8	13.6	17.4	17.6	14.8	15.1	15.5	20.9	57.8	48.0	27.7	46.2	29.7
21	16.4	20.5	14.8	16.0	34.8	22.9	46.6	42.5	22.4	23.2	20.5	20.2	13.0	37.2	46.6	44.8	22.1	43.1	39.1	47.3	54.6	22.1	27.5	21.3	30.0
22	22.7	45.3	26.2	51.8	22.0	54.9	45.7	35.0	21.6	24.3	17.1	14.6	14.3	11.3	9.3	7.4	7.1	13.9	10.9	10.5	8.6	16.5	22.4	29.0	22.6
23	26.1	22.5	10.8	9.0	13.8	14.5	16.2	23.4	13.4	21.7	15.3	14.0	55.1	45.2	27.9	41.5	63.7	20.8	65.3	42.7	22.6	36.2	48.1	57.0	30.3
24	57.0	13.5	23.7	41.4	18.9	5.9	4.6	8.1	8.1	10.6	20.6	19.1	27.7	23.5	23.7	52.0	11.1	25.2	30.4	54.0	25.8	74.9	36.6	56.4	28.0
25	33.1	32.5	32.6	40.5	54.9	65.0	49.4	44.2	51.3	39.5	32.8	14.2	15.2	9.4	14.3	11.7	6.2	8.3	52.2	52.8	64.5	32.6	38.3	69.2	36.0
26	64.6	56.0	58.6	24.9	10.3	14.5	24.5	15.4	40.4	35.8	18.1	20.3	21.3	12.4	4.9	4.6	14.2	7.3	10.3	20.4	17.5	28.9	33.8	14.4	23.9
27	7.2	8.7	7.6	64.2	31.9	50.2	16.9	11.8	29.6	7.4	15.6	15.0	21.8	18.4	14.8	15.5	18.1	18.1	14.1	22.2	21.8	30.9	26.5	9.0	20.7
28	17.4	16.3	22.6	18.6	36.0	36.2	37.3	23.4	27.0	10.5	11.8	18.6	21.2	16.6	14.9	5.8	6.9	14.2	13.4	19.6	19.8	45.3	15.8	7.8	19.9
29	6.1	7.7	5.7	5.4	6.2	11.5	28.8	14.9	14.8	10.4	10.4	10.5	16.5	20.5	19.9	17.2	17.8	13.0	15.6	15.1	16.5	19.9	23.7	12.8	14.2
30	16.7	33.6	11.2	9.9	38.8	15.0	44.8	19.6	30.4	15.3	9.0	13.1	6.5	4.9	4.0	5.4	9.1	16.4	18.1	10.9	8.7	6.3	7.5	12.8	15.3
31	38.4	51.8	22.8	10.0	9.0	20.5	7.7	43.0	10.4	9.8	10.6	13.9	8.9	7.9	7.8	17.4	19.0	17.5	17.7	24.6	16.7	13.7	7.7	8.3	17.3

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 74.9 07/24/93 21:00:00 2ND MAX. 1 HR AVG 69.2 07/25/93 23:00:00

MIN. 1HR AVG 4.0 07/30/93 14:00:00 ARITHMETIC MEAN 20.8 STANDARD DEV. 13.7

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR SD60H in DEG

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	13.9	25.9	11.6	9.2	18.5	16.0	25.7	19.6	11.8	10.9	9.7	10.0	10.6	9.8	8.6	6.3	4.8	8.1	8.8	44.1	53.5	45.7	34.3	44.8	19.3
2	27.0	27.1	39.7	14.8	14.7	29.7	41.2	40.2	17.7	11.9	8.2	8.7	10.9	6.6	5.4	4.3	8.4	11.6	10.0	38.5	37.0	55.7	18.7	10.6	20.8
3	47.4	50.1	24.1	29.3	60.0	14.4	24.2	51.5	15.0	16.8	8.5	8.8	3.9	4.0	3.9	4.9	6.2	9.8	13.3	12.4	12.9	52.8	14.6	10.1	20.8
4	13.7	37.5	12.8	47.4	34.9	16.7	34.6	14.1	15.4	6.6	12.6	10.4	12.3	9.2	3.7	3.8	6.2	10.6	12.7	17.4	16.8	14.2	39.5	17.2	17.5
5	19.1	7.4	4.9	11.2	10.0	10.8	6.6	23.3	16.9	7.5	14.3	7.9	7.5	6.3	6.8	10.5	9.8	12.3	8.8	10.3	11.1	43.0	12.4	17.7	12.4
6	23.0	12.5	14.7	17.9	47.8	41.7	21.3	45.5	13.4	15.8	14.5	9.5	8.9	5.9	6.7	6.8	10.0	9.0	14.2	23.0	17.9	19.3	39.0	31.3	19.6
7	32.0	43.0	19.3	8.2	22.3	9.8	6.7	8.8	7.6	4.6	12.4	11.7	8.8	12.6	6.8	9.5	12.3	11.1	7.6	16.1	17.8	15.6	43.8	18.1	15.3
8	16.0	25.8	16.6	12.2	10.3	7.6	16.3	34.4	10.1	10.3	10.2	16.3	12.5	12.8	11.9	12.6	12.0	10.3	15.2	11.5	8.3	7.9	7.9	39.7	14.5
9	21.8	7.5	6.1	10.4	10.6	10.7	10.9	21.6	12.6	8.3	9.1	9.8	14.2	9.6	13.1	13.5	8.2	11.6	12.7	12.5	11.4	15.5	21.1	11.9	12.3
10	9.5	13.0	33.6	15.1	38.5	23.4	16.1	32.6	11.2	7.5	12.9	16.3	20.0	14.3	12.5	10.9	15.8	13.2	14.4	12.5	10.9	18.2	42.1	22.9	18.2
11	11.8	33.2	15.9	8.2	6.8	10.4	13.6	37.6	12.2	6.2	6.4	9.8	13.6	8.7	9.5	17.2	16.8	15.3	11.9	19.6	30.7	24.9	30.6	25.7	16.5
12	31.5	4.9	4.2	4.3	5.1	11.9	5.8	7.3	8.9	19.6	14.1	11.2	13.1	7.7	7.0	8.4	9.4	11.2	12.7	14.5	42.7	35.2	17.9	21.8	13.8
13	5.9	4.8	7.7	7.5	5.5	5.1	4.6	9.2	11.3	10.7	6.8	8.2	10.5	20.9	12.8	8.3	5.2	5.4	8.6	9.8	20.4	44.8	8.6	15.3	10.7
14	10.3	5.7	10.6	10.5	9.7	8.3	11.7	50.3	11.6	14.9	15.1	15.3	13.4	14.8	11.1	15.1	13.7	14.1	23.8	22.3	17.0	21.7	33.9	16.5	16.3
15	11.1	40.9	38.0	21.8	27.9	19.0	14.6	14.5	12.1	12.4	9.3	13.0	9.2	10.7	16.8	10.8	8.8	32.5	13.6	34.1	49.4	22.2	49.4	50.6	22.6
16	8.5	24.6	8.8	6.9	7.0	17.5	13.1	16.0	8.3	7.5	6.7	11.1	16.1	13.7	12.7	8.8	11.7	12.7	15.0	14.8	15.7	22.4	34.9	17.4	13.8
17	43.6	32.8	18.3	15.7	7.4	10.3	48.6	21.9	6.0	8.1	4.0	7.7	11.3	7.0	6.7	10.7	11.8	9.3	14.9	32.0	14.8	29.9	36.3	43.7	18.9
18	42.2	50.8	58.7	46.3	10.9	34.3	30.1	22.6	9.4	12.0	14.3	8.5	3.8	8.3	9.4	10.0	12.3	11.2	12.1	10.5	11.0	33.4	15.8	59.3	22.4
19	52.6	26.7	30.0	35.2	11.6	38.9	46.1	16.7	14.7	17.7	13.7	8.8	11.8	8.9	13.1	7.4	20.6	17.0	42.8	20.2	29.2	22.5	46.9	53.9	25.3
20	47.2	20.3	50.4	29.0	54.8	55.2	50.4	22.2	7.7	7.3	6.0	8.7	10.2	8.2	10.5	8.4	8.9	8.7	9.2	12.2	48.1	44.9	25.4	42.6	24.9
21	10.8	18.6	15.6	14.1	24.3	21.0	57.6	26.5	14.6	16.1	18.2	15.0	8.2	42.2	42.6	38.4	17.0	41.7	38.3	51.9	67.7	16.9	24.8	23.4	27.7
22	19.7	54.0	32.3	47.3	17.8	50.6	50.8	36.3	16.1	21.4	17.0	11.7	12.2	10.0	6.5	5.0	4.7	12.0	9.9	7.5	6.3	15.4	22.5	23.8	21.3
23	18.5	19.7	11.5	9.1	13.9	9.9	13.1	20.4	11.1	17.2	12.9	12.6	55.0	41.0	27.0	37.9	62.2	16.8	63.6	45.1	31.3	31.5	45.8	52.4	28.3
24	59.7	12.6	17.4	31.7	20.5	5.2	3.7	6.6	6.6	8.9	22.9	22.1	25.5	20.2	22.5	41.2	8.4	23.5	21.0	35.9	18.2	68.0	32.1	45.3	24.1
25	26.5	30.9	43.2	36.6	55.7	70.7	48.1	41.0	49.4	34.1	33.7	14.3	11.4	7.4	9.2	8.1	4.7	6.6	45.1	65.9	64.1	30.1	35.1	66.0	34.9
26	57.9	54.8	46.8	18.4	7.9	13.6	24.3	16.6	41.7	37.0	17.0	17.4	14.0	17.2	3.7	3.7	8.7	6.0	12.9	12.2	13.7	23.7	28.2	14.3	21.3
27	5.7	7.3	5.9	66.8	49.8	49.8	15.1	9.9	33.4	5.1	10.7	7.2	10.8	9.8	10.0	10.7	13.6	12.7	9.6	16.7	16.6	21.3	12.6	8.6	17.5
28	24.6	19.4	21.7	39.6	48.8	41.5	36.9	26.7	33.0	10.5	11.2	14.8	11.6	12.2	11.1	5.9	5.1	12.5	11.5	16.0	16.0	62.3	9.5	8.3	21.3
29	6.0	7.1	4.6	4.9	7.3	12.3	35.9	12.2	13.7	10.2	8.4	7.3	12.0	13.2	14.7	12.1	14.3	11.8	13.4	13.5	16.8	21.2	31.8	13.5	13.3
30	18.2	47.1	15.4	9.5	36.0	15.3	32.3	20.1	23.4	10.3	4.9	9.1	5.1	4.2	3.6	5.4	9.0	12.4	15.6	9.8	7.6	4.4	7.4	35.2	15.1
31	33.4	46.8	21.2	12.1	15.0	12.8	10.7	42.7	19.0	7.4	10.0	14.0	6.5	5.4	6.1	13.1	13.8	13.1	15.3	22.8	13.6	11.1	6.6	8.0	15.9

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 70.7 07/25/93 05:00:00 2ND MAX. 1 HR AVG 68.0 07/24/93 21:00:00

MIN. 1HR AVG 3.6 07/30/93 14:00:00 ARITHMETIC MEAN 19.2 STANDARD DEV. 14.2

KEY FOR MISSING CODES
BadC - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR SW1OM in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	0.3	0.3	0.2	0.3	0.4	0.4	0.4	0.5	0.8	1.0	0.9	1.4	1.7	1.5	1.2	0.9	0.8	0.8	0.8	0.8	0.4	0.6	0.3	0.6	0.7
2	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.4	0.7	1.3	1.9	1.8	1.8	1.5	1.2	0.9	0.8	0.9	0.6	0.7	0.5	0.9	1.9	1.8	0.9
3	0.9	0.8	0.8	0.8	0.7	0.6	0.4	0.6	0.9	1.2	1.1	1.4	1.0	1.0	0.8	0.7	0.8	0.9	0.7	0.4	0.5	0.6	0.9	1.1	0.8
4	0.3	0.3	0.4	0.4	0.4	0.3	0.2	0.5	0.7	1.1	1.0	1.0	1.0	1.0	1.1	1.2	1.3	1.4	0.9	0.7	0.4	0.3	0.3	0.9	0.9
5	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.4	0.7	0.8	0.9	1.2	1.1	1.0	1.1	1.2	1.1	1.2	1.0	1.1	1.1	0.5	0.4	0.2	0.7
6	0.3	0.3	0.2	0.3	0.3	0.4	0.4	0.5	0.8	1.1	0.9	1.0	1.0	1.1	0.9	1.2	1.2	1.2	0.7	0.5	0.3	0.3	0.3	0.1	0.6
7	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.5	0.6	0.8	0.9	1.1	1.1	1.2	1.2	1.0	0.9	0.7	0.6	0.4	0.4	0.4	0.3	0.4	0.6
8	0.5	0.5	0.4	0.3	0.2	0.2	0.2	0.5	0.7	0.7	0.9	1.0	1.4	1.2	1.5	1.1	0.8	0.9	0.7	0.5	0.5	0.4	0.3	0.3	0.6
9	0.6	0.4	0.2	0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.9	1.0	0.9	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.2	0.5
10	0.2	0.3	0.2	0.3	0.4	0.3	0.3	0.3	0.6	0.9	1.3	1.0	1.0	1.0	0.8	0.8	0.8	0.9	0.7	0.4	0.1	0.2	0.2	0.1	0.5
11	0.2	0.2	0.3	0.4	0.3	0.2	0.5	0.5	0.7	0.9	1.1	1.0	1.3	0.9	0.9	0.7	0.8	0.7	0.6	0.4	0.3	0.2	0.2	0.3	0.6
12	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.9	1.2	1.2	1.0	1.2	1.0	0.9	0.9	0.8	0.7	0.4	0.3	0.2	0.2	0.3	0.6
13	0.2	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.6	0.7	1.0	1.1	1.1	1.0	1.0	1.0	0.9	0.8	0.6	0.3	0.3	0.2	0.2	0.3	0.6
14	0.8	0.3	0.3	0.4	0.3	0.4	1.0	1.3	1.1	0.9	1.0	1.1	0.9	1.0	1.2	1.0	0.8	0.8	0.7	0.4	0.7	0.9	0.6	0.5	0.8
15	0.6	0.4	0.8	0.7	0.5	0.3	0.3	0.5	0.8	1.5	1.4	1.0	1.4	1.4	1.2	0.9	1.0	0.9	0.6	0.4	0.3	0.2	0.5	0.4	0.7
16	0.4	0.6	0.4	0.5	0.4	0.4	0.3	0.6	0.8	0.8	1.0	1.7	1.4	1.1	0.9	1.1	1.3	0.8	0.8	0.4	0.3	0.2	0.3	0.3	0.7
17	0.4	0.5	0.8	1.7	1.8	0.9	0.8	0.7	0.9	1.1	1.7	1.5	1.3	1.9	1.4	1.4	1.3	1.1	1.0	0.6	0.8	0.6	0.2	0.3	1.0
18	0.3	0.4	0.3	0.4	0.4	0.3	0.4	0.6	1.0	1.0	1.0	1.1	1.3	1.3	1.2	1.0	0.8	0.5	0.4	0.4	0.6	0.4	1.0	1.4	0.7
19	1.3	1.3	1.1	1.5	1.0	0.7	0.2	0.5	1.3	1.6	1.8	1.5	1.5	1.2	1.6	1.4	1.3	1.2	1.0	0.9	0.4	0.7	0.4	0.6	1.1
20	1.0	0.4	0.5	1.1	0.6	0.5	0.5	0.7	1.4	1.3	1.4	1.7	1.2	0.4	0.4	0.4	0.6	0.5	0.8	0.5	0.5	0.8	0.3	0.2	0.7
21	0.6	0.1	0.1	0.1	0.6	0.9	3.0	1.3	1.2	1.0	1.1	1.4	1.1	1.2	1.5	1.4	1.2	0.7	0.4	0.2	0.4	0.5	0.5	0.2	0.9
22	0.2	0.5	0.6	0.6	0.4	0.7	0.2	0.7	0.8	0.7	1.0	0.9	1.0	1.1	1.2	1.5	1.8	2.4	1.8	1.4	1.0	1.6	1.1	1.2	1.0
23	1.2	1.4	1.4	0.9	0.4	0.8	0.9	0.8	0.9	0.9	0.7	0.8	1.0	1.2	1.2	1.1	0.9	0.6	0.5	0.3	0.4	1.0	0.8	1.4	0.9
24	1.1	1.0	0.8	0.8	1.2	1.1	1.0	1.6	1.8	2.3	1.5	1.4	1.6	1.3	1.9	1.4	1.0	0.9	1.0	1.3	1.6	1.2	1.6	1.5	1.3
25	0.6	0.8	0.7	1.2	1.6	1.5	1.3	1.2	1.1	1.8	1.6	1.4	1.5	1.2	1.1	1.1	1.2	0.8	0.6	0.9	0.9	1.1	1.0	1.2	1.1
26	1.5	1.3	1.4	0.9	0.3	0.8	1.0	1.4	1.3	1.0	1.2	1.7	2.1	1.6	1.2	1.0	0.7	0.9	0.8	0.5	0.1	0.1	0.2	0.3	1.0
27	0.3	0.4	0.3	0.2	0.3	0.2	0.2	0.3	0.5	0.7	0.9	1.3	1.8	1.3	1.2	0.7	0.9	0.8	0.6	0.3	0.3	0.4	0.2	0.2	0.6
28	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.5	0.7	0.8	1.3	1.1	1.3	1.5	1.4	1.1	1.0	0.7	0.5	0.4	0.3	0.1	0.2	0.2	0.7
29	0.3	0.2	0.2	0.2	0.2	0.4	0.2	0.7	1.1	1.0	1.2	1.3	1.0	0.9	1.0	0.9	0.8	0.8	0.8	0.6	0.5	0.4	0.3	0.4	0.6
30	0.3	0.1	0.2	0.2	0.3	0.2	0.2	0.4	0.5	1.1	0.9	1.0	1.1	1.1	1.1	1.2	1.3	1.0	0.9	0.4	0.5	0.4	0.5	0.2	0.6
31																									

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 3.0 07/22/93 06:00:00 2ND MAX. 1 HR AVG 2.4 07/23/93 17:00:00

MIN. 1HR AVG 0.1 07/22/93 02:00:00 ARITHMETIC MEAN 0.8 STANDARD DEV. 0.4

KEY FOR MISSING CODES
BadC - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR SW30M in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	0.2	0.2	0.1	0.2	0.7	0.7	0.4	0.6	1.0	1.2	1.1	1.7	1.8	1.5	1.2	0.7	0.7	0.9	0.8	0.9	0.6	0.8	0.4	0.8	0.8
2	0.6	0.5	0.4	0.3	0.3	0.2	0.2	0.6	1.0	1.6	2.0	1.8	2.1	1.6	1.0	0.7	0.8	1.0	0.7	0.9	0.6	1.3	2.1	1.8	1.0
3	1.2	0.9	1.0	0.9	1.1	0.6	0.4	0.7	1.0	1.4	1.2	1.6	0.7	0.8	0.7	0.7	0.9	0.9	0.9	0.5	0.5	0.7	1.0	1.2	0.9
4	0.9	1.0	0.8	1.1	0.9	0.7	0.6	0.6	0.9	1.0	1.5	1.7	1.8	1.1	0.7	0.8	1.1	1.5	1.5	1.0	0.8	0.4	0.3	0.4	1.0
5	0.3	0.2	0.3	0.3	0.2	0.3	0.2	0.7	1.1	1.0	1.4	1.1	1.0	0.9	1.0	1.4	1.2	1.3	1.2	1.2	1.2	0.8	0.3	0.1	0.8
6	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.7	0.8	1.1	1.2	1.3	1.3	0.9	0.9	0.9	1.3	1.0	1.0	0.6	0.5	0.3	0.3	0.3	0.7
7	0.3	0.4	0.2	0.2	0.4	0.3	0.4	0.5	0.9	0.9	1.1	1.3	1.1	1.6	0.9	1.3	1.4	1.4	0.7	0.7	0.4	0.5	0.4	0.1	0.7
8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.6	0.7	0.9	1.1	1.6	1.4	1.7	1.5	1.4	1.3	0.9	0.9	0.4	0.3	0.4	0.3	0.5	0.7
9	0.6	0.5	0.3	0.3	0.2	0.2	0.2	0.7	1.0	0.8	0.9	1.0	1.7	1.2	1.8	1.4	1.0	1.0	1.0	0.6	0.6	0.4	0.5	0.3	0.8
10	0.6	0.6	0.4	0.1	0.2	0.0	0.1	0.6	0.9	1.0	1.1	1.4	1.4	1.0	0.9	1.0	0.9	0.9	0.7	0.5	0.4	0.4	0.3	0.2	0.6
11	0.1	0.2	0.2	0.2	0.3	0.3	0.2	0.4	0.7	0.9	1.0	1.1	1.3	1.1	0.9	1.1	1.2	1.1	0.8	0.5	0.2	0.3	0.1	0.1	0.6
12	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.6	0.8	1.3	1.5	1.1	1.8	1.0	1.0	0.8	1.0	0.7	0.8	0.6	0.4	0.2	0.2	0.2	0.6
13	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.5	0.8	1.0	1.2	1.3	1.1	1.6	1.4	0.9	0.9	0.8	0.6	0.5	0.3	0.3	0.1	0.3	0.7
14	0.2	0.3	0.4	0.3	0.3	0.2	0.2	0.4	0.7	1.1	1.3	1.4	1.4	1.4	1.2	1.4	1.2	1.2	0.7	0.5	0.6	0.4	0.2	0.6	0.7
15	0.7	0.3	0.3	0.5	0.3	0.5	0.9	1.2	1.2	1.0	1.2	1.4	1.0	1.1	1.5	1.2	1.0	1.0	0.7	0.4	0.9	1.2	0.8	0.5	0.9
16	0.6	0.5	0.8	0.5	0.4	0.3	0.2	0.6	0.7	1.3	1.2	1.1	2.0	1.6	1.5	0.9	1.1	1.1	0.8	0.4	0.4	0.3	0.6	0.3	0.8
17	0.5	0.7	0.5	0.6	0.4	0.3	0.3	0.6	0.7	0.7	0.7	1.7	1.7	1.0	0.9	1.3	1.5	0.9	0.8	0.6	0.3	0.2	0.3	0.4	0.7
18	0.4	0.7	1.2	1.8	1.8	1.3	1.0	0.8	0.8	1.2	1.9	1.3	0.9	2.2	1.7	1.6	1.4	1.3	1.1	0.6	1.0	0.8	0.3	0.5	1.2
19	0.3	0.4	0.3	0.5	0.4	0.3	0.7	0.8	1.1	1.3	1.2	1.0	1.5	1.4	1.3	1.0	1.0	0.7	0.5	0.6	0.6	0.5	1.3	1.9	0.9
20	1.7	1.5	1.6	2.0	1.3	0.9	0.2	0.6	1.1	1.4	2.0	1.6	1.7	1.2	1.8	1.6	1.2	1.2	1.0	1.1	0.5	1.0	0.6	0.8	1.2
21	1.0	0.6	0.5	1.0	0.7	0.7	0.6	0.8	1.7	1.3	1.5	2.0	1.4	0.6	0.3	0.6	0.7	0.6	0.9	0.6	0.8	0.8	0.3	0.2	0.8
22	0.7	0.2	0.1	0.2	0.7	1.3	2.9	1.8	1.3	1.2	1.4	1.7	1.3	1.1	1.2	1.0	0.8	0.7	0.4	0.2	0.4	0.5	0.4	0.3	0.9
23	0.2	0.7	0.7	0.7	0.6	0.8	0.3	0.8	0.9	0.9	1.1	1.1	1.1	1.2	1.3	1.9	2.5	2.8	2.3	1.5	1.1	1.7	1.3	1.4	1.2
24	1.6	1.6	1.5	1.2	0.6	0.6	0.7	0.8	1.0	1.0	0.9	0.8	1.3	1.6	1.3	1.6	0.9	0.7	0.7	0.5	0.4	1.2	1.1	1.7	1.0
25	1.4	1.3	0.8	0.9	1.5	1.5	1.6	1.8	2.2	2.9	2.1	1.7	1.8	1.1	2.1	1.3	0.8	0.8	1.3	1.7	2.3	1.5	1.9	1.9	1.6
26	1.0	1.3	1.1	1.5	1.9	1.8	1.7	1.4	1.4	2.3	1.5	1.7	1.7	1.1	0.8	0.7	1.3	0.8	0.6	1.0	0.9	1.2	1.2	1.3	1.3
27	1.4	1.3	1.2	1.2	0.4	0.9	1.1	1.5	1.1	0.8	1.4	1.8	2.5	1.8	1.4	1.1	0.9	1.2	0.8	0.6	0.2	0.2	0.3	0.2	1.0
28	0.3	0.3	0.5	0.2	0.2	0.1	0.3	0.4	0.8	0.7	1.0	1.6	1.9	1.6	1.3	0.7	0.8	0.9	0.7	0.5	0.4	0.5	0.2	0.2	0.7
29	0.2	0.3	0.3	0.3	0.3	0.4	0.3	0.7	0.9	0.9	1.1	1.1	1.5	1.8	1.7	1.5	1.4	0.8	0.8	0.6	0.5	0.2	0.3	0.2	0.8
30	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.9	1.3	1.0	1.1	1.1	0.9	0.7	0.7	0.7	0.9	0.9	1.0	0.7	0.5	0.3	0.3	0.3	0.6
31	0.4	0.2	0.1	0.2	0.2	0.3	0.2	0.5	0.6	1.2	1.0	1.4	1.2	1.1	1.0	1.5	1.5	1.2	1.0	0.6	0.5	0.4	0.4	0.2	0.7

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 2.9 07/25/93 09:00:00 2ND MAX. 1 HR AVG 2.9 07/22/93 06:00:00

MIN. 1HR AVG 0.0 07/10/93 05:00:00 ARITHMETIC MEAN 0.9 STANDARD DEV. 0.5

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR SW6OH in MPH

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	0.3	0.1	0.1	0.2	0.8	0.6	0.3	0.7	0.9	1.0	1.1	1.2	1.4	1.2	1.0	0.7	0.5	0.8	0.7	1.1	0.8	0.9	0.6	0.9	0.7
2	0.8	0.7	0.4	0.4	0.4	0.2	0.2	0.7	1.1	1.2	1.4	1.2	1.6	1.2	0.8	0.6	0.8	0.8	0.7	1.2	0.8	1.7	2.2	1.9	1.0
3	1.4	1.3	1.2	1.1	1.3	0.7	0.5	0.8	0.9	1.2	0.9	1.3	0.6	0.7	0.5	0.5	0.5	0.8	0.7	0.5	0.5	0.9	0.9	0.8	0.9
4	0.8	1.3	1.0	1.4	1.0	0.7	0.8	0.8	0.8	0.7	1.2	1.3	1.5	0.9	0.5	0.6	0.7	1.2	1.3	1.1	0.8	0.5	0.5	0.5	0.9
5	0.3	0.2	0.2	0.4	0.3	0.3	0.2	0.7	1.1	0.8	1.5	0.9	1.1	1.0	0.8	1.1	1.0	1.1	0.9	1.0	1.0	1.0	0.3	0.1	0.7
6	0.0	0.2	0.1	0.1	0.3	0.1	0.1	0.8	0.9	1.2	1.3	1.1	0.9	0.7	0.7	0.8	1.1	0.8	0.9	0.7	0.6	0.4	0.3	0.3	0.6
7	0.3	0.3	0.3	0.2	0.4	0.4	0.4	0.5	0.7	0.8	1.2	1.1	1.0	1.3	0.8	1.1	1.2	1.2	0.7	0.8	0.5	0.5	0.6	0.1	0.7
8	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.7	0.7	1.0	1.0	1.7	1.2	1.5	1.4	1.3	1.4	0.9	0.9	0.5	0.2	0.4	0.3	0.5	0.7
9	0.7	0.6	0.3	0.4	0.2	0.2	0.1	0.7	1.0	0.8	0.9	1.0	1.6	1.1	1.6	1.3	0.8	0.9	1.0	0.7	0.6	0.5	0.5	0.4	0.7
10	0.6	0.6	0.5	0.1	0.2	0.0	0.1	0.6	0.9	0.8	1.1	1.6	1.7	1.1	1.0	0.8	0.9	0.8	0.7	0.6	0.4	0.5	0.4	0.1	0.7
11	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.6	0.8	0.8	1.1	1.3	1.1	0.9	1.2	1.1	1.0	0.8	0.6	0.3	0.4	0.3	0.2	0.6
12	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	1.2	1.5	1.0	1.5	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.4	0.3	0.1	0.1	0.6
13	0.3	0.4	0.5	0.4	0.4	0.4	0.3	0.5	0.7	1.0	1.0	1.3	1.3	1.6	1.1	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.1	0.2	0.6
14	0.2	0.3	0.4	0.3	0.3	0.1	0.1	0.5	0.6	1.2	1.3	1.4	1.4	1.4	1.0	1.4	1.2	1.3	0.8	0.5	0.7	0.5	0.4	0.7	0.7
15	0.6	0.3	0.4	0.6	0.4	0.6	0.8	1.1	1.1	0.9	0.9	1.2	1.0	1.1	1.5	1.1	0.9	1.1	0.6	0.5	1.1	1.5	1.0	0.7	0.9
16	0.6	0.7	1.0	0.7	0.5	0.4	0.2	0.7	0.6	1.2	1.0	1.0	1.9	1.6	1.3	0.8	0.9	0.9	0.7	0.5	0.4	0.4	0.7	0.3	0.8
17	0.7	1.0	0.6	0.7	0.5	0.4	0.4	0.6	0.6	0.7	0.6	1.2	1.3	0.8	0.7	1.2	1.2	0.8	0.7	0.8	0.3	0.2	0.2	0.5	0.7
18	0.5	1.0	1.4	1.9	1.8	1.6	1.3	1.0	0.7	0.9	1.7	1.1	0.6	1.7	1.2	1.2	1.2	1.1	0.8	0.5	0.8	0.7	0.4	0.8	1.1
19	0.4	0.5	0.3	0.5	0.6	0.3	0.9	0.8	1.1	1.4	1.2	0.7	1.4	1.2	1.1	0.8	1.1	0.6	0.6	0.6	0.7	0.5	1.5	2.4	0.9
20	2.2	1.8	2.0	2.2	1.7	1.0	0.2	0.6	0.8	1.1	1.3	1.1	1.4	0.9	1.5	1.1	1.0	0.9	0.8	0.8	0.7	1.2	0.6	1.0	1.2
21	0.8	0.6	0.6	0.9	0.8	0.8	0.9	0.9	1.5	1.2	1.6	1.8	0.9	0.8	0.4	0.7	0.7	0.7	1.2	0.7	1.0	0.7	0.4	0.2	0.9
22	0.8	0.3	0.2	0.4	0.9	1.9	3.1	2.4	1.1	1.2	1.7	1.8	1.5	0.9	0.9	0.6	0.5	0.6	0.5	0.3	0.3	0.9	0.4	0.3	1.0
23	0.2	1.0	0.9	0.9	0.6	0.8	0.4	0.9	0.8	1.0	1.0	0.8	1.4	1.5	1.5	2.2	3.1	2.8	2.8	2.1	1.6	2.0	1.3	1.8	1.4
24	1.9	2.0	1.9	1.3	0.6	0.6	0.6	0.8	1.0	1.1	0.9	0.7	1.1	1.3	1.3	2.0	0.8	0.7	0.7	0.5	0.4	1.6	1.3	1.9	1.1
25	1.6	1.6	1.1	1.2	2.0	2.2	2.2	2.5	2.6	3.5	2.5	1.7	1.5	1.2	1.8	1.1	0.7	0.6	1.6	2.2	2.8	1.9	2.4	2.3	1.9
26	1.4	2.1	1.6	2.0	2.3	2.5	2.3	2.0	1.9	2.6	1.3	1.5	1.4	1.1	0.7	0.6	1.0	0.7	0.6	0.8	0.8	1.1	1.4	1.6	1.5
27	1.4	1.4	1.2	1.6	0.5	1.0	1.1	1.7	1.0	0.6	1.0	1.2	1.9	1.4	1.1	0.9	0.7	0.9	0.7	0.6	0.2	0.3	0.3	0.1	1.0
28	0.2	0.3	0.6	0.2	0.2	0.0	0.4	0.5	0.9	0.7	1.0	1.4	1.4	1.4	1.1	0.6	0.7	0.8	0.6	0.6	0.4	0.7	0.2	0.1	0.6
29	0.2	0.3	0.2	0.2	0.4	0.4	0.3	0.9	0.9	0.8	1.0	0.8	1.2	1.5	1.4	1.4	1.4	0.8	0.8	0.7	0.6	0.3	0.3	0.2	0.7
30	0.2	0.2	0.2	0.2	0.4	0.3	0.3	1.0	1.2	0.8	0.6	0.9	0.6	0.5	0.6	0.6	0.8	0.9	0.9	0.7	0.6	0.3	0.2	0.3	0.6
31	0.2	0.1	0.0	0.1	0.0	0.3	0.1	0.6	0.5	0.9	1.0	1.4	1.1	1.0	1.0	1.2	1.4	1.0	1.0	0.6	0.5	0.4	0.4	0.3	0.6

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 3.5 07/25/93 09:00:00 2ND MAX. 1 HR AVG 3.1 07/22/93 06:00:00

MIN. 1HR AVG 0.0 07/10/93 05:00:00 ARITHMETIC MEAN 0.9 STANDARD DEV. 0.5

KEY FOR MISSING CODES
BadC - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR TEMO2 in DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	23.5	23.3	23.0	22.7	22.2	22.1	22.9	25.0	25.8	26.7	27.5	27.5	28.2	28.2	28.5	28.8	28.2	27.5	26.8	26.7	26.5	26.2	25.6	25.1	25.8
2	24.6	24.1	23.7	23.5	23.1	23.0	23.7	25.6	26.3	27.0	27.4	27.9	28.4	28.6	28.6	28.2	27.3	26.6	26.6	26.3	25.8	25.6	25.1	24.7	25.9
3	25.4	25.0	24.8	25.3	25.3	25.1	24.8	25.7	26.8	27.3	27.9	28.5	29.0	29.7	29.6	29.5	29.1	28.7	27.7	27.3	26.9	26.4	25.8	25.6	27.0
4	24.8	24.1	24.2	23.9	23.4	23.3	24.0	25.5	26.0	26.7	27.5	28.4	28.9	29.3	29.0	28.3	27.9	27.5	26.7	26.3	26.1	25.6	25.3	25.0	25.8
5	23.5	23.2	23.0	22.9	23.4	22.7	23.0	24.9	25.4	26.4	27.3	28.2	28.7	28.9	28.5	28.5	27.8	27.5	26.7	26.1	26.1	24.8	24.2	23.9	26.0
6	24.4	24.5	24.7	23.9	23.6	23.7	24.2	25.3	26.3	27.1	27.3	28.3	28.6	28.6	28.7	28.5	27.9	27.3	27.0	26.5	26.2	26.1	26.0	25.5	26.3
7	24.8	24.3	24.0	23.5	23.5	23.3	23.9	25.5	25.8	26.4	26.7	27.5	27.9	28.5	28.4	28.4	28.5	28.3	27.5	27.0	26.9	26.9	26.5	26.5	26.3
8	26.4	26.2	25.8	25.7	25.5	24.8	25.2	26.4	26.7	27.2	27.7	28.1	28.8	28.4	29.0	28.7	28.4	27.7	27.3	26.9	26.7	26.6	26.6	26.3	27.0
9	26.3	26.2	25.9	25.3	24.9	24.5	25.1	26.3	26.8	27.3	27.4	27.7	27.9	28.0	27.9	27.7	27.2	27.0	26.7	26.5	26.5	26.3	25.9	25.4	26.5
10	24.8	24.3	24.3	24.4	24.6	24.4	24.6	25.6	26.2	26.8	27.0	27.3	27.7	27.6	27.4	27.4	27.2	27.4	26.8	26.4	26.3	26.2	26.2	25.7	26.1
11	25.0	24.9	24.7	24.5	24.6	24.1	24.7	26.3	27.1	27.0	27.2	27.2	27.7	27.8	28.0	27.6	27.3	26.8	26.6	26.5	26.3	26.3	25.7	25.2	26.2
12	24.9	25.1	25.2	25.1	25.1	25.2	25 3	27.0	27.2	27.4	28.0	28.1	28.7	29.2	29.4	29.4	29.3	28.4	27.6	27.2	26.7	26.6	26.2	25.8	27.0
13	25.7	25.7	25.4	25.2	24.7	24.6	25.1	26.2	26.4	26.9	27.6	27.6	28.0	27.9	28.2	28.3	27.9	27.7	27.2	27.4	27.0	26.6	26.6	26.3	26.7
14	25.7	24.7	24.4	24.1	24.0	23.9	25.0	26.4	26.8	27.9	28.2	28.4	28.7	28.9	29.3	29.1	28.6	29.0	28.1	27.3	27.5	27.0	26.9	26.2	26.9
15	25.6	25.0	25.2	24.7	24.5	24.3	24.6	25.8	26.2	27.4	27.7	27.9	28.9	28.8	28.6	28.2	27.9	27.6	27.0	26.6	26.5	26.4	26.5	25.9	26.6
16	25.4	25.4	25.1	25.3	25.0	24.7	25.0	26.4	27.0	27.5	28.1	28.1	28.7	28.9	28.9	28.5	28.2	27.9	27.2	27.2	26.6	26.3	25.9	25.7	26.8
17	25.3	25.4	25.5	26.0	26.5	26.4	26.3	26.4	26.9	27.5	27.7	27.7	28.5	28.7	28.8	28.9	28.3	28.4	27.6	27.0	26.9	26.8	26.5	26.2	27.1
18	25.8	25.6	25.0	25.0	25.1	24.2	24.7	26.3	27.0	28.0	28.5	30.3	31.1	30.5	29.8	29.8	28.4	27.0	27.6	27.6	27.4	26.6	25.8	26.9	27.2
19	26.3	26.4	26.9	26.8	26.5	26.7	26.6	27.7	28.1	27.6	27.4	28.2	28.4	28.2	28.8	29.1	29.0	28.3	27.9	27.6	27.4	27.2	26.9	26.8	27.5
20	26.6	26.0	25.6	25.8	25.5	25.4	25.8	26.9	27.7	29.2	29.9	27.7	26.3	25.3	25.2	25.6	26.0	26.2	26.3	25.9	25.7	25.9	25.6	25.2	26.3
21	25.4	24.9	24.6	24.3	24.9	23.9	25.0	27.8	27.6	26.8	27.4	28.0	27.7	28.4	28.7	28.6	28.2	27.9	28.0	27.7	27.8	27.9	27.3	26.9	26.9
22	26.7	26.5	26.6	26.5	26.2	26.2	26.4	26.6	26.9	27.4	27.7	27.7	28.3	28.8	30.9	32.2	32.8	31.2	30.2	28.6	28.9	29.0	29.0	28.3	28.3
23	28.7	27.5	26.2	25.6	25.4	25.1	25.1	25.7	26.5	26.2	26.8	27.6	29.0	29.3	30.0	30.1	28.7	28.9	28.6	27.9	26.9	26.7	27.0	27.3	27.3
24	27.0	26.9	26.7	26.0	26.1	26.2	26.4	27.5	29.1	30.6	31.3	30.9	30.2	30.5	29.2	29.0	29.1	28.2	28.0	27.8	27.4	27.9	28.1	27.8	28.3
25	26.4	26.2	25.8	25.5	25.4	25.4	26.4	27.7	29.0	29.5	29.5	29.9	29.4	29.7	29.4	29.4	28.5	28.4	27.8	27.4	27.4	27.2	27.1	26.8	27.7
26	26.5	26.3	26.1	26.2	26.3	26.2	26.7	28.4	27.8	27.1	28.4	29.0	28.7	27.4	27.8	27.7	28.1	28.3	27.6	27.2	27.0	26.5	26.3	25.8	27.2
27	25.4	25.2	25.2	24.7	24.6	25.1	25.9	26.4	27.0	27.8	28.6	29.1	28.7	28.9	29.1	28.5	28.6	28.0	27.2	26.8	26.7	26.7	26.2	25.7	26.9
28	25.4	25.0	24.7	24.7	24.6	24.2	24.1	26.1	26.7	27.5	28.3	28.0	28.5	29.0	29.1	28.7	28.4	27.7	27.3	26.8	26.5	26.3	26.3	25.9	26.7
29	25.4	25.2	25.0	25.5	25.1	24.7	24.9	26.2	27.1	28.2	29.1	30.2	29.8	29.6	29.6	29.1	28.7	28.1	27.3	26.9	26.8	26.5	26.4	25.8	27.1
30	25.6	25.0	24.6	24.5	24.2	24.2	24.5	26.0	26.6	27.1	27.6	28.2	29.0	29.6	29.3	28.9	28.3	27.9	27.1	26.7	26.6	26.5	26.4	25.9	26.7
31																									

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 32.8 07/23/93 16:00:00 2ND MAX. 1 HR AVG 32.2 07/23/93 15:00:00

MIN. 1HR AVG 22.1 07/01/93 05:00:00 ARITHMETIC MEAN 26.8 STANDARD DEV. 1.7

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR TEM10 in DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	25.0	24.8	24.5	24.4	23.6	23.2	24.4	25.1	25.7	26.4	27.0	27.0	27.4	27.5	27.5	27.6	27.3	27.1	26.7	26.7	26.6	26.4	26.0	25.6	26.0
2	25.3	24.9	24.9	24.8	24.4	24.3	24.6	25.4	25.9	26.6	26.9	27.3	27.7	27.5	27.3	26.9	26.5	26.3	26.4	26.3	26.0	25.8	25.3	24.9	25.9
3	25.6	25.0	24.9	25.5	25.5	25.4	25.0	25.6	26.3	26.7	27.3	27.8	28.2	28.4	28.2	28.1	28.1	28.3	27.6	27.4	26.9	26.5	26.1	26.0	26.7
4	25.3	24.9	24.7	24.4	24.3	24.5	24.7	25.4	25.7	26.2	26.7	27.4	27.6	27.8	27.7	27.4	27.2	26.9	26.4	26.1	26.1	25.0	24.5	24.9	25.9
5	24.7	24.5	24.4	24.2	24.2	24.1	24.0	24.8	25.1	25.9	26.5	27.4	27.4	27.6	27.2	27.2	27.0	26.8	26.4	26.2	26.1	25.7	25.5	25.3	25.7
6	24.8	25.1	25.1	24.6	24.5	24.4	24.5	25.3	25.9	26.5	26.5	27.3	27.4	27.5	27.4	27.4	27.1	26.8	26.6	26.3	26.2	26.1	26.0	25.7	26.0
7	25.3	24.9	24.6	24.4	24.3	24.1	24.5	25.3	25.5	25.8	26.0	26.6	27.0	27.5	27.5	27.4	27.7	27.6	27.3	27.0	26.9	26.9	26.5	26.5	26.1
8	26.5	26.2	25.9	25.9	25.8	25.4	25.5	26.2	26.4	26.6	26.8	27.1	27.9	27.4	28.0	27.8	27.5	27.2	27.1	26.8	26.7	26.6	26.6	26.4	26.7
9	26.4	26.2	26.0	25.7	25.3	25.3	25.4	26.0	26.4	26.7	26.8	27.0	27.2	27.4	27.3	27.1	26.8	26.7	26.6	26.5	26.6	26.4	26.0	25.8	26.4
10	25.6	25.4	25.3	25.1	25.0	24.8	24.9	25.6	25.9	26.2	26.4	26.6	26.9	26.7	26.7	26.8	26.7	26.8	26.5	26.3	26.3	26.3	26.1	26.1	26.0
11	25.6	25.3	25.1	25.0	25.2	24.9	24.9	26.1	26.7	26.4	26.5	26.5	26.9	26.8	27.0	26.8	26.8	26.6	26.5	26.4	26.3	26.3	25.9	25.5	26.1
12	25.2	25.3	25.6	25.6	25.5	25.6	25.5	26.6	26.8	26.9	27.2	27.2	27.7	28.3	28.5	28.5	28.4	27.8	27.3	26.9	26.6	26.7	26.6	26.2	26.8
13	26.1	26.0	25.8	25.5	25.2	25.2	25.4	26.1	26.1	26.3	26.8	26.9	27.1	27.1	27.3	27.4	27.2	27.1	26.9	27.2	26.8	26.6	26.5	26.5	26.5
14	26.0	25.3	25.1	24.8	25.0	24.7	25.3	26.4	26.6	27.4	27.5	27.6	27.7	27.8	28.4	28.3	28.0	28.1	27.8	27.3	27.6	27.1	27.3	26.6	26.8
15	26.0	25.5	25.5	25.0	24.8	24.8	24.9	25.6	25.9	26.8	27.0	27.1	27.9	27.8	27.7	27.4	27.3	27.2	26.8	26.6	26.7	26.6	26.5	26.1	26.4
16	25.8	25.6	25.4	25.6	25.3	25.3	25.4	26.3	26.7	26.9	27.4	27.4	27.9	27.6	27.6	27.6	27.5	27.2	26.9	27.1	26.7	26.4	26.2	26.2	26.6
17	26.1	25.9	25.8	26.3	26.8	26.7	26.3	26.4	26.7	27.0	27.4	27.4	27.8	27.9	28.0	28.1	27.8	27.8	27.3	26.9	27.0	26.9	26.7	26.6	27.0
18	26.3	26.1	25.9	25.8	25.6	25.3	25.5	26.2	26.8	27.5	27.7	29.1	30.2	29.3	28.8	28.8	27.9	27.0	27.6	27.5	27.2	26.8	26.1	27.1	27.2
19	26.8	26.6	27.1	27.0	26.8	26.9	26.9	27.6	27.9	27.3	26.9	27.4	27.7	27.4	28.0	28.2	28.3	28.0	27.7	27.6	27.5	27.3	27.1	27.0	27.4
20	26.7	26.2	25.9	26.0	25.8	25.8	26.1	26.9	27.5	28.7	29.3	27.3	26.3	25.2	25.0	25.6	26.0	26.0	26.4	26.2	26.0	26.1	25.8	25.5	26.3
21	25.5	25.1	25.1	24.9	25.1	24.3	25.8	28.1	27.6	26.6	26.9	27.3	27.1	27.9	28.1	28.0	27.8	27.6	27.6	27.6	27.8	27.9	27.5	27.4	26.9
22	27.1	26.9	27.0	26.8	26.6	26.4	26.5	26.7	26.8	27.1	27.2	27.2	27.9	28.4	30.3	31.4	31.9	30.9	30.0	28.5	29.0	29.2	29.1	28.4	28.2
23	28.9	27.5	26.1	25.7	25.6	25.5	25.4	25.9	26.5	26.1	26.2	27.0	28.1	28.3	29.1	29.2	28.3	28.6	28.3	27.9	27.1	26.8	27.4	27.7	27.2
24	27.3	27.2	27.2	26.6	26.5	26.7	26.8	27.6	28.9	30.2	30.7	30.1	29.3	29.1	28.1	28.0	27.9	27.6	27.6	27.8	27.6	28.2	28.3	28.1	28.1
25	27.0	26.5	26.2	25.8	25.6	25.5	26.6	27.6	28.6	29.3	28.8	29.3	28.6	28.3	27.9	27.9	27.6	27.6	27.5	27.4	27.5	27.3	27.2	26.8	27.4
26	26.6	26.4	26.2	26.4	26.7	26.5	26.9	28.1	27.6	26.8	27.9	28.4	28.1	27.0	27.2	27.3	27.6	27.9	27.4	27.3	27.1	26.8	26.5	26.2	27.1
27	26.0	25.9	25.6	25.7	25.5	25.7	26.0	26.3	26.8	27.3	27.9	28.3	28.0	28.0	28.0	27.5	27.6	27.3	26.9	26.8	26.8	26.6	26.3	26.0	26.8
28	25.7	25.4	25.0	25.1	25.1	24.9	25.0	26.0	26.4	26.9	27.6	27.2	27.6	28.1	28.1	27.8	27.6	27.1	27.0	26.7	26.5	26.4	26.3	26.1	26.5
29	25.8	25.7	25.5	25.6	25.4	25.1	25.2	26.0	26.8	27.8	28.4	29.3	28.5	28.1	28.0	27.8	27.6	27.3	27.0	26.8	26.8	26.6	26.5	26.1	26.8
30	26.1	25.7	25.6	25.3	25.0	24.8	25.0	26.0	26.1	26.5	26.8	27.4	27.7	28.0	27.8	27.9	27.6	27.3	26.8	26.6	26.5	26.4	26.3	26.0	26.5
31																									

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 31.9 07/23/93 16:00:00 2ND MAX. 1 HR AVG 31.4 07/23/93 15:00:00

MIN. 1HR AVG 23.2 07/01/93 05:00:00 ARITHMETIC MEAN 26.6 STANDARD DEV. 1.2

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR TEH30 in DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	25.4	25.2	25.1	25.0	24.3	24.2	25.0	25.1	25.5	26.2	26.7	26.7	26.9	26.9	26.8	26.8	26.7	26.8	26.5	26.6	26.6	26.4	26.1	25.9	26.0
2	25.6	25.3	25.4	25.2	25.1	25.0	25.0	25.2	25.7	26.2	26.5	26.8	27.1	26.7	26.4	26.1	26.0	26.1	26.1	26.3	26.0	25.9	25.3	25.0	25.8
3	25.8	25.6	25.6	25.5	24.9	24.6	24.6	25.2	25.6	26.2	26.4	27.0	26.2	26.4	26.3	26.4	26.6	26.6	26.5	26.5	26.5	26.4	26.1	25.8	26.0
4	25.5	25.0	25.0	25.5	25.6	25.4	25.0	25.4	26.0	26.3	26.9	27.3	27.8	27.7	27.1	27.1	27.5	27.9	27.5	27.3	26.9	26.6	26.3	26.1	26.4
5	25.7	25.5	25.3	25.0	25.1	25.1	25.1	25.3	25.4	25.8	26.3	26.8	26.7	26.9	26.8	26.8	26.8	26.6	26.2	26.0	26.0	25.1	24.9	25.3	25.8
6	25.2	25.0	24.9	24.8	24.4	24.3	24.3	24.7	24.9	25.5	26.2	26.8	26.6	26.6	26.4	26.4	26.4	26.2	26.2	26.2	26.0	25.7	25.6	25.4	25.6
7	25.2	25.3	25.2	25.0	25.0	25.0	24.9	25.2	25.7	26.1	26.2	26.7	26.7	26.9	26.6	26.8	26.6	26.5	26.3	26.2	26.1	26.1	26.0	25.7	25.9
8	25.5	25.3	25.2	25.1	24.9	24.8	24.8	25.2	25.3	25.5	25.7	26.3	26.4	27.0	27.0	27.0	27.3	27.3	27.1	27.0	26.8	26.8	26.4	26.4	26.1
9	26.4	26.1	26.0	26.0	25.9	25.9	25.9	26.1	26.3	26.3	26.4	26.7	27.4	27.0	27.5	27.3	27.0	27.0	26.9	26.7	26.6	26.5	26.5	26.3	26.5
10	26.3	26.1	26.0	25.8	25.5	25.6	25.6	25.9	26.3	26.4	26.6	26.7	26.9	27.1	27.1	26.9	26.6	26.5	26.4	26.4	26.6	26.4	26.1	26.1	26.3
11	25.9	25.9	25.7	25.4	25.4	25.3	25.4	25.5	25.8	25.9	25.9	26.2	26.6	26.4	26.4	26.6	26.5	26.5	26.4	26.3	26.2	26.2	26.1	26.1	26.0
12	25.9	25.7	25.6	25.6	25.7	25.4	25.2	25.9	26.4	26.0	26.2	26.2	26.5	26.2	26.4	26.4	26.4	26.3	26.4	26.3	26.2	26.3	26.1	25.9	26.0
13	25.9	25.8	26.1	26.0	26.0	26.0	26.0	26.5	26.5	26.7	26.7	26.8	27.4	28.1	28.1	28.0	27.9	27.4	27.0	26.8	26.5	26.8	26.7	26.8	26.8
14	26.5	26.2	26.0	25.8	25.7	25.7	25.6	26.0	26.0	26.2	26.4	26.5	26.8	26.8	26.9	27.0	26.8	26.9	26.8	27.2	26.8	26.5	26.5	26.5	26.4
15	26.0	25.7	25.5	25.6	25.4	25.2	25.5	26.3	26.3	27.0	27.0	27.2	27.3	27.4	27.9	27.8	27.7	27.7	27.6	27.3	27.6	27.2	27.4	26.9	26.8
16	26.4	25.8	25.7	25.4	25.3	25.3	25.2	25.5	25.7	26.3	26.4	26.7	27.5	27.4	27.3	27.1	27.0	27.0	26.7	26.6	26.7	26.6	26.5	26.3	26.3
17	26.0	25.9	25.7	25.8	25.6	25.7	25.7	26.1	26.5	26.6	27.0	27.0	27.1	26.7	26.7	27.0	27.1	26.9	26.7	27.0	26.6	26.4	26.4	26.4	26.4
18	26.3	26.2	26.0	26.4	26.9	26.9	26.3	26.4	26.4	26.7	27.3	27.2	27.4	27.3	27.5	27.5	27.4	27.4	27.1	26.8	26.9	26.9	26.8	26.8	26.9
19	26.5	26.3	26.5	26.3	25.9	25.7	25.8	26.1	26.6	27.1	27.4	28.4	29.5	28.5	28.2	28.0	27.6	26.9	27.5	27.4	27.1	26.8	26.3	27.1	27.1
20	26.9	26.7	27.2	27.1	26.9	27.1	27.1	27.6	27.6	27.0	26.5	26.8	27.0	26.9	27.4	27.7	27.9	27.8	27.5	27.5	27.4	27.3	27.1	27.1	27.2
21	26.7	26.4	26.1	26.1	25.9	25.9	26.2	26.8	27.2	28.3	28.9	26.9	26.1	25.2	25.0	25.5	25.9	25.9	26.4	26.2	26.1	26.2	25.8	25.6	26.3
22	25.5	25.1	25.2	25.1	25.3	24.6	26.5	28.3	27.5	26.4	26.8	26.9	26.8	27.5	27.6	27.6	27.5	27.5	27.4	27.6	27.9	27.9	27.6	27.6	26.8
23	27.6	27.1	27.3	27.0	26.8	26.5	26.5	26.6	26.7	26.9	26.9	27.0	27.7	28.3	30.0	31.1	31.6	30.6	29.9	28.5	29.1	29.4	29.2	28.5	28.2
24	29.0	27.5	26.1	25.7	25.8	25.8	25.7	26.0	26.4	26.0	26.1	26.6	27.7	28.1	28.6	28.9	28.1	28.5	28.2	27.8	27.1	26.9	27.5	27.9	27.2
25	27.5	27.3	27.6	26.9	26.9	27.1	27.0	27.5	28.7	30.0	30.3	29.8	28.7	28.1	27.4	27.2	27.1	27.1	27.5	27.8	27.6	28.3	28.3	28.2	27.9
26	27.4	26.7	26.5	26.0	25.7	25.7	26.7	27.5	28.5	29.1	28.3	28.9	27.9	27.4	26.9	26.9	27.0	27.1	27.3	27.4	27.5	27.3	27.2	26.8	27.2
27	26.6	26.4	26.2	26.6	26.8	26.6	26.9	27.9	27.4	26.5	27.5	27.9	27.5	26.6	26.8	27.0	27.3	27.6	27.2	27.2	27.1	27.0	26.7	26.8	27.0
28	26.6	26.4	26.0	26.0	26.0	25.9	26.1	26.3	26.6	27.1	27.6	27.9	27.4	27.4	27.4	26.9	27.0	26.7	26.8	26.8	26.8	26.6	26.4	26.3	26.7
29	26.1	25.9	25.7	25.6	25.5	25.5	25.5	25.9	26.2	26.6	27.0	26.7	27.1	27.5	27.7	27.4	27.2	26.9	26.8	26.5	26.4	26.3	26.2	26.1	26.4
30	26.2	25.8	25.8	25.7	25.5	25.4	25.4	25.9	26.5	27.4	27.9	28.7	27.5	27.2	27.0	26.9	26.9	26.9	26.8	26.8	26.7	26.6	26.6	26.7	26.6
31	26.4	26.0	25.9	25.8	25.6	25.3	25.5	25.9	26.0	26.2	26.5	26.9	27.0	27.0	26.9	27.3	27.2	27.0	26.6	26.5	26.4	26.3	26.2	26.0	26.3

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 31.6 07/23/93 16:00:00 2ND MAX. 1 HR AVG 31.1 07/23/93 15:00:00

MIN. 1HR AVG 24.2 07/01/93 05:00:00 ARITHMETIC MEAN 26.6 STANDARD DEV. 1.0

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR TEH60 in DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	25.2	25.0	24.9	24.8	24.4	24.5	24.8	24.8	25.2	25.8	26.4	26.3	26.3	26.3	26.4	26.5	26.3	26.4	26.1	26.3	26.3	26.2	25.9	25.7	25.7
2	25.4	25.2	25.3	25.0	24.9	24.8	24.8	25.0	25.4	25.8	26.1	26.3	26.5	26.3	26.0	25.8	25.7	25.7	25.8	26.0	25.8	25.7	25.2	24.9	25.6
3	25.7	25.5	25.5	25.4	24.8	24.5	24.5	24.9	25.3	25.7	25.9	26.5	26.0	26.0	26.0	26.1	26.3	26.2	26.2	26.2	26.2	26.2	25.9	25.6	25.7
4	25.3	24.8	24.9	25.4	25.4	25.2	24.7	25.1	25.7	25.8	26.4	26.6	27.2	27.2	26.9	26.8	27.6	27.8	27.4	27.1	26.6	26.4	26.3	26.0	26.2
5	25.4	25.2	25.1	24.9	25.0	25.0	24.9	25.0	25.1	25.4	25.9	26.3	26.5	26.6	26.5	26.4	26.4	26.1	25.8	25.7	25.7	24.9	24.8	25.2	25.6
6	25.0	24.9	24.8	24.6	24.3	24.1	24.1	24.5	24.6	25.2	25.9	26.3	26.1	26.2	26.0	26.0	26.0	25.9	25.9	25.9	25.8	25.5	25.5	25.3	25.3
7	25.1	25.1	25.0	24.9	24.9	24.9	24.8	25.0	25.4	25.8	25.9	26.2	26.2	26.3	26.2	26.2	26.1	26.1	25.9	25.9	25.9	25.8	25.7	25.5	25.6
8	25.3	25.1	25.0	24.9	24.7	24.6	24.6	24.9	25.0	25.2	25.3	25.9	26.0	26.4	26.5	26.6	26.8	26.9	26.8	26.7	26.6	26.5	26.2	26.1	25.8
9	26.1	25.8	25.8	25.8	25.7	25.7	25.6	25.8	25.9	26.0	26.1	26.4	26.8	26.6	26.9	26.9	26.6	26.6	26.5	26.4	26.3	26.3	26.2	26.1	26.2
10	26.0	25.9	25.8	25.6	25.4	25.4	25.4	25.6	26.0	26.1	26.2	26.4	26.6	26.7	26.7	26.5	26.2	26.2	26.1	26.1	26.3	26.1	25.9	25.8	26.0
11	25.7	25.6	25.4	25.2	25.2	25.2	25.2	25.3	25.5	25.5	25.5	25.9	26.2	26.0	26.0	26.3	26.1	26.1	26.0	26.0	26.0	26.0	25.8	25.9	25.7
12	25.7	25.5	25.3	25.5	25.6	25.4	25.3	25.7	26.1	25.6	25.8	25.8	26.0	25.7	25.9	25.9	26.0	26.0	26.1	26.0	25.9	26.0	25.8	25.8	25.8
13	25.8	25.8	26.0	25.9	25.9	25.8	26.0	26.2	26.2	26.3	26.2	26.3	27.0	27.7	27.7	27.6	27.5	27.0	26.6	26.4	26.3	26.5	26.5	26.6	26.5
14	26.2	26.0	25.8	25.6	25.5	25.4	25.4	25.8	25.7	25.8	26.0	26.2	26.3	26.4	26.5	26.6	26.5	26.5	26.5	26.9	26.5	26.3	26.3	26.3	26.1
15	25.8	25.5	25.4	25.4	25.3	25.1	25.4	26.1	26.0	26.6	26.4	26.8	26.9	27.0	27.4	27.4	27.3	27.4	27.3	27.0	27.3	27.0	27.2	26.9	26.5
16	26.4	25.8	25.5	25.3	25.2	25.1	25.1	25.2	25.4	25.9	26.0	26.4	26.9	26.8	26.8	26.7	26.6	26.5	26.4	26.3	26.4	26.3	26.2	26.1	26.0
17	25.9	25.7	25.5	25.6	25.5	25.5	25.5	25.9	26.1	26.3	26.8	26.6	26.5	26.3	26.3	26.5	26.5	26.5	26.4	26.7	26.4	26.2	26.1	26.2	26.1
18	26.2	26.1	25.9	26.3	26.9	26.9	26.1	26.1	26.2	26.3	27.0	27.0	27.2	27.0	27.1	27.0	27.0	27.0	26.7	26.5	26.6	26.6	26.6	26.6	26.6
19	26.4	26.2	26.3	26.1	25.8	25.6	25.6	25.8	26.2	26.7	27.0	28.1	29.1	28.2	27.7	27.5	27.2	26.7	27.2	27.1	26.9	26.6	26.2	26.9	26.8
20	26.8	26.5	27.0	26.9	26.7	27.1	27.0	27.3	27.4	26.9	26.2	26.4	26.5	26.5	26.9	27.3	27.6	27.5	27.2	27.3	27.1	27.1	26.9	26.9	26.9
21	26.5	26.2	25.9	25.9	25.8	25.8	26.0	26.5	26.9	28.0	28.7	26.6	25.7	25.0	24.8	25.3	25.6	25.7	26.2	26.0	25.9	25.9	25.6	25.4	26.1
22	25.2	24.9	25.0	25.1	25.2	24.7	26.8	28.2	27.3	26.1	26.5	26.5	26.5	27.2	27.3	27.4	27.4	27.3	27.2	27.5	27.7	27.7	27.5	27.5	26.7
23	27.5	26.9	27.2	26.8	26.6	26.3	26.3	26.3	26.4	26.6	26.6	26.7	27.4	28.1	29.7	30.8	31.3	30.3	29.7	28.4	29.0	29.3	29.1	28.4	28.0
24	28.9	27.3	26.0	25.5	25.6	25.8	25.6	25.9	26.2	25.7	25.8	26.4	27.3	27.6	28.3	28.6	27.8	28.2	27.9	27.6	26.9	26.7	27.4	27.9	26.9
25	27.3	27.1	27.5	27.0	26.9	26.9	26.8	27.3	28.4	29.6	30.0	29.7	28.4	28.1	27.4	26.9	26.8	26.8	27.2	27.6	27.4	28.1	28.1	28.0	27.7
26	27.4	26.8	26.5	25.9	25.6	25.6	26.7	27.4	28.2	29.0	28.0	28.5	27.5	27.2	26.7	26.7	26.7	26.7	27.0	27.2	27.4	27.0	26.9	26.6	27.0
27	26.4	26.2	26.0	26.4	26.7	26.5	26.8	27.6	27.1	26.3	27.1	27.6	27.1	26.2	26.3	26.6	26.9	27.1	26.8	26.9	26.9	26.8	26.6	26.6	26.7
28	26.5	26.3	26.0	25.8	25.8	25.8	25.9	26.0	26.4	26.8	27.3	27.4	26.7	26.9	26.9	26.5	26.5	26.3	26.5	26.5	26.5	26.4	26.2	26.1	26.4
29	26.0	25.8	25.6	25.5	25.4	25.4	25.3	25.7	25.9	26.3	26.6	26.3	26.6	26.9	27.0	26.8	26.7	26.6	26.5	26.2	26.2	26.1	26.0	25.9	26.1
30	25.9	25.6	25.6	25.5	25.3	25.2	25.2	25.6	26.2	27.1	27.4	28.3	27.2	26.8	26.7	26.6	26.5	26.5	26.5	26.5	26.4	26.4	26.4	26.5	26.3
31	26.3	25.9	25.7	25.6	25.4	25.2	25.2	25.6	25.8	25.9	26.2	26.6	26.5	26.4	26.4	26.7	26.7	26.5	26.3	26.2	26.1	26.1	26.0	25.8	26.0

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 31.3 07/23/93 16:00:00 2ND MAX. 1 HR AVG 30.8 07/23/93 15:00:00

MIN. 1HR AVG 24.1 07/06/93 05:00:00 ARITHMETIC MEAN 26.3 STANDARD DEV. 0.9

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii 2 TO 10 METERS

HOURLY AVERAGES FOR DIFT1 In DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	1.5	1.6	1.6	1.7	1.5	1.2	1.5	0.2	-0.1	-0.2	-0.5	-0.4	-0.7	-0.7	-1.0	-1.2	-0.8	-0.3	-0.1	0.1	0.2	0.3	0.5	0.7	0.3
2	0.8	0.9	1.3	1.3	1.4	1.4	1.0	-0.1	-0.3	-0.3	-0.4	-0.5	-0.6	-1.1	-1.2	-1.2	-0.7	-0.2	-0.2	0.1	0.3	0.3	0.3	0.3	0.1
3	0.5	1.0	0.8	0.8	0.8	0.8	0.7	-0.1	-0.2	-0.4	-0.7	-0.7	-1.5	-1.3	-1.1	-0.9	-1.0	-0.6	-0.2	-0.1	0.0	0.2	0.2	0.2	-0.1
4	0.2	0.1	0.3	0.3	0.3	0.3	0.3	-0.1	-0.3	-0.5	-0.6	-0.5	-0.7	-1.2	-1.4	-1.3	-0.9	-0.4	-0.1	0.1	0.1	0.2	0.4	0.4	-0.2
5	0.7	0.9	0.6	0.6	0.9	1.3	0.8	0.0	-0.3	-0.5	-0.7	-0.9	-1.3	-1.5	-1.2	-0.8	-0.6	-0.5	-0.2	0.0	0.1	0.3	0.4	1.1	0.0
6	1.3	1.4	1.4	1.3	0.9	1.5	1.1	0.0	-0.2	-0.5	-0.6	-0.8	-1.2	-1.3	-1.2	-1.2	-0.8	-0.7	-0.2	0.0	0.1	0.1	0.3	0.4	0.0
7	0.4	0.6	0.5	0.7	1.0	0.8	0.4	0.1	-0.3	-0.5	-0.7	-1.0	-1.1	-1.0	-1.2	-1.0	-0.8	-0.4	-0.3	-0.1	0.1	0.1	0.1	0.2	-0.1
8	0.5	0.7	0.7	1.0	0.9	0.8	0.7	-0.1	-0.2	-0.5	-0.6	-0.8	-0.8	-1.0	-0.8	-0.9	-0.7	-0.6	-0.1	0.1	0.1	0.1	0.1	0.1	-0.1
9	0.1	0.1	0.2	0.3	0.4	0.7	0.4	0.0	-0.2	-0.5	-0.8	-1.0	-0.8	-0.9	-0.9	-0.8	-0.8	-0.4	-0.2	-0.1	0.0	0.1	0.1	0.2	-0.2
10	0.2	0.1	0.2	0.5	0.5	0.9	0.4	-0.2	-0.3	-0.5	-0.5	-0.6	-0.6	-0.5	-0.5	-0.5	-0.3	-0.2	0.0	0.1	0.2	0.2	0.2	0.5	0.0
11	0.8	1.1	1.1	0.8	0.5	0.6	0.4	0.0	-0.2	-0.4	-0.5	-0.6	-0.7	-0.8	-0.6	-0.6	-0.4	-0.5	-0.1	0.1	0.1	0.1	0.0	0.4	0.0
12	0.8	0.5	0.5	0.6	0.6	0.9	0.3	-0.2	-0.3	-0.5	-0.5	-0.7	-0.7	-0.9	-1.0	-0.7	-0.5	-0.2	-0.1	0.0	0.1	0.0	0.2	0.4	-0.1
13	0.4	0.3	0.4	0.5	0.5	0.4	0.3	-0.3	-0.3	-0.4	-0.7	-0.8	-0.9	-0.8	-0.8	-0.8	-0.8	-0.5	-0.2	-0.2	0.0	0.2	0.4	0.5	-0.2
14	0.5	0.4	0.4	0.4	0.6	0.7	0.4	0.0	-0.2	-0.4	-0.7	-0.7	-0.8	-0.7	-0.8	-0.9	-0.7	-0.5	-0.2	-0.1	-0.1	0.0	0.0	0.3	-0.1
15	0.3	0.7	0.8	0.8	1.1	1.0	0.4	0.1	-0.2	-0.5	-0.7	-0.7	-0.9	-1.0	-0.8	-0.8	-0.5	-0.9	-0.2	0.1	0.2	0.2	0.5	0.5	0.0
16	0.4	0.6	0.4	0.4	0.4	0.6	0.4	-0.1	-0.2	-0.5	-0.6	-0.8	-0.9	-0.8	-0.9	-0.7	-0.6	-0.3	-0.1	0.1	0.2	0.2	0.1	0.3	-0.1
17	0.4	0.3	0.4	0.4	0.4	0.6	0.5	-0.1	-0.2	-0.5	-0.6	-0.6	-0.8	-1.3	-1.2	-0.8	-0.7	-0.6	-0.1	-0.1	0.1	0.2	0.4	0.6	-0.1
18	0.8	0.6	0.5	0.4	0.4	0.4	0.1	0.1	-0.1	-0.4	-0.2	-0.2	-0.6	-0.7	-0.7	-0.8	-0.4	-0.5	-0.2	0.0	0.1	0.2	0.3	0.5	0.0
19	0.5	0.5	1.0	0.9	0.6	1.2	0.8	0.0	-0.2	-0.5	-0.7	-1.0	-0.8	-1.1	-0.9	-0.9	-0.5	0.0	0.0	0.0	-0.1	0.3	0.4	0.3	0.0
20	0.5	0.3	0.3	0.2	0.3	0.4	0.5	0.0	-0.1	-0.2	-0.4	-0.7	-0.7	-0.7	-0.8	-0.8	-0.6	-0.2	-0.1	0.1	0.1	0.1	0.2	0.3	-0.1
21	0.2	0.3	0.4	0.3	0.4	0.4	0.3	0.1	-0.2	-0.4	-0.5	-0.3	0.0	0.0	-0.1	0.0	0.0	-0.1	0.2	0.3	0.4	0.3	0.3	0.4	0.1
22	0.2	0.3	0.6	0.6	0.3	0.5	0.8	0.3	0.1	-0.1	-0.4	-0.6	-0.4	-0.4	-0.5	-0.4	-0.3	-0.2	-0.4	0.0	0.1	0.0	0.3	0.5	0.0
23	0.5	0.4	0.5	0.4	0.5	0.3	0.2	0.1	0.0	-0.3	-0.4	-0.4	-0.4	-0.3	-0.6	-0.8	-0.8	-0.2	-0.1	0.0	0.2	0.3	0.3	0.2	0.0
24	0.3	0.1	0.1	0.2	0.3	0.5	0.4	0.3	0.1	0.0	-0.5	-0.5	-0.8	-0.9	-0.8	-0.8	-0.3	-0.2	-0.2	0.1	0.3	0.2	0.4	0.5	-0.1
25	0.4	0.3	0.6	0.7	0.5	0.6	0.5	0.1	-0.2	-0.3	-0.6	-0.7	-0.8	-1.4	-1.0	-1.0	-1.1	-0.6	-0.3	0.1	0.2	0.4	0.3	0.3	-0.1
26	0.6	0.4	0.5	0.4	0.2	0.3	0.3	0.0	-0.3	-0.2	-0.5	-0.5	-0.7	-1.3	-1.4	-1.4	-0.8	-0.7	-0.3	0.1	0.2	0.2	0.2	0.1	-0.2
27	0.1	0.1	0.2	0.3	0.4	0.3	0.2	-0.2	-0.1	-0.2	-0.5	-0.6	-0.6	-0.4	-0.5	-0.3	-0.4	-0.4	-0.1	0.1	0.2	0.3	0.3	0.5	0.0
28	0.8	0.8	0.5	1.1	1.0	0.7	0.2	0.0	-0.2	-0.4	-0.7	-0.7	-0.6	-0.8	-1.0	-0.9	-0.9	-0.7	-0.2	0.0	0.1	0.0	0.2	0.4	-0.1
29	0.4	0.5	0.5	0.5	0.5	0.8	1.0	0.0	-0.2	-0.5	-0.7	-0.7	-0.8	-0.8	-0.9	-0.8	-0.7	-0.5	-0.2	-0.1	0.1	0.2	0.1	0.2	-0.1
30	0.5	0.5	0.5	0.3	0.3	0.4	0.4	-0.1	-0.3	-0.4	-0.6	-0.8	-1.3	-1.4	-1.5	-1.2	-1.0	-0.7	-0.2	0.0	0.1	0.1	0.3	0.4	-0.2
31	0.6	0.7	1.2	0.9	0.9	0.7	0.6	0.0	-0.4	-0.5	-0.7	-0.7	-1.2	-1.5	-1.4	-0.9	-0.6	-0.5	-0.2	0.0	0.0	0.0	0.1	0.2	-0.1

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 1.7 07/01/93 03:00:00 2ND MAX. 1 HR AVG 1.6 07/01/93 02:00:00

MIN. 1HR AVG -1.5 07/30/93 14:00:00 ARITHMETIC MEAN -0.1 STANDARD DEV. 0.6

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qai - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR DIFT2 in DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	0.5	0.5	0.7	0.8	0.8	1.2	0.8	0.1	0.0	-0.1	-0.1	-0.2	-0.4	-0.4	-0.6	-0.6	-0.5	-0.1	-0.1	0.1	0.1	0.1	0.3	0.4	0.1
2	0.4	0.6	0.7	0.6	0.8	0.8	0.5	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.8	-0.7	-0.4	-0.1	-0.1	0.1	0.2	0.2	0.2	0.2	0.1
3	0.3	0.4	0.5	0.4	0.4	0.6	0.4	0.0	0.0	-0.1	-0.4	-0.5	-1.0	-1.0	-0.6	-0.5	-0.5	-0.3	-0.1	0.1	0.1	0.1	0.1	0.1	-0.1
4	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.3	-0.3	-0.4	-0.3	-0.6	-1.0	-0.8	-0.4	-0.2	0.0	0.1	0.1	0.2	0.4	0.3	-0.1
5	0.5	0.7	0.7	0.7	1.0	0.8	0.6	0.0	-0.1	-0.3	-0.2	-0.5	-0.7	-0.8	-0.7	-0.4	-0.2	-0.2	-0.1	0.0	0.1	0.2	0.5	0.6	0.1
6	0.6	0.7	0.7	0.7	0.4	0.4	0.4	0.0	0.0	-0.2	-0.2	-0.4	-0.6	-0.8	-0.7	-0.7	-0.3	-0.3	0.0	0.1	0.1	0.2	0.3	0.3	0.0
7	0.5	0.4	0.2	0.6	0.7	0.8	0.5	0.1	-0.1	-0.3	-0.2	-0.5	-0.6	-0.5	-0.6	-0.6	-0.3	-0.2	-0.2	0.0	0.1	0.1	0.1	0.2	0.0
8	0.4	0.6	0.7	0.8	0.8	0.9	0.4	0.0	0.0	-0.1	-0.2	-0.2	-0.4	-0.4	-0.3	-0.3	-0.3	-0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1
9	0.1	0.1	0.2	0.2	0.3	0.6	0.5	0.0	0.0	-0.1	-0.2	-0.2	-0.4	-0.3	-0.4	-0.3	-0.3	-0.1	-0.1	0.0	0.1	0.1	0.1	0.1	0.0
10	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.1
11	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.1	0.0	-0.2	-0.4	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.2	0.0	0.1	0.1	0.1	0.1	0.2	0.1
12	0.4	0.5	0.6	0.7	0.7	0.7	0.4	0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.5	-0.5	-0.3	-0.3	-0.1	0.0	0.0	0.1	0.1	0.3	0.6	0.1
13	0.9	0.6	0.7	0.6	0.7	0.6	0.7	0.0	-0.1	-0.1	-0.3	-0.3	-0.2	-0.1	-0.3	-0.4	-0.4	-0.2	-0.2	0.0	0.1	0.2	0.3	0.7	0.1
14	0.5	0.4	0.4	0.4	0.6	0.7	0.4	0.0	0.0	0.0	-0.2	-0.2	-0.2	-0.1	-0.3	-0.2	-0.2	-0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1
15	0.2	0.5	0.5	0.9	0.5	0.6	0.3	0.0	-0.1	-0.3	-0.3	-0.2	-0.3	-0.2	-0.3	-0.3	-0.2	-0.2	0.0	0.1	0.1	0.2	0.3	0.5	0.1
16	0.5	0.5	0.3	0.5	0.6	0.6	0.5	0.0	-0.1	-0.4	-0.5	-0.2	-0.3	-0.3	-0.2	-0.1	-0.2	-0.1	0.0	0.1	0.2	0.1	0.1	0.3	0.1
17	0.4	0.4	0.4	0.3	0.5	0.6	0.4	0.0	-0.1	-0.1	-0.2	-0.3	-0.6	-0.7	-0.7	-0.4	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.3	0.3	0.0
18	0.4	0.5	0.3	0.3	0.3	0.4	0.1	0.1	-0.1	-0.2	0.0	-0.1	-0.3	-0.4	-0.3	-0.4	-0.2	-0.3	-0.1	0.0	0.1	0.1	0.2	0.3	0.0
19	0.4	0.4	0.7	0.6	0.4	0.5	0.5	0.0	-0.1	-0.2	-0.1	-0.6	-0.5	-0.6	-0.5	-0.6	-0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.1
20	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.1	-0.1	-0.1	-0.2	-0.5	-0.5	-0.3	-0.4	-0.4	-0.3	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.0
21	0.1	0.3	0.3	0.2	0.2	0.3	0.2	0.1	-0.1	-0.3	-0.2	-0.2	0.0	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1
22	0.1	0.1	0.2	0.4	0.3	0.4	0.9	0.3	0.0	0.0	0.0	-0.3	-0.2	-0.2	-0.4	-0.3	-0.2	0.0	0.0	0.1	0.2	0.2	0.3	0.4	0.1
23	0.6	0.3	0.4	0.3	0.3	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	-0.1	-0.2	-0.2	-0.1	0.0	0.2	0.2	0.3	0.3	0.2	0.1
24	0.3	0.2	0.2	0.2	0.3	0.5	0.4	0.3	0.1	0.0	0.0	-0.2	-0.2	-0.1	-0.3	-0.1	-0.1	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.1
25	0.3	0.3	0.5	0.5	0.5	0.5	0.3	0.1	0.0	-0.1	-0.2	-0.2	-0.4	-0.8	-0.6	-0.6	-0.7	-0.3	0.0	0.1	0.2	0.2	0.2	0.2	0.0
26	0.5	0.4	0.5	0.3	0.3	0.3	0.3	0.1	0.0	0.0	-0.4	-0.3	-0.5	-0.7	-0.8	-0.9	-0.5	-0.4	-0.1	0.1	0.1	0.1	0.1	0.2	-0.1
27	0.2	0.2	0.2	0.3	0.3	0.3	0.2	-0.1	-0.1	-0.1	-0.3	-0.3	-0.4	-0.2	-0.3	-0.2	-0.2	-0.1	-0.1	0.1	0.1	0.3	0.4	0.7	0.0
28	0.7	0.7	0.5	0.5	0.6	0.4	0.2	0.1	0.0	-0.1	-0.2	-0.3	-0.5	-0.4	-0.5	-0.5	-0.5	-0.4	0.0	0.1	0.1	0.1	0.2	0.5	0.1
29	0.5	0.6	0.8	0.7	0.6	0.8	0.6	0.1	-0.1	-0.1	-0.4	-0.3	-0.3	-0.4	-0.3	-0.3	-0.2	-0.1	0.0	0.0	0.1	0.1	0.1	0.2	0.1
30	0.5	0.3	0.4	0.2	0.2	0.5	0.3	0.0	-0.1	-0.2	-0.4	-0.4	-0.9	-0.8	-0.8	-0.7	-0.5	-0.3	-0.1	0.1	0.0	0.1	0.2	0.7	-0.1
31	0.5	0.5	0.4	0.6	0.7	0.7	0.6	0.0	0.0	-0.2	-0.2	-0.3	-0.6	-0.9	-0.9	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.0

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 1.2 07/01/93 05:00:00 2ND MAX. 1 HR AVG 1.0 07/05/93 04:00:00

MIN. 1HR AVG -1.0 07/03/93 13:00:00 ARITHMETIC MEAN 0.0 STANDARD DEV. 0.4

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

KAWAIHAE METEOROLOGICAL TOWER
Kawaihae, Hawaii

HOURLY AVERAGES FOR DIFF3 in DEG C

JULY 1993

DAY	HOUR (HST) 00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAILY AVG
1	0.3	0.3	0.5	0.6	0.9	1.4	0.6	-0.2	-0.4	-0.5	-0.5	-0.6	-1.0	-1.0	-1.0	-0.9	-0.9	-0.5	-0.4	-0.2	-0.1	-0.1	0.1	0.2	-0.1
2	0.2	0.4	0.6	0.4	0.7	0.6	0.3	-0.2	-0.4	-0.6	-0.7	-0.9	-1.1	-1.1	-1.1	-1.0	-0.7	-0.5	-0.4	-0.2	-0.1	0.0	0.0	0.2	-0.2
3	0.3	0.2	0.4	0.3	0.2	0.4	0.3	-0.3	-0.4	-0.6	-0.8	-1.0	-1.2	-1.4	-1.0	-0.8	-0.9	-0.7	-0.5	-0.3	-0.3	-0.1	-0.2	-0.2	-0.3
4	-0.2	-0.1	0.1	0.0	0.0	0.0	-0.1	-0.3	-0.6	-0.8	-0.8	-1.1	-0.9	-1.1	-1.2	-1.1	-0.3	-0.4	-0.1	-0.2	-0.1	0.1	0.4	0.1	-0.4
5	0.2	0.4	0.5	0.5	0.8	0.6	0.3	-0.3	-0.5	-0.7	-0.7	-1.0	-1.0	-1.1	-1.1	-0.9	-0.6	-0.7	-0.5	-0.3	-0.3	0.1	0.4	0.4	-0.2
6	0.5	0.5	0.5	0.5	0.2	0.2	0.2	-0.2	-0.3	-0.5	-0.5	-1.0	-1.2	-1.2	-1.1	-1.1	-0.8	-0.8	-0.4	-0.2	-0.2	-0.1	0.1	0.1	-0.3
7	0.4	0.2	0.0	0.4	0.5	0.6	0.4	-0.2	-0.4	-0.7	-0.5	-0.9	-1.2	-1.1	-1.1	-1.1	-0.9	-0.6	-0.6	-0.3	-0.2	-0.2	-0.2	-0.1	-0.3
8	0.2	0.3	0.4	0.5	0.5	0.7	0.2	-0.3	-0.3	-0.5	-0.6	-0.6	-0.9	-1.0	-0.9	-0.7	-0.8	-0.6	-0.4	-0.2	-0.2	-0.3	-0.2	-0.2	-0.2
9	-0.2	-0.2	-0.1	0.0	0.0	0.4	0.2	-0.3	-0.4	-0.5	-0.6	-0.6	-1.0	-0.6	-1.0	-0.8	-0.8	-0.5	-0.5	-0.3	-0.3	-0.2	-0.2	-0.2	-0.4
10	-0.2	-0.2	-0.1	0.0	0.2	0.2	0.0	-0.3	-0.3	-0.5	-0.5	-0.5	-0.5	-0.6	-0.5	-0.5	-0.5	-0.4	-0.3	-0.2	-0.2	-0.2	0.0	0.1	-0.2
11	0.3	0.4	0.3	0.3	0.3	0.5	0.4	-0.2	-0.3	-0.6	-0.8	-0.5	-0.6	-0.6	-0.6	-0.4	-0.5	-0.6	-0.4	-0.2	-0.2	-0.2	-0.2	0.0	-0.2
12	0.1	0.2	0.3	0.6	0.5	0.7	0.5	-0.2	-0.5	-0.6	-0.6	-0.6	-0.8	-1.0	-1.0	-0.7	-0.7	-0.4	-0.3	-0.3	-0.2	-0.2	0.0	0.4	-0.2
13	0.8	0.5	0.5	0.4	0.5	0.3	0.6	-0.3	-0.5	-0.5	-0.8	-0.8	-0.6	-0.6	-0.7	-0.8	-0.7	-0.6	-0.5	-0.3	-0.2	-0.1	0.0	0.5	-0.2
14	0.2	0.1	0.2	0.2	0.4	0.4	0.1	-0.2	-0.3	-0.4	-0.7	-0.6	-0.7	-0.6	-0.7	-0.6	-0.5	-0.5	-0.3	-0.2	-0.2	-0.2	-0.1	0.0	-0.2
15	-0.1	0.3	0.4	0.7	0.4	0.4	0.3	-0.2	-0.5	-0.6	-0.9	-0.7	-0.7	-0.6	-0.8	-0.8	-0.7	-0.6	-0.3	-0.2	-0.1	0.0	0.1	0.4	-0.2
16	0.5	0.4	0.1	0.4	0.5	0.4	0.3	-0.3	-0.4	-0.8	-0.9	-0.6	-0.9	-0.9	-0.7	-0.5	-0.6	-0.5	-0.3	-0.2	-0.1	-0.1	-0.2	0.1	-0.2
17	0.2	0.2	0.2	0.1	0.3	0.4	0.2	-0.3	-0.5	-0.5	-0.5	-0.7	-1.2	-1.1	-1.1	-1.0	-0.8	-0.6	-0.4	-0.3	-0.2	-0.2	0.0	0.2	-0.3
18	0.3	0.3	0.1	0.2	0.3	0.3	-0.1	-0.2	-0.4	-0.7	-0.3	-0.3	-0.5	-0.7	-0.8	-1.0	-0.7	-0.7	-0.4	-0.3	-0.2	-0.2	0.0	0.0	-0.3
19	0.2	0.3	0.5	0.4	0.3	0.4	0.3	-0.3	-0.5	-0.7	-0.5	-1.0	-0.9	-0.9	-1.0	-1.1	-0.5	-0.2	-0.2	-0.2	-0.2	-0.1	0.2	0.0	-0.2
20	0.1	0.0	0.0	0.0	0.1	0.2	0.2	-0.2	-0.4	-0.3	-0.6	-0.9	-1.1	-0.8	-1.0	-0.9	-0.6	-0.3	-0.4	-0.2	-0.2	-0.1	-0.1	0.0	-0.3
21	-0.1	0.1	0.1	0.0	0.1	0.2	0.0	-0.2	-0.4	-0.6	-0.4	-0.5	-0.4	-0.2	-0.1	-0.2	-0.2	-0.2	0.0	0.0	0.0	-0.1	-0.1	0.0	-0.1
22	-0.1	-0.1	0.0	0.3	0.2	0.5	1.2	0.2	-0.2	-0.3	-0.4	-0.7	-0.5	-0.6	-0.7	-0.5	-0.3	-0.2	-0.2	0.0	0.0	0.0	0.2	0.2	-0.1
23	0.6	0.1	0.2	0.1	0.1	0.0	-0.1	-0.2	-0.3	-0.4	-0.5	-0.4	-0.4	-0.2	-0.4	-0.5	-0.5	-0.5	-0.3	0.0	0.1	0.3	0.1	0.1	-0.1
24	0.1	0.0	-0.1	-0.1	0.1	0.5	0.4	0.2	-0.2	-0.3	-0.3	-0.5	-0.6	-0.6	-0.6	-0.5	-0.4	-0.3	-0.3	-0.2	-0.1	0.0	0.1	0.3	-0.1
25	0.1	0.1	0.4	0.5	0.5	0.3	0.2	-0.2	-0.3	-0.5	-0.5	-0.3	-0.7	-0.8	-0.6	-1.0	-1.0	-0.7	-0.3	-0.1	0.0	0.0	-0.1	0.1	-0.2
26	0.5	0.3	0.4	0.2	0.1	0.2	0.2	-0.1	-0.3	-0.1	-0.7	-0.6	-1.0	-0.9	-1.1	-1.1	-0.9	-0.8	-0.4	-0.1	0.0	-0.1	-0.1	0.0	-0.3
27	0.0	-0.1	0.0	0.1	0.1	0.1	0.1	-0.4	-0.4	-0.4	-0.7	-0.6	-0.9	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.2	-0.1	0.1	0.2	0.5	-0.3
28	0.5	0.5	0.5	0.3	0.4	0.2	0.0	-0.2	-0.2	-0.4	-0.5	-0.8	-1.1	-0.9	-1.1	-0.8	-1.0	-0.8	-0.3	-0.2	-0.2	-0.1	0.0	0.3	-0.3
29	0.4	0.5	0.6	0.5	0.4	0.6	0.4	-0.2	-0.4	-0.5	-0.9	-0.7	-0.8	-1.1	-1.0	-0.8	-0.7	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	0.0	-0.2
30	0.2	0.1	0.2	0.0	0.0	0.3	0.0	-0.3	-0.4	-0.6	-0.8	-0.9	-1.2	-1.1	-1.1	-1.1	-1.0	-0.7	-0.4	-0.2	-0.3	-0.1	0.0	0.5	-0.4
31	0.3	0.3	0.2	0.4	0.5	0.6	0.3	-0.2	-0.2	-0.5	-0.5	-0.7	-1.1	-1.5	-1.3	-1.1	-0.8	-0.7	-0.4	-0.3	-0.3	-0.2	-0.3	-0.1	-0.3

TOTAL HOURS 744 TOTAL GOOD HOURS 744 DATA CAPTURE 100.0%

MAX. 1HR AVG 1.4 07/01/93 05:00:00 2ND MAX. 1 HR AVG 1.2 07/22/93 06:00:00

MIN. 1HR AVG -1.5 07/31/93 13:00:00 ARITHMETIC MEAN -0.2 STANDARD DEV. 0.5

KEY FOR MISSING CODES
Bad< - To few samples for valid average, Cal - calibration, OCal - Analyzer out of calibration
BadS - Bad Analyzer Status, PwrF - Power Failure, Down - Operator downed channel, Miss - Missing Data
Qad - Data questionable insufficient documentation, Qal - Data questionable external influence, Purg - Analyzer in Purge

APPENDIX C

SUMMARY OF PERMIT FOR PREVENTION OF SIGNIFICANT DETERIORATION

By

Sierra Research

sierra
research

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Kawaihae Cogeneration Partnership is requesting from the State of Hawaii Department of Health approval to construct and operate a new combined cycle turbine power plant, at a new site near Kawaihae, Hawaii. This request is made pursuant to State of Hawaii Administrative Rules, Chapter 11-60.1, Subchapters 1,5 and 7. The permit application support document discusses the proposed cogeneration project and demonstrates the project's compliance with all applicable rules and regulations.

The new facility will be a major source and thus will be subject to the Prevention of Significant Deterioration (PSD) review requirements of Subchapter 7.

Project Emissions

Since the proposed project will be a completely new facility, the net emission increase from the project is the sum of all emissions from the new equipment. The proposed facility will consist of two distillate-fueled LM2500 gas turbines, two unfired heat recovery steam generators, and associated equipment, including selective catalytic reduction system, continuous emissions monitoring systems, one steam turbine generator, cooling tower, two fuel storage tanks, a black start Diesel generator and day tank, a condenser, centrifugal refrigeration units, water supply wells, reinjection wells, treated-water storage tank, reverse osmosis units, condensate polisher, wastewater storage tank, and an electrical substation. The total project emissions are shown in the following table.

Net Cogeneration Project Emissions

	Emissions, tons per year				
	NOx	SO_2	CO	NMHC	PM/PM_{10}
Gas Turbines (excluding startups and shutdowns)	121	852	1268	25	66
Black Start Diesel Generator	<1	<1	<1	<1	<1
Cooling Tower	0	0	0	0	87
Fuel Storage Tanks	0	0	0	11	0
Total	121	852	1268	36	153
PSD Significance Level	40	40	100	40	25/15
Significant?	yes	yes	yes	no	yes

Based on the analysis above, the cogeneration project will be a major source, as emissions of at least one pollutant will be in excess of 100 tons per year. Therefore, the project is considered a covered source under state regulations and is subject to the requirements of Subchapter 5 (Covered Sources) and Subchapter 7 (Prevention of Significant Deterioration Review). In addition, the project will have significant emissions of NOx, SO_2, CO and particulate for the purposes of Prevention of Significant Deterioration (PSD) review.

Air Quality Impact Analysis

The air quality impact analysis performed for the project demonstrates that the proposed new Kawaihae Cogeneration Project will not cause any exceedances of existing federal or state ambient air quality standards for nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulate or fine particulate; will not emit noncriteria pollutants in sufficient quantity to pose a significant risk to public health; and will not cause the TSP, SO_2 or NO_2 increments to be exceeded. These

modeling results are based on worst case project impacts, and therefore very conservatively estimate project air quality impacts.

Maximum ground-level impacts for allowable operation of the cogeneration facility are shown together with the ambient air quality standards in the following table.

Modeled Maximum Project Impacts

Pollutant/ Averaging Time	Maximum Project Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
NOx					
Annual	1.5	2	4	70	100
SO_2					
3-hour	368.3	110	478	1300	1300
24-hour	72.6	20	93	365	365
Annual	10.4	0.3	11	80	80
CO					
1-hour	737.8	2,290	3,028	10,000	40,000
8-hour	207.4	2,290	2,497	5,000	10,000
TSP/PM_{10}					
24-hour	7.1	28	35	150	150
Annual	1.2	14	15	60	50

Throughout the analysis, assumptions were made to be conservative (that is, overpredictive). Despite this fact, total (source plus background) ground-level concentrations of all modeled pollutants are expected to be well within all applicable federal and state standards. Maximum project impacts for all pollutants are less than 29% of the strictest applicable standard.

In addition, modeling analyses demonstrate that the proposed project will not cause significant pollutant impacts and will not impair visibility in the nearby Class I area, Volcanoes National Park.