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GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

LAND DIVISION
ENGINEERING BRANCH

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JUN 17 1998
DEPT. OF LAND AND NATURAL RESOURCES
QUALITY CONTROL

Keahole Reservoir

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WATER RESOURCE MANAGEMENT

TO: Mr. Gary Gill, Director
Office of Environmental Quality Control
Department of Health

FROM: Michael D. Wilson, Chairperson *Michael D. Wilson*

SUBJECT: Final Environmental Assessment (FEA), Keahole Reservoir
Findings of No Significance Impact (FONSI)
Tax Map Key: 7-3-10-33: Kona, Hawaii

We have reviewed the final Environmental Assessment (EA) for the subject project and have determined that this project will not have significant environmental effects. We are, therefore, issuing a negative declaration the project. Please publish notice of availability for this project in the June 25, 1998 OEQC Bulletin. ✓

We have enclosed a completed OEQC Publication Form and four copies of the final EA. Please call Mr. Andrew Monden of the Land Division, Engineering Branch, at 587-0230 if you have any questions.

Encl.

1998-07-08-HI-*FEA-Keahole
Reservoir*

JUL 8 1998
FILE COPY

**Final Environmental Assessment
of the
Proposed Keahole Reservoir**

**Prepared for
State of Hawaii
Department of Land and Natural Resources**

June 1998

**Prepared by
Kukulu Corporation**

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Preface

The State of Hawaii, Department of Land and Natural Resources proposes to build, a 1.0 million gallon reservoir in Keahole, Hawaii. (TMK Portions 7-3-10:33). Pursuant to Chapter 343, Hawaii Revised Statutes, and Chapter 200 of Title 11, *Administrative Rules, Environmental Impact Statement Rules*, this Environmental Assessment (EA) documents the project's technical characteristics and environmental impacts, and advances findings and conclusions relative to the significance of the project.

Summary

Proposing Agency and Landowner

The proposing agency for the proposed project is the State of Hawaii Department of Land and Natural Resources (DLNR). The landowner for the property is State of Hawaii (DLNR).

Property Location and Description

The proposed Keahole Reservoir site is located mauka of the Hawaii Electric Light Company's (HELCO) Keahole Generating Station in Kalaoa, Kona, Hawaii Island. The project area is situated at the east end of a small road servicing an existing water reservoir mauka of Queen Kaahumanu Highway immediately across from the Kona International Airport Access Road. The water reservoir and existing fence surrounding the reservoir make up the southwestern portion of the project area. This entire portion and an area of approximately 50 feet surrounding the fence, has been cleared during reservoir construction activities. The remainder of the project area remains undisturbed by construction activity. The proposed water reservoir site is located mauka of the existing reservoir which is found near the Hawaii Electric Light Company's (HELCO) Keahole Generating Station. The proposed reservoir site is approximately 1.7 acres in size. Access to the new reservoir will be from the 16-foot wide, paved "Reservoir Road" which services the HELCO generating station and the existing reservoir.

Proposed Action

The proposed action involves the construction of a 1.0 million gallon water reservoir and related infrastructure and repair of the existing 0.5 million gallon water reservoir. The new 1.0 million reservoir will be located mauka of an existing 0.5 million gallon water reservoir to provide adequate fire protection for the Kona International Airport and the Natural Energy Laboratory of Hawaii. The existing 0.5 million gallon water reservoir is located approximately 1,800 feet mauka of Queen Kaahumanu Highway and is owned by the Department of Water Supply, County of Hawaii. The

work includes construction of a 1.0 million gallon reinforced concrete water reservoir, with asphaltic concrete perimeter and connecting road, grading, fencing of the reservoir property, piping to connect existing piping to the new reservoir, and repair of the existing reservoir. Repair of the existing reservoir includes cleaning and painting of the existing hardware, replacement of water level gauge and waterproofing of the roof and reservoir.

Alternatives

"No Action" Alternative

A "no action" alternative would in the short-term, simply produce no development on the subject project site, the land would remain in its vacant state, and there would be no increased demands on infrastructure support. However, in the longer term, if no reservoir is built on the site, present and future demand for water would be effected negatively. Because the proposed project site was the site designated by and in accordance with the proposed use in the 1994 North Kona Water Plan, alternative sites were not proposed. Additionally, the present 0.5 gallon reservoir is inadequate to supply the expanding water needs for fire protection of the Kona International Airport and the Natural Energy Laboratory of Hawaii.

Findings and Conclusion

The proposed project will involve earthwork and construction activities. In the short-term, these activities may create temporary nuisances normally associated with construction activities. However, dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. All construction activities are anticipated to be limited to normal daylight working hours. Impacts generated from construction activities are not considered adverse. From a long-term perspective, the proposed project is not anticipated to result in adverse environmental impacts. There are no known significant habitats or rare, endangered or threatened species of flora or fauna or archaeological sites located on the project site. The proposed project conforms with area-wide improvements. Appropriate erosion control

associated with construction activities. With regard to other infrastructural systems and public services, the proposed project should have no adverse environmental impact.

In light of the foregoing findings, it is concluded that the proposed action will not result in any adverse environmental impacts. Therefore, DLNR anticipates the filing of the official Findings of No Significant Impacts (FONSI).

Development Summary

Proposing Agency: Department of Land and Natural Resources

Property Owner: State of Hawaii, DLNR

Property Location: The project area is situated at the east end of a small road servicing an existing water reservoir mauka of Queen Kaahumanu Highway immediately across from the Kona International Airport Access Road. The water reservoir and existing fence surrounding the reservoir make up the southwestern portion of the project area.

Tax Map Key: Zone 7, Section 3, Plat 10, Parcel 33.

Area: 1.7 acres

*State Land
Use District:* Urban (U)

*Hawaii County
Zoning:* Open (O)

Existing Uses: Undeveloped

Proposed Use: Reservoir

Proposed Action: Construction of a 1.0 million gallon water reservoir and related infrastructure and repair of the existing 0.5 million gallon water reservoir. The new 1.0 million reservoir will be located mauka of an existing 0.5 million gallon water reservoir to provide adequate fire protection for the Kona International Airport and the Natural Energy Laboratory of Hawaii.

*EA Accepting
Authority:* Governor, State of Hawaii

Necessary Permits and Approvals

A. State of Hawaii

Department of Health

- a) *Best Management Practices*
- b) *National Pollutant Discharge Elimination System*

B. Hawaii County

1. Department of Public Works

- a) *Grading Permit*
- b) *Erosion Control Report*
- c) *Drain Connection Application*
- d) *Point Source Identification Information Application*

2. Building Department

- a) *Building Permit*
- b) *Separate Foundation Permit*

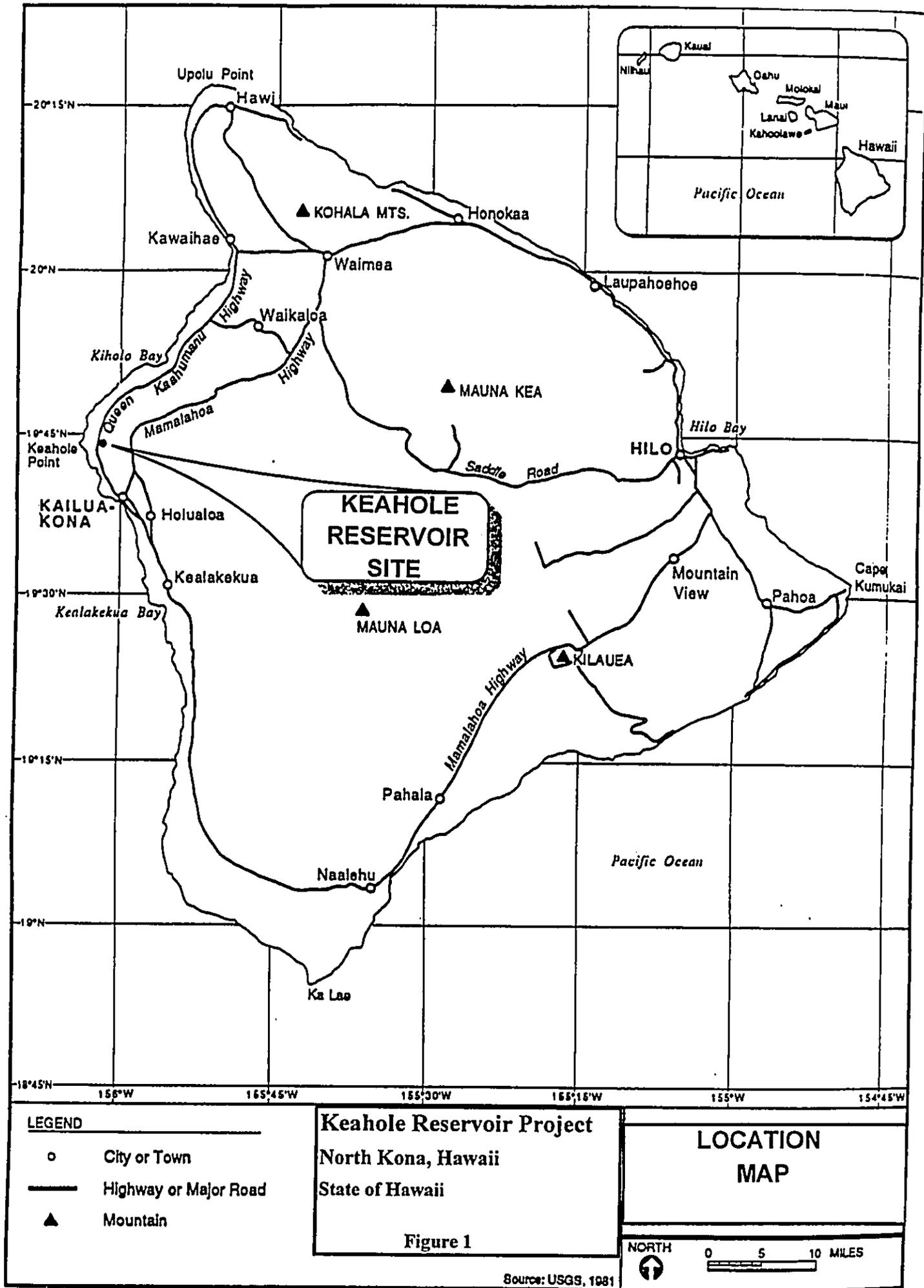
I. PROJECT OVERVIEW

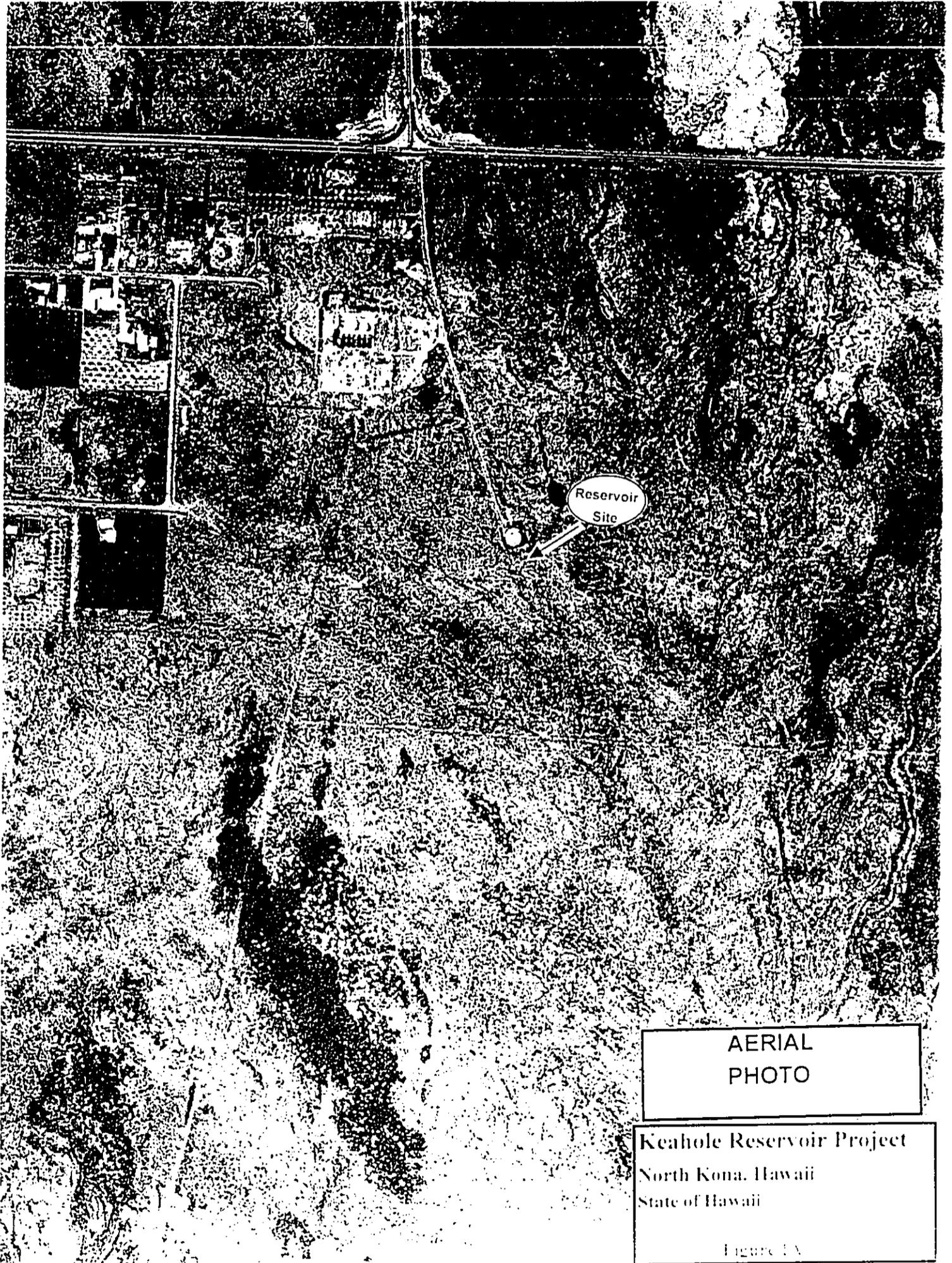
A. PROJECT LOCATION, EXISTING USE, AND LAND OWNERSHIP

The proposed Keahole Reservoir site is located mauka of the Hawaii Electric Light Company's (HELCO) Keahole Generating Station in Kalaoa, Kona, Hawaii Island. The proposed water reservoir is located mauka of the existing reservoir which is found near the Hawaii Electric Light Company's (HELCO) Keahole Generating Station. The proposed reservoir site is approximately 1.7 acres in size. Access to the new reservoir will be from the 16-foot wide, paved "Reservoir Road" which services the HELCO generating station and the existing reservoir (see Location Map, Figure 1). The project area is situated at the east end of a small road servicing an existing water reservoir mauka of Queen Kaahumanu Highway immediately across from the Kona International Airport Access Road. The water reservoir and existing fence surrounding the reservoir make up the southwestern portion of the project area. This entire portion and an area of approximately 50 feet surrounding the fence, has been cleared during reservoir construction activities. The remainder of the project area remains undisturbed by construction activity (see Aerial Photo, Figure 1A; Project Site Map, Figure 2; and General Site Plan, Figure 2A).

The project site is designated Urban for State Land Use. The project site was designated Conservation as was the HELCO site which it borders. (See State Land Use Map, Figure 3.) The HELCO site is still designated Conservation. However, in 1993 the Office of State Planning (OSP) submitted a petition to amend the Conservation and Agriculture Land Use District Boundaries for approximately 2,640 acres of State-owned land mauka of Queen Kaahumanu Highway (Land Use Commission (LUC) Docket No. A92-685). In October 1997, the reservoir site was reclassified to the Urban District (see Reclassification Area, Figure 3A).

The proposed Keahole 1.0 Million Gallon Reservoir Project site is presently owned by the State of Hawaii Department of Land and Natural Resources (DLNR). The existing 0.5 million gallon water reservoir is located approximately 1,800 feet mauka of



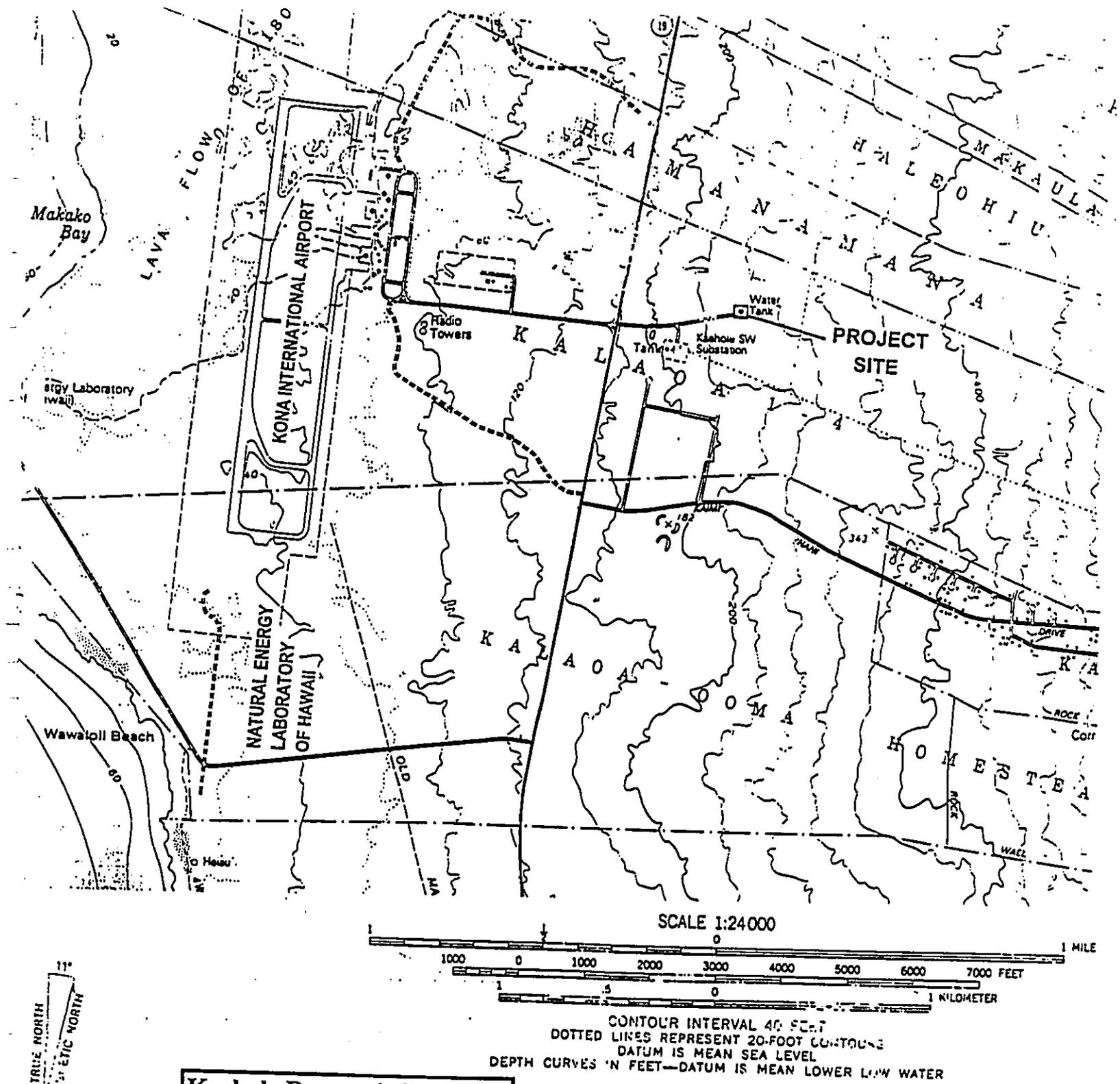


Reservoir Site

AERIAL
PHOTO

Keahole Reservoir Project
North Kona, Hawaii
State of Hawaii

Figure 1A

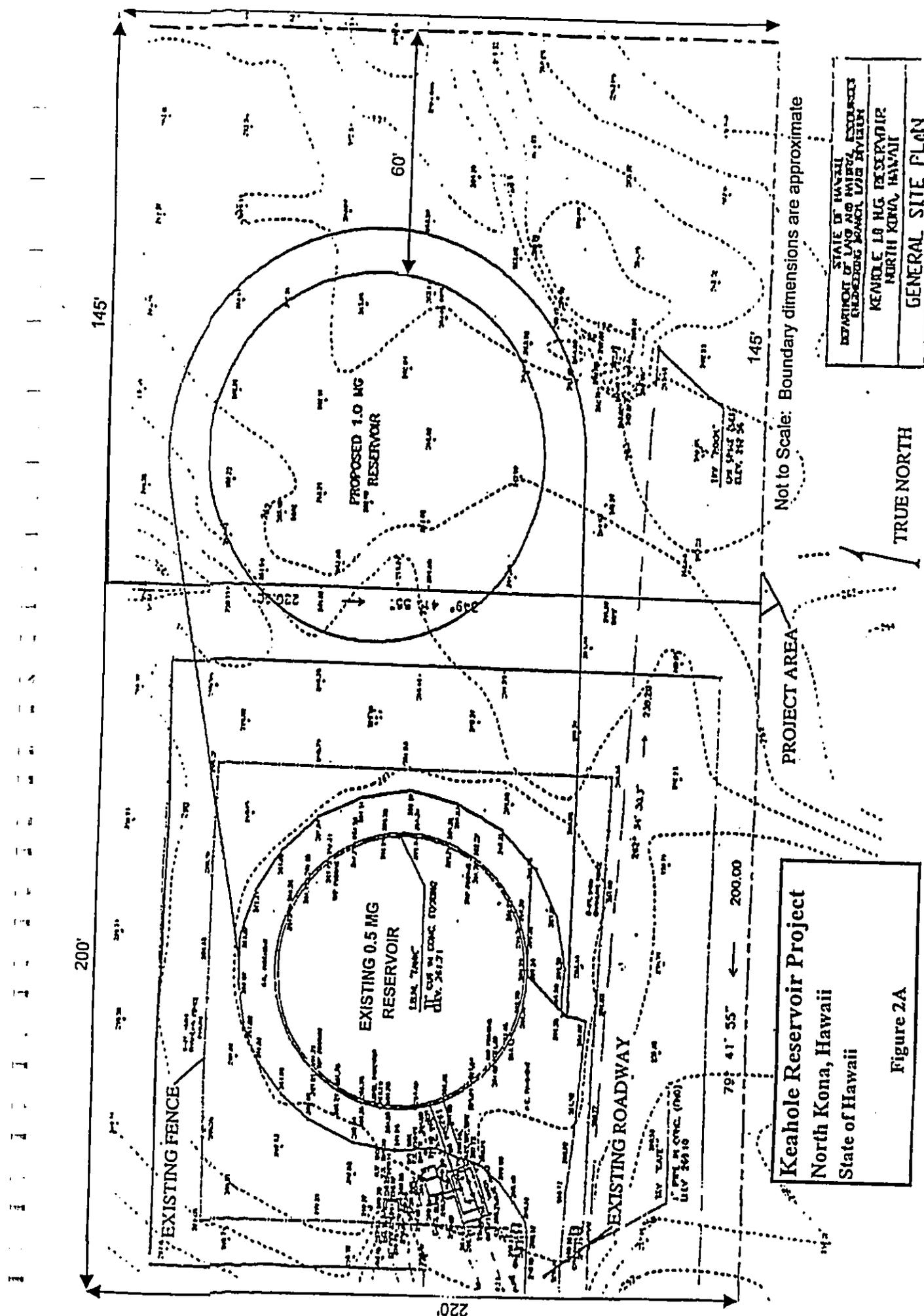


Keahole Reservoir Project
 North Kona, Hawaii
 State of Hawaii

Figure 2

**PROJECT
 SITE MAP**

Portion of USGS Map, Keahole Quad, Showing Location of the Project Area

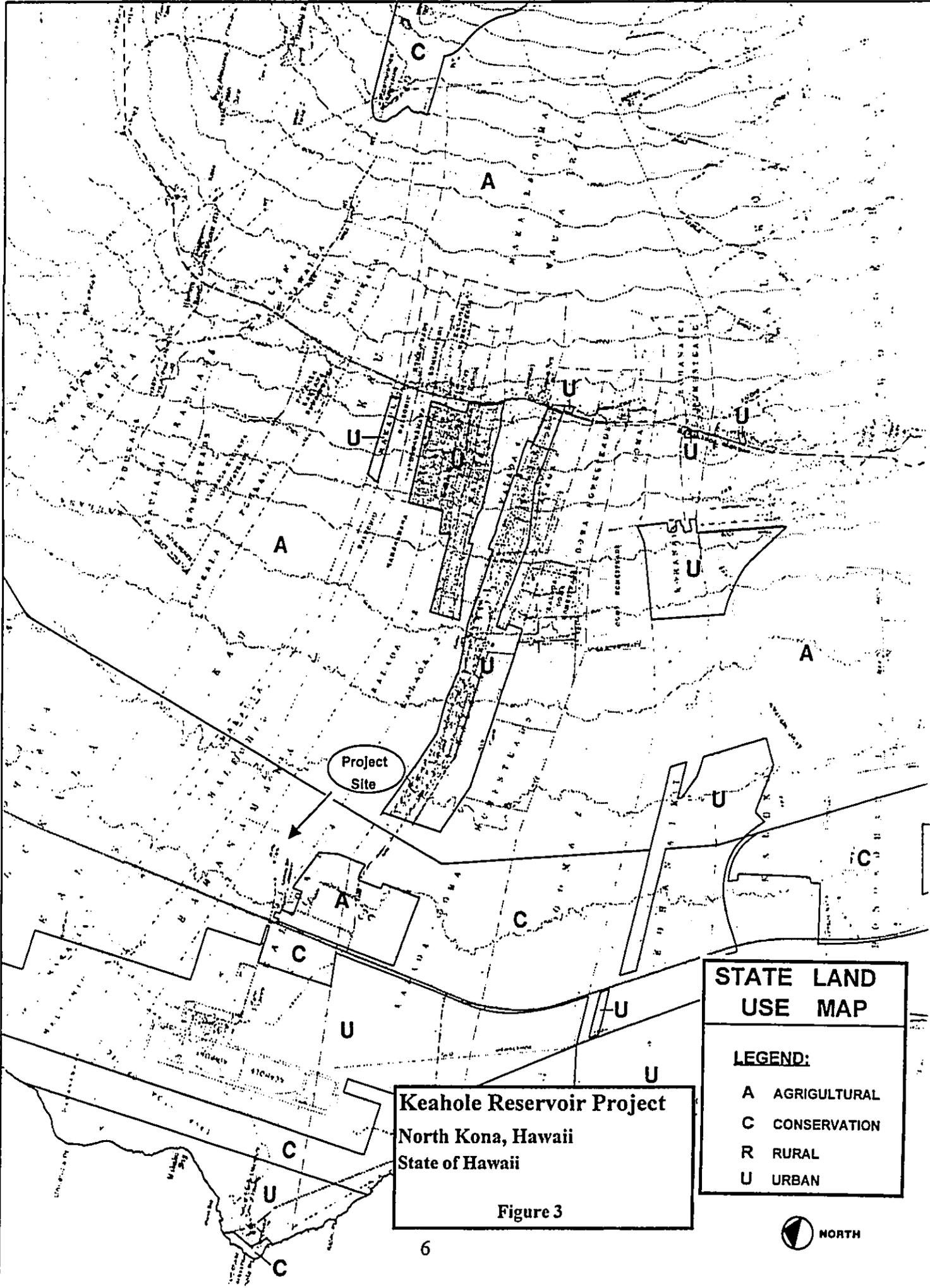


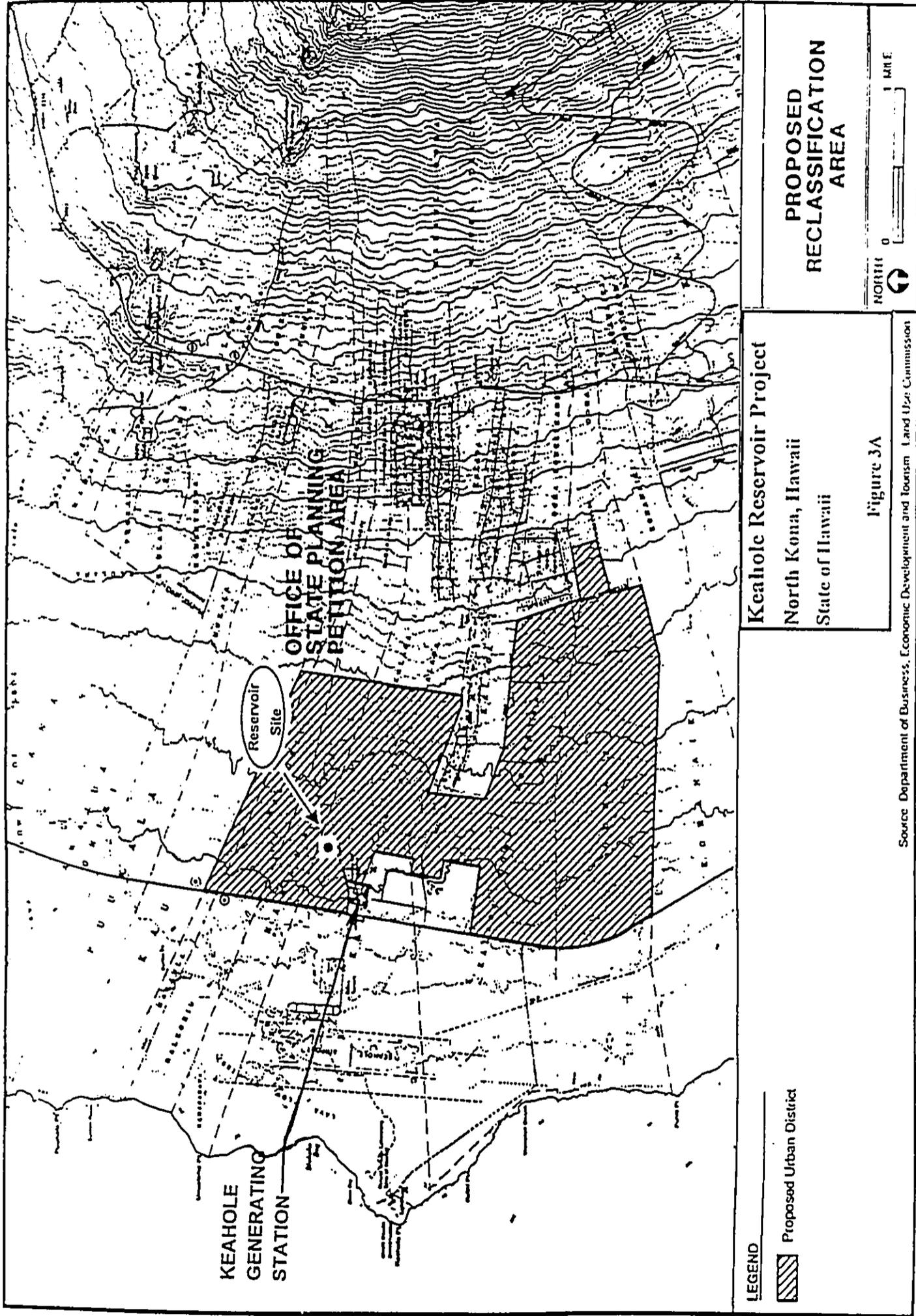
Keahole Reservoir Project
 North Kona, Hawaii
 State of Hawaii

Figure 2A

Project Map Showing Location of Present Water Reservoir Tank in Relation to the Proposed Water Reservoir Tank

STATE OF HAWAII
 DEPARTMENT OF LAND AND NATURAL RESOURCES
 ENGINEERING DIVISION
 KEAHOLE 1.0 MG RESERVOIR
 NORTH KONA, HAWAII
 GENERAL SITE PLAN





Queen Kaahumanu Highway and is owned by the Department of Water Supply, County of Hawaii.

B. PROJECT NEED

The proposed action involves the construction of a 1.0 million gallon water reservoir and related infrastructure and repair of the existing 0.5 million gallon water reservoir. The new 1.0 million gallon reservoir will be located mauka of an existing 0.5 million gallon water reservoir to provide adequate fire protection for the Kona International Airport and the Natural Energy Laboratory of Hawaii. Moreover, the proposed project is in accordance with the 1995 North Kona Water Master Plan.

C. PROPOSED ACTION

The proposed action involves the construction of a 1.0 million gallon water reservoir and related infrastructure and repair of the existing 0.5 million gallon water reservoir on approximately 1.7 acres of land. The new 1.0 million gallon reservoir will be located mauka of an existing 0.5 million gallon reservoir to provide adequate fire protection for the Kona International Airport and the Natural Energy Laboratory of Hawaii. The existing 0.5 million gallon water reservoir is located approximately 1,800 feet mauka of Queen Kaahumanu Highway and is owned by the Department of Water Supply, County of Hawaii. The work includes construction of a 1.0 million gallon reinforced concrete water reservoir, with asphaltic concrete perimeter and connecting road, grading, fencing of the existing and proposed reservoir property, piping to connect existing piping to the new reservoir, and repair of the existing reservoir. Repair of the existing reservoir includes cleaning and painting of the existing hardware, replacement of water level gauge and waterproofing of the roof and reservoir.

D. PROJECT SCHEDULE AND COSTS

Building construction is expected to begin in January 1999, and be completed in October 1999. Total project costs for the Keahole Reservoir Project is approximately \$1,300,000.

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. PHYSICAL ENVIRONMENT

1. Regional Context

Undeveloped land lies to the north of the project site. Keahole Generating Station and Keahole Agricultural Park is located to the project site's southeastern boundaries. Queen Kaahumanu Highway, Kona International Airport, and the Natural Energy Laboratory of Hawaii Authority (NELHA) are located west of the project site. The nearest residential subdivision in the study area is Kona Palisades to the southeast of the site.

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

NELHA is located at Keahole Point on 870 acres of State-owned land. The NELHA comprises the Natural Energy Laboratory of Hawaii (NELH) and the Hawaii Ocean Science and Technology (HOST) Park. NELH supports the research, development, and demonstration of OTEC and OTEC-related technologies. OTEC creates energy by using the temperature difference between warm ocean water at the surface and cold seawater pumped up from depths of 2,000 feet. HOST Park supports the commercialization of those technologies. Kona Palisades is located approximately 1 mile southeast of the Keahole Reservoir Site. It is the closest residential subdivision to the facility site. The 1991 Keahole to Kailua Development Plan identifies Kona Palisades as the largest subdivision in the North Kona district, with 532 single-family units (see Regional Context Existing Land Use, Figure 4).

2. Climate

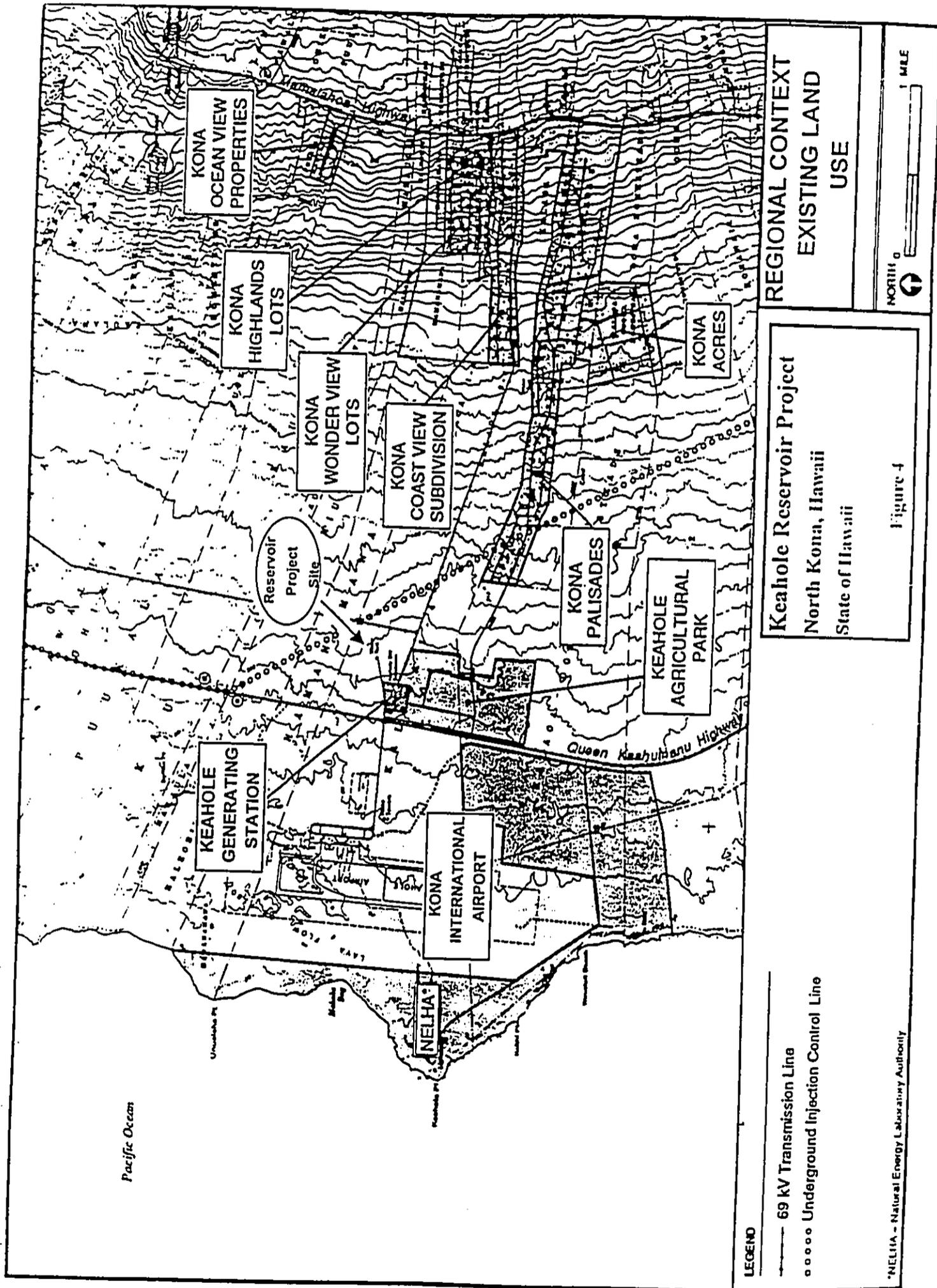
The Island of Hawaii is located in the trade wind band. For most of the year, the large-scale clockwise air circulation pattern results in winds from the east through the northeast (Figure 5, Wind Rose). These tradewinds are modified along the North Kona coast. Data collected on wind patterns in the general area show a strong daily recurring (diurnal) flow for much of the year.

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

3. Topography and Soil Characteristics

The Keahole site is located in terrain that slopes gently downward from the mountains east of the project site to the Pacific Ocean. Contours of constant elevation parallel the coastline. There are no significant terrain features (such as cliffs, bluffs, and hills) in the immediate area that would affect air circulation. The site's elevation ranges between 255 and 265 feet above mean sea level. There is very little soil on the site which is situated on the western coastal slopes of Hualalai Volcano. Hualalai was last active in 1801, when pahoehoe lava flowed from two vents along the northwest trending rift of the volcano. The northwest rift represents the major geologic structure in the area. At its nearest point, the rift is 4.5 miles northeast of the site. Lava flow from the vent at the 1,500-foot elevation spread out along the coast as far south as the current site of Kona International Airport, approximately 1 mile north of the Keahole Reservoir site.

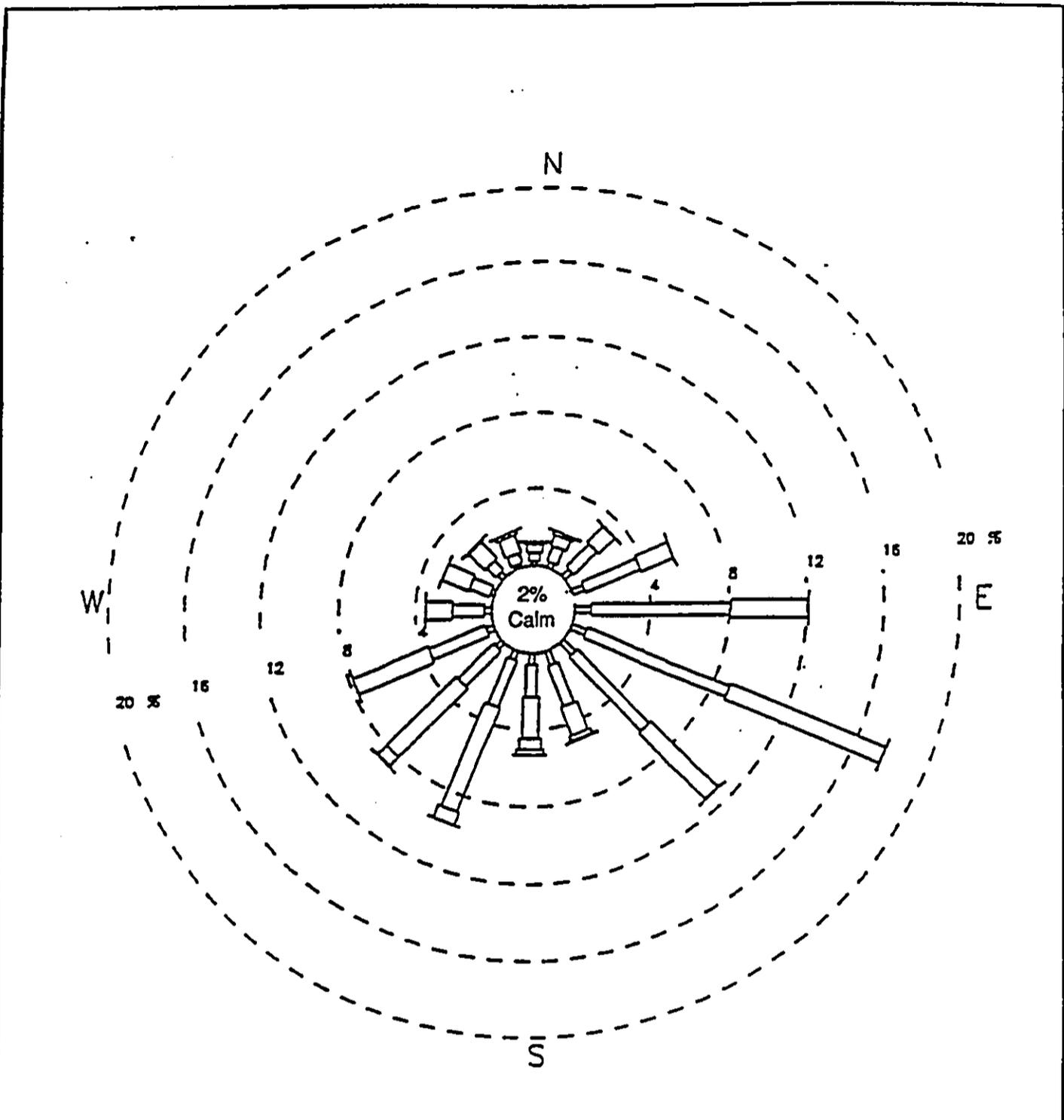
The site is located on the older prehistoric lava flows of Hualalai. Elevation of the ground surface ranges from approximately 255 to 265 feet above mean sea level.



Keahole Reservoir Project
 North Kona, Hawaii
 State of Hawaii

Figure 4

*NELHA - Natural Energy Laboratory Authority



Keahole Reservoir Project
 North Kona, Hawaii
 State of Hawaii
 Figure 5

LEGEND					
Wind Speed (in knots)					
1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	22 - 99
(8%)	(43%)	(46%)	(2%)	(0%)	(0%)
Stability Class Distribution					
A - 5%					
B - 7%					
C - 19%					
D - 22%					
E - 36%					
F - 11%					

WIND ROSE

NOTE: Wind direction is the direction wind is blowing from.
 Source: HELCO Meteorological Monitoring Data, February 1984 to January 1985

The surface consists of aa and pahoehoe lava that slopes to the west in the direction of the coastline.

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

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

4. Flood and Tsunami Hazard

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

5. Flora and Fauna

A botanical survey report was prepared by Char & Associates. This section summarizes the report; the complete report is provided in Appendix B.

Field studies to assess the botanical resources found on the project site were conducted on 17 October 1997. The primary objectives of the survey were to:

- 1) provide a description of the vegetation on the site;
- 2) inventory the flora;
- 3) search for threatened and endangered species as well as species of concern;
and
- 4) identify areas of potential environmental problems or concerns.

Survey Methods

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. A tax map of the site and soil survey maps (based on aerial photographs) were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, drainage, exposure, disturbances, topography, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium (University of Hawaii, Manoa--HAW), and for comparison with the most recent taxonomic literature.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the survey. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

Description of the Vegetation

Two earlier botanical studies have been conducted for the lands adjacent to the project site. These were for the Keahole Generating Station Expansion (Char 1992a) and for the State's West Hawaii Boundary Review (Char 1992b). In both of these studies, the vegetation around the proposed reservoir site was described as fountain grass grassland, that is, somewhat sparsely vegetated lava fields dominated by fountain grass.

Fountain grass grassland also occurs on the proposed project site and is described in more detail along a checklist of all the plant species which occur on the project site in Appendix B.

Char & Associates found that none of the plants found during the field studies is a listed, proposed, or candidate threatened and endangered species; nor is any plant a species of concern (U.S. Fish and Wildlife Service 1997). One small shrub of maiapilo (*Capparis sandwichiana*), a species of concern, is found just outside of the project site. Char & Associates concluded that; "the proposed project is not expected to have a significant negative impact on the botanical resources. Given the findings above, there are no botanical reasons to impose any restrictions, conditions, or impediments to the proposed use of the site for a water reservoir. No recommendations are proposed at this time." (See Appendix B.)

Also, the area is not a suitable habitat for native birds or endangered species or mammals. Various surveys of the area concluded that the entire region has been disturbed for over a hundred years, resulting in severe alteration of the native ecosystem. A bird and mammal study of the approximately 15,000 acre area just south of the reservoir site conducted by Philip L. Brunner of Faunal Surveys in July 1992 concluded that "no particularly special or unique bird or mammal habitat was discovered".

6. Archaeological Resources

An archeological reconnaissance of the proposed reservoir site was conducted by Ian Masterson and Hallett H. Hammett, Ph.D. of Cultural Survey Hawaii on October

30, 1997. The study concluded that no archaeological sites are present within the bounds of the present project area and based on the lack of sites within the present project area no further archaeological work is recommended at this time. For a complete summary of details of methods and findings see Appendix C.

7. Air Quality

Meteorological data near the Keahole site were collected from February 1984 to January 1985 at the Keahole air quality monitoring station located approximately 0.8 mile southeast of the project site. This station was operated in compliance with U.S. Environmental Protection Agency (EPA) guidelines. (See Figure 6.)

The proposed project site is located about 1 mile east of Kona International Airport and about 2 miles northwest of the Kalaoa residential area. The HELCO generating station is the only industrial stationary source in the vicinity.

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

Applicable Federal Regulations

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

- National Ambient Air Quality Standards (NAAQS)
- New Source Review (NSR)
 - Prevention of Significant Deterioration (PSD) Program
 - Nonattainment Regulations

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

^aMonitoring Locations: (1) Keahole air quality monitoring station, (2) Department of Health station located at the Kona Health Center at Kealahou about 25 miles south of Keahole, and (3) Waiakea air quality monitoring station.

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

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

Keahole Reservoir Project
 North Kona, Hawaii
 State of Hawaii

 Figure 6

- New Source Performance Standards (NSPS)
- National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- Good Engineering Practice (GEP) Stack Height Provisions

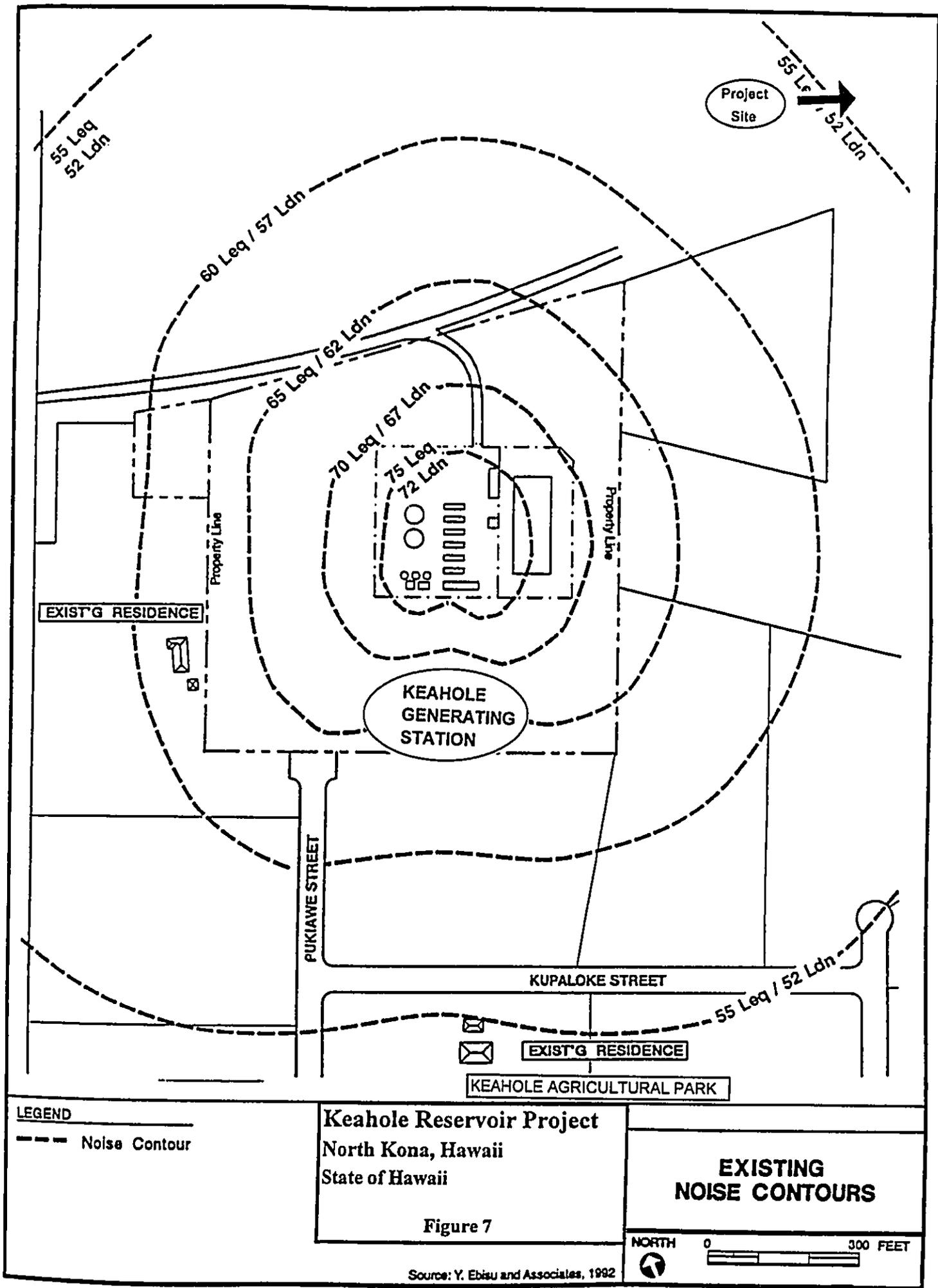
8. Noise

Existing noise levels in the vicinity of the project area are mostly generated from Kona International Airport operations. Noise impacts of aircraft operations from Kona International Airport on the project area and surrounding environment have been the subject of a number of studies. Other noise sources at and in the vicinity of the project site include the Keahole Generating Station's six diesel generators and one 13.75-MW combustion turbine, and vehicular traffic on Queen Kaahumanu Highway which is in the same Ldn range of 52-55 Ldn. The 1990 airport noise contours recorded the closest existing noise-sensitive areas to the airport (i.e. residences in the Keahole Agricultural Park) to be currently exposed to aircraft noise of less than Ldn 55. The Keahole Agricultural Park is less than one half mile southwest of the project site (see Figure 7).

9. Visual Resources

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

Background views, between 5 miles from the site and the horizon, include Hualalai, and Mauna Loa. Middleground views, between 0.5 mile and 5 miles from the project site, include Kona International Airport and the Pacific Ocean, residential subdivisions at higher elevations to the east, and undeveloped sloping land to the north and south. These subdivisions include Kona Palisades and Kona Acres. Dominant landforms include broad plains, gently sloping hills, and lava flows. (See Aerial Photo, Figure 1A and Appendix D, Photos of Project Site.)



B. SOCIO-ECONOMIC ENVIRONMENT

1. Land Use History

The land within which lies the present project area is Kekaha. Despite its desolate appearance, legends and other traditional accounts indicate that Kekaha was once a populous and productive region. As settlement patterns changed and the 1801 Huehue lava flow inundated much of the productive regions just north of the study parcel fewer people inhabited the region. These inhabitants of the barren zone were primarily focused on salt manufacture and fishing for subsistence and trade with travelers from more productive regions. After the Mahele, at which time the area became government lands, settlement continued to centralize around Kailua town while ranching activities ensued in the vicinity of the project area. Industrial expansion and the construction of the Kona International Airport caused the greatest change in land use within the region. Presently, the project area contains one water reservoir tank supplying the Kona International Airport.

2. Population and Economy

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

The proposed project would be located in the North Kona district of West Hawaii. Forty-six percent of the island of Hawaii's population in the year 2005 is expected to be located in West Hawaii and 25 percent in the Kona district (see Population Table: Island of Hawaii on the following page).

Population Table: Island of Hawaii
Forecast Population and Visitor Census

Year	Population	Visitors
1992	129,610	14,715
1994	136,700	16,116
1995	139,710	16,712
2000	157,300	23,004
2005	177,110	30,351
2010	202,340	36,874

Source: HELCO. Long Term Sales and Peak Forecast.
March 1993.

C. PUBLIC SERVICES

1. Police and Fire Protection

The area is the Hawaii County Police Department which has a staff of 60 officers for the North Kona District. The North Kona District police station is located off of Queen Kaahumanu Highway approximately 5 miles south of the project site.

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

2. Solid Waste

The new 300-acre sanitary landfill is planned approximately 7.5 miles northeast of the project site. The new County landfill includes recycling and resource recovery facilities and serves the North and South Kona, South Kohala, and Kamuela districts. This landfill can accommodate solid waste volume of 70,300 tons per year. By the year 2015, the landfill is projected to receive 134,000 tons of solid waste annually.

3. Health Care

The emergency care facility serving the site is Kona Hospital, which is located in Kealahou, approximately 16 miles south of the site. Also the adjacent Keahole Generating Station is equipped with appropriate first aid equipment.

D. INFRASTRUCTURE

1. Roadways

Queen Kaahumanu Highway is the primary arterial highway in the region. It is a high-quality, two-lane, two-way highway between Kawaihae and Kailua. Queen Kaahumanu Highway is signalized at its intersection with the Kona International Airport Access Road and unsignalized at its intersection with Kaiminani Drive. Mamalahoa Highway is a secondary arterial highway serving the region located mauka of Queen Kaahumanu Highway. The only connection between the two arterials in the project vicinity is Kaiminani Drive, a residential collector roadway. The posted speed limit on Queen Kaahumanu Highway in the vicinity of the project is 55 miles per hour (mph).

The construction documents for the four-lane widening of Queen Kaahumanu Highway from Kailua to Keahole is being prepared. Queen Kaahumanu Highway will be widened to a four-lane divided highway in the phase. Existing traffic to the project site consist of one car per day for daily maintenance inspection of the existing 0.5 million gallon reservoir. The same inspector will also include the new 1.0 million gallon reservoir as part of the daily inspections.

2. Drainage and Hydrology

The average annual rainfall at the project site is about 20 inches. In the area, the mean annual rainfall ranges from less than 20 inches near the coast to more than 75 inches on the upper slopes.

Rainfall on the upper slopes of Kona, above a general elevation of 2,500 feet, is the source of virtually all of Kona's groundwater resources. This rainfall occurs in a 4-

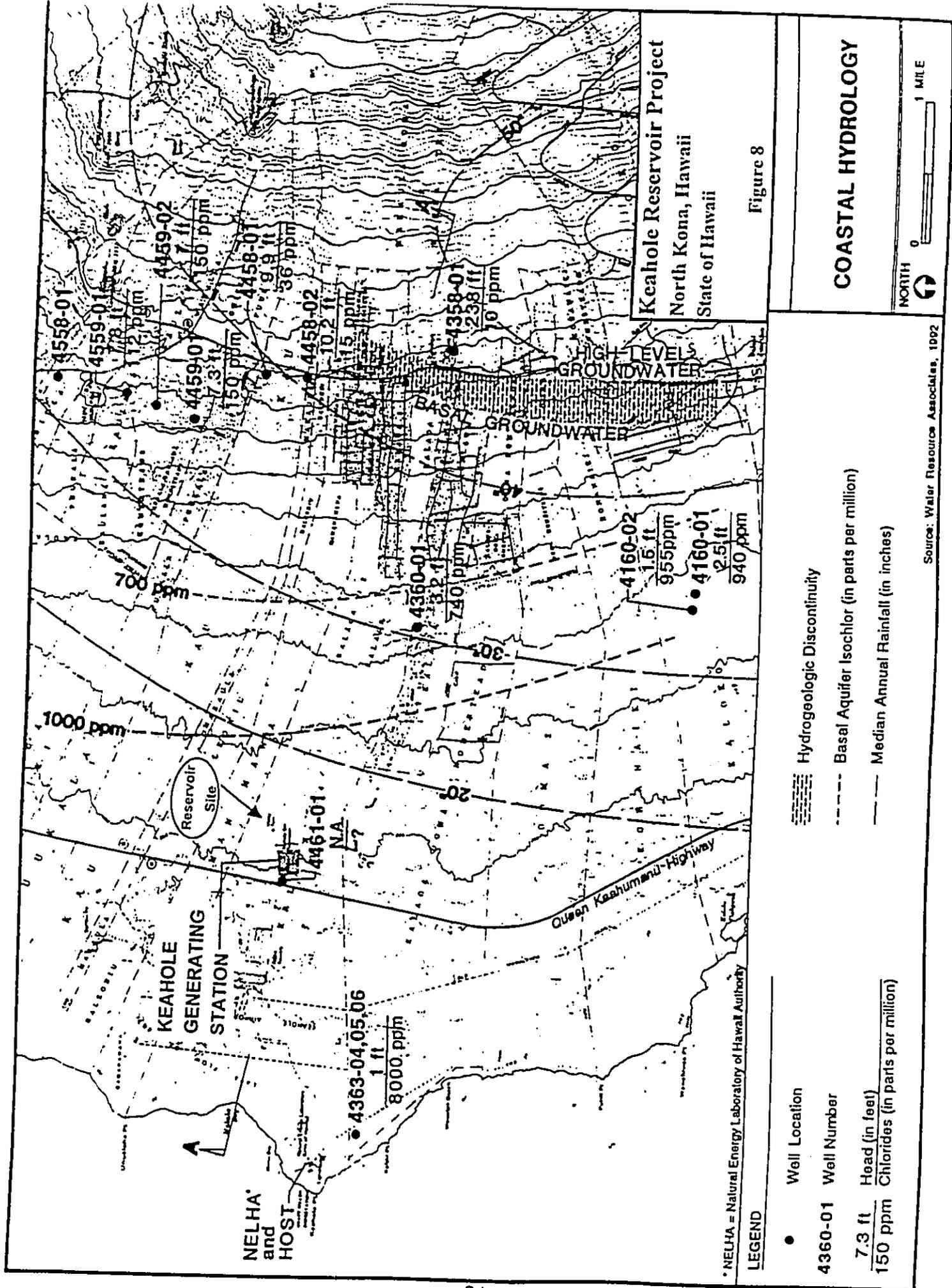
to 5-mile-wide belt that is parallel to the coast and centered south of the project site about 4 miles inland. Rainfall at this location averages 40 to 75 inches a year, most of which percolates quickly into the ground. There is little, if any, runoff to the sea, even during times of heavy rainfall. Perennial streams do not exist in Kona.

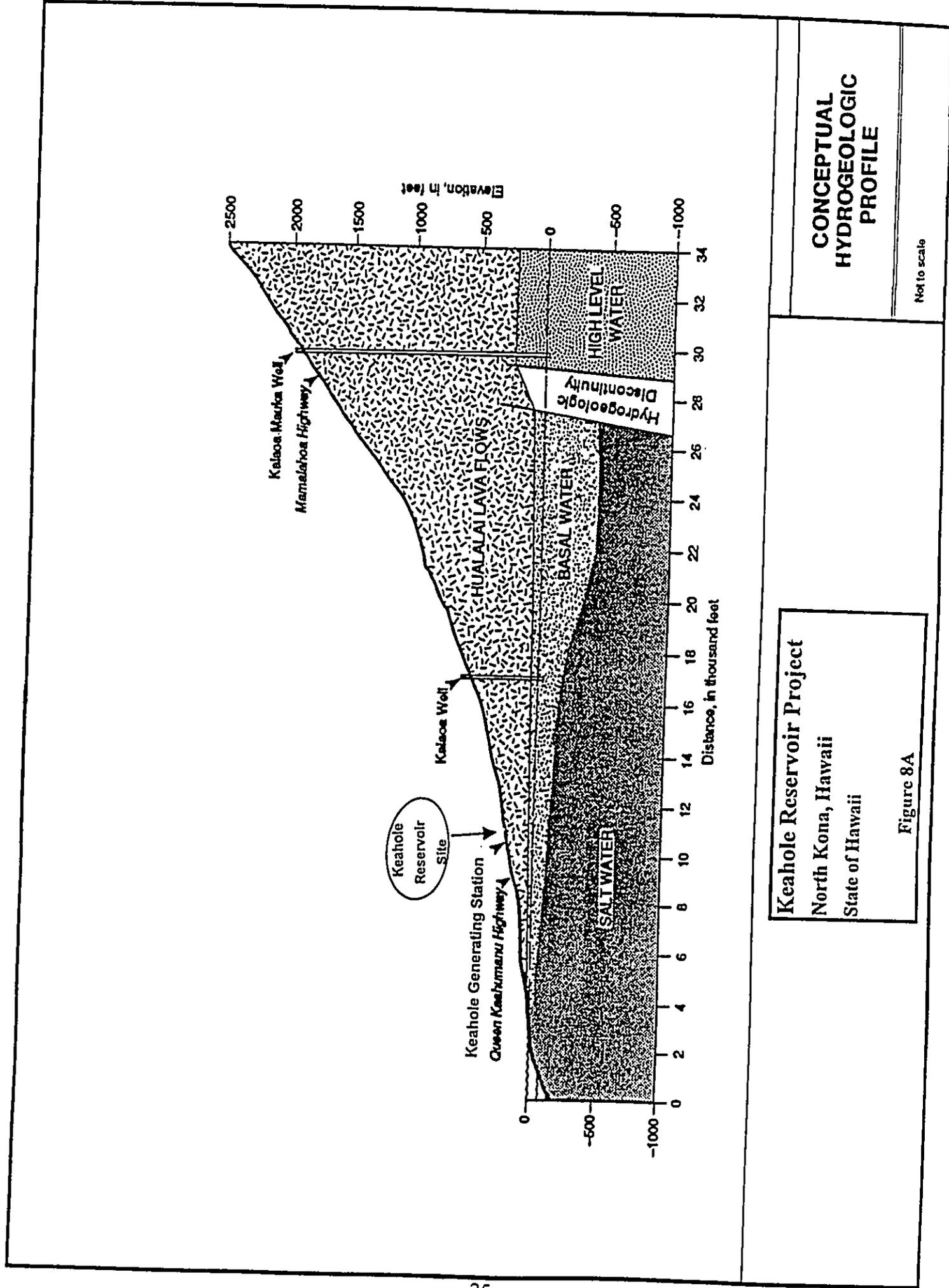
The hydrogeology of the region and site vicinity is described below in terms of *groundwater occurrence, movement, and quality*. (See *Coastal Hydrology, Figure 8.*)

The project site is located within the Keauhou aquifer system, which encompasses the southern half of Hualalai Volcano and is delineated by the northwest rift zone. According to the Department of Land and Natural Resources (DLNR), the Keauhou system covers an area of 167 square miles and has an estimated sustainable yield of 38 million gallons per day (mgd). This sustainable yield represents the total developable groundwater, which is the sum of both potable and nonpotable groundwater. Figure 8 shows the location of wells for an area within a 3-mile radius of Keahole Reservoir site. These wells were identified from DLNR records and from information provided by NELHA.

Groundwater on the Island of Hawaii may occur as high-level groundwater or basal groundwater. (See *Conceptual Hydrogeologic Profile, Figure 8A.*) In general, high-level groundwater occurs inland, at higher elevations, whereas basal groundwater generally occurs at much lower elevations (near sea level) in coastal areas. High-level confined groundwater results on the Island of Hawaii from the presence of geologic formations that restrict horizontal groundwater flow. Such geologic features include semi-impermeable dikes, ash beds, and dense cores of lava.

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





Keahole Reservoir Project
 North Kona, Hawaii
 State of Hawaii
 Figure 8A

3. Electric Power and Telephone Service

Off-site power requirements will be provided by the nearby Keahole Electric Generating Station. Telephone service is provided by GTE Hawaiian Tel.

III. **POTENTIAL IMPACTS AND MITIGATION MEASURES**

A. PHYSICAL ENVIRONMENT

1. Surrounding Uses

The proposed project is compatible with the surrounding uses which include an existing 0.5 million gallon reservoir (water tank), an electric generating station and an agricultural park.

Impacts - There are no negative impacts anticipated with regard to surrounding uses.

Mitigation - No mitigation measures are proposed.

2. Flora and Fauna

There are no known significant habitats or rare, endangered or threatened species of flora and fauna located within the project site. The proposed project is therefore not considered an adverse impact upon these environmental features. There are also no wetland indicator plants on the project site.

Impacts - There are no impacts associated with the project with regard to flora and fauna.

Mitigation - No mitigation measures are proposed.

3. Archaeological Resources

There are no surface or sub-surface archaeological materials present on the project site or evidenced by existing studies of the site.

Impacts - There are no known impacts with regard to archeological resources.

Mitigation - In accordance with State and DLNR requirement, Construction Method Section 01100, Archaeological Protection, representatives of the State will from time to time examine the area as work proceeds. If historical values are noted, the State may order a halt to the work in the vicinity of the historical values until the State can examine further. The Contractor shall notify the State if he finds anything he suspects to be of historic significance and shall discontinue further work in the vicinity of the find until the State can examine the area. In either case, further work in the vicinity of such historical or suspected historical values may proceed only upon approval by the State. Such approval can be normally expected within one week and shall in no case require more than one month.

4. Air Quality

Air quality impacts attributed to the project will include dust generated by short-term, construction-related activities. Site work such as filling and grading, for example, will generate airborne particulates. Dust control measures such as regular watering and sprinkling will be implemented as needed to minimize wind-blown emissions. Other dust prevention measures will be utilized in accordance with Department of

Health (DOH) regulation. Project-related emissions are not expected to adversely impact local and regional ambient air quality conditions.

Impacts - Fugitive dust during construction.

Mitigation - As required by the State, Section 01567 Pollution Control, a dust prevention plan will be provided by contractor in accordance with Department of Health (DOH) Standards and Rules.

5. Noise

As with air quality, ambient noise conditions will be impacted by construction activities. Heavy construction equipment would be the dominant source of noise during the site construction period. To aid in the mitigation of construction noise impacts upon surrounding uses, construction activities will be conducted during the daylight hours only. The project is not anticipated to generate adverse noise conditions.

Impacts - Noise from construction activities.

Mitigation - In accordance with Section 01567, Pollution Control, noise shall be kept within acceptable levels at all times in conformance with DOH, Administrative Rules, Title 11, Chapter 43. Construction activities and hours will be in accordance with the 11.46 Rules of Department of Health (DOH) regulating noise impacts.

6. Visual Resources

The project will be graded to create a site visually integrated with the other surrounding developed properties. The tank structure is proposed to be approximately 22 feet in height which is less than the existing two-story townhouse structures located within the nearest residential development.

Impacts - Impacts will be positive.

Mitigation - No mitigation measures are proposed.

B. IMPACT TO COMMUNITY SETTING

1. Population and Local Economy

On the short-term basis, the project will support construction and construction-related employment. Over the long-term, the project will provide limited support to the service sector for project operations and maintenance. Direct on-site employment generated by the project will not create new jobs.

Impacts - Short-and long-term employment opportunities are a beneficial impact to the Keahole area.

Mitigation - No mitigation is proposed.

2. Agriculture

The 1.7-acre project site is currently not in agricultural use. The proposed development will not affect agricultural endeavors on the island.

Impacts - No adverse agricultural impacts are anticipated.

Mitigation - No mitigation is proposed.

3. Police, Fire and Medical Services

Police, fire and medical services are not expected to be adversely impacted by the proposed project. The project will not extend existing service area limits for emergency services.

Impact - There are no negative impacts with regard to police, fire and medical services.

Mitigation - No mitigation measures are proposed.

4. Solid Waste

Only a minimal amount of solid waste is expected to be generated and only during the construction period. There will be only temporary toilets during the construction period.

Impacts - Once the reservoir is constructed there will be no waste disposal necessary at the site. Impact will be minimal and temporary.

Mitigation - All solid waste disposal during the construction period will be in accordance with State requirements for Rubbish Disposal as part of Section 01567, Pollution Control.

C. IMPACTS TO INFRASTRUCTURE

1. Roadways

Access to the subject property would be from the 16-foot wide paved "Reservoir Road" which services the HELCO generating station and existing reservoir.

Impacts - There will be no noticeable increase in traffic due to the addition of the proposed 1.0 million gallon reservoir alongside the existing 0.5 million gallon reservoir.

Mitigation - No mitigation measures are proposed.

2. Water

The addition of the proposed 1.0 million gallon reservoir to the existing 0.5 million gallon reservoir will increase available water resources to the Kona International Airport, NELHA, and the surrounding area.

Impact - Impacts to existing water resources are expected to be positive.

Mitigation - Mitigation measures include the protective fencing of the area around the tank to prevent vandalism and standard protective measures on the tank itself to prevent tank contamination.

3. Wastewater

The sewer system will be designed in conformance with Hawaii County Sewer Standards and Standard Details.

Development of the proposed project is not expected to cause any adverse effects due to wastewater.

Impact - Project will not increase sewage flow, because there will be no sewage flow from the project.

Mitigation - There is no sewage connection to the project so no mitigation is necessary.

4. Drainage

The internal drainage system will be designed to comply with the Hawaii County Drainage Standards and Standard Details.

Impact - Development of the proposed project is not expected to cause any adverse effects to adjacent or downstream properties.

Mitigation - No mitigation measures are proposed.

5. Electrical and Telephone Systems

No electrical or telephone service will be required for the project.

Impacts - None

Mitigation - No mitigation measures are proposed.

IV. RELATIONSHIP TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS

The following plans apply to Keahole Reservoir Project:

- Hawaii State Plan, Hawaii Revised Statutes (HRS) 226
- County of Hawaii, The General Plan
- North Kona Water Master Plan

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

A. HAWAII STATE PLAN

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

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

- a. Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.
- b. To achieve the general facility system objective, it shall be the policy of this State to:

1. Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans
2. Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.
3. Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user
4. Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.

The proposed reservoir facility expansion is designed to improve water system reliability.

B. HAWAII COUNTY GENERAL PLAN

Policies

- Public utility facilities shall be designed so as to complement adjacent land uses and shall be operated so as to minimize pollution or disturbance.
- Provide utilities and service facilities which minimize total cost to the public and effectively service the needs of the community
- Utility facilities shall be designed to minimize conflict with the natural environment and natural resources.
- Improvement of existing utility services shall be encouraged to meet the needs of users.

- The County shall develop short- and long-range capital improvement programs and plans for public utilities within its jurisdiction and which are consistent with the County General Plan.

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

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

The plan to add the Keahole 1.0 million gallon reservoir is consistent with the goals, policies, and standards of the 1989 Hawaii County General Plan. Although the proposed project's primary purpose is for airport fire protection it can also be used as needed to provide adequate, efficient, and dependable water to the public for future development.

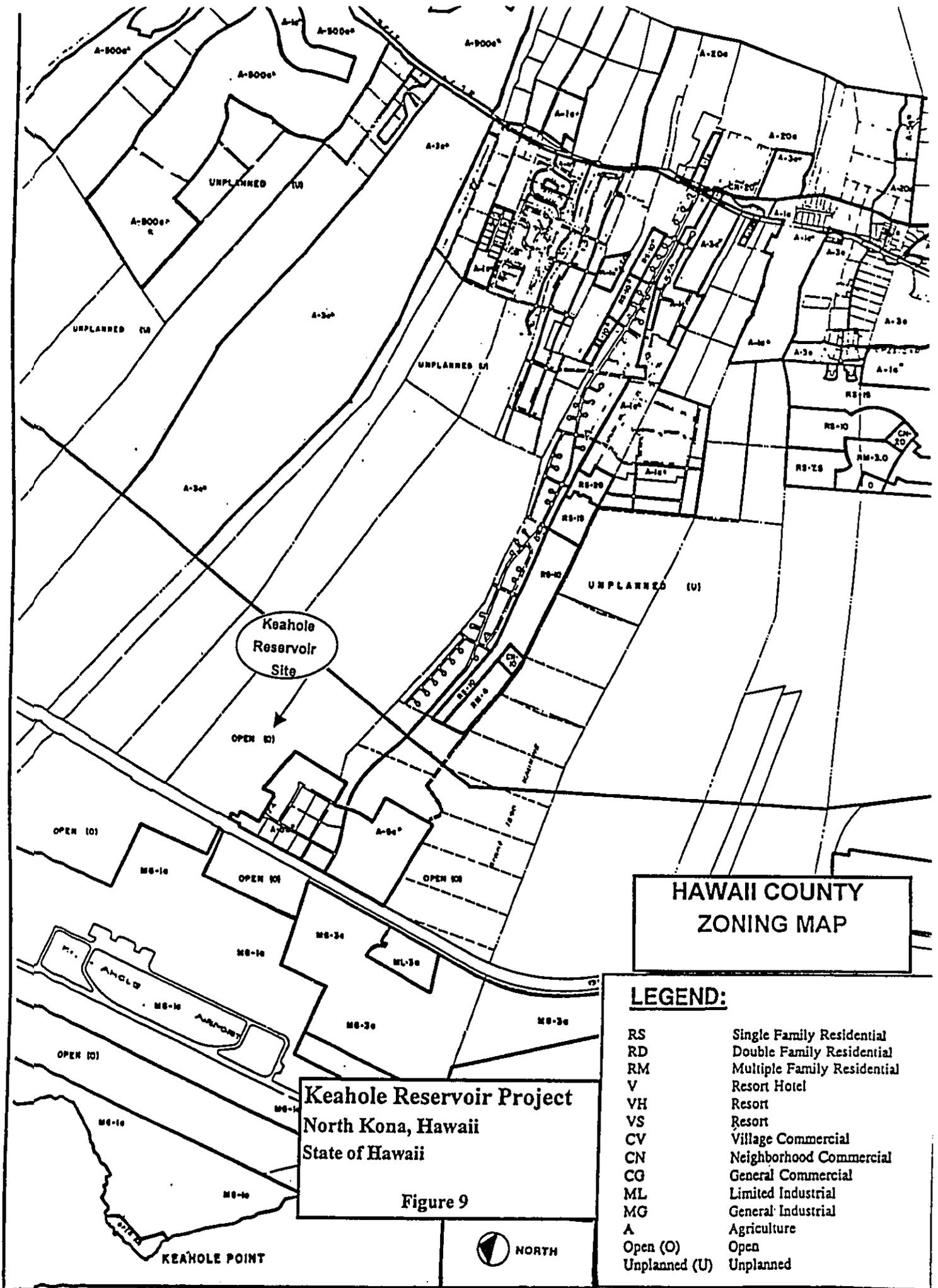
C. COUNTY ZONING

Hawaii County has zoned the site open (O). A 1.0 million gallon water tank/reservoir is compatible with this zoning and the proposed project will be constructed adjacent to the existing 0.5 million gallon water tank/reservoir. (See Hawaii County Zoning Map, Figure 9.)

D. THE NORTH KONA MASTER PLAN

The North Kona Water Master Plan of 1995 under "Storage" specifically proposes that the State construct;

"A 1 mg reservoir near Keahole-Kona International Airport for fire and storage requirements at the airport and NELH."



V. **FINDINGS AND CONCLUSION**

A. **DETERMINATION, FINDINGS AND REASONS FOR SUPPORTING DETERMINATION**

1. **Significance Criteria**

According to the Department of Health Rules (11-200-12), an applicant or agency must determine whether an action may have significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short and long-term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any one of the following criteria:

- a. **Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;**

The project will not impact scenic views of the ocean or any ridge lines in the area. The visual character of the area will not change with the addition of a water reservoir which will be of the same height of the existing water reservoir and will be mostly hidden and blocked by the existing reservoir from view points from the highway. Also, the new water reservoir will be less visible than the existing reservoir from mauka view points of the Kona Palisades Community, because of the natural terrain and slope. Moreover, the new water reservoir will be much less visible than the existing smoke stacks of the HELCO Keahole Generating Station which adjoins the project site; and compatible with the surrounding land use plans and programs being implemented for the region. As previously noted, no significant archaeological or historical sites are known to exist within the project site. Should any archaeologically significant artifacts, bones, or other indicators of previous on-site

activity be uncovered during the construction phases of development, their treatment will be conducted in strict compliance with the requirements of the Department of Land and Natural Resources.

b. Curtails the range of beneficial uses of the environment;

The subject property is only one acre and not suitable for agricultural uses and is on land area adjoining an existing water tank and the HELCO Keahole Generating Station. To return the site to a natural environmental condition is not practical from both an environmental and economic perspective.

c. Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;

The proposed development is consistent with the Environmental Policies established in Chapter 344, HRS, and the National Environmental Policy Act.

d. Substantially affects the economic or social welfare of the community or state;

The proposed project will provide a contribution to future population by providing residents with a safer environment by providing water for fire protection at the airport and Natural Energy Laboratory of Hawaii. The proposed project is designed to support surrounding land use patterns, will not negatively or significantly alter existing residential areas, nor will unplanned population growth or its distribution be stimulated.

e. Substantially affects public health

Impacts to public health will not be affected by air, noise, and water quality impacts.

f. Involves substantial secondary impacts, such as population changes or effects on public facilities

The proposed project will not generate new population growth, but provide needed water for fire protection for the area's present and future population.

g. Involves a substantial degradation of environmental quality;

The proposed development will not utilize any existing vacant agricultural land and is compatible with existing land use requirements as well as existing uses and visual impact. (See V.A.1.a. for further explanation).

h. Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger action;

By planning now to address the future water need of the airport and of the community and the State the project for a new water reservoir is consistent with the short and long-term plans for Kona and the island of Hawaii. No views will be obstructed or be visually incompatible with the surrounding area.

i. Substantially affects a rare, threatened or endangered species or its habitat;

No endangered plant or animal species are located within the one-acre project area.

j. Detrimently affects air or water quality or ambient noise levels;

Any possible impact resulting from surface runoff, will be mitigated by the establishment of on-site retention basins during the construction phases of development. After development, the proposed project is not expected to cause any adverse effects to adjacent or downstream properties.

- k. **Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.**

Development of the property is compatible with the above criteria since there are no environmentally sensitive areas associated with the project. Shoreline, valleys, or ridges will not be impacted by the development.

- l. **Substantially affects scenic vistas and view planes identified in county or state plans or studies;**

Due to the topographical characteristics of the property, views of the area to be developed are generally not significant although they are visible. The proposed project will not be visible, except from higher elevations by the general public or from persons traveling along the highway. (See explanation in V.A.1.a. above.)

- m. **Requires substantial energy consumption.**

Construction of the proposed project will not require substantial energy consumption relative to other similar projects.

B. SUMMARY AND CONCLUSION

The proposed project will involve earthwork and construction activities. In the short-term, these activities may create temporary nuisances normally associated with construction activities. However, dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions. All construction activities are anticipated to be limited to normal daylight working hours. Impacts generated from construction activities are not considered adverse. From a long-term perspective, the proposed project is not anticipated to result in adverse environmental impacts. There are no known significant habitats or rare, endangered or threatened species of flora or fauna or archaeological sites located on the project site. The proposed project conforms with area-wide improvements. Appropriate erosion control

measures are being incorporated during the construction phase to minimize soil loss associated with construction activities. With regard to other infrastructural systems and public services, the proposed project should have no adverse environmental impact.

In light of the foregoing findings, it is concluded that the proposed action will not result in any adverse environmental impacts. Therefore, DLNR anticipates the filing of the Findings of No Significant Impact (FONSI).

VI. AGENCIES CONTACTED IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT

The following agencies were contacted during the preparation of the draft Environmental Assessment:

A. Federal Agencies

1. Federal Aviation Administration
Flight Standards District Office

B. State Agencies

1. Department of Accounting and General Services
2. Department of Agriculture
3. Department of Business, Economic Development and Tourism
Office of Planning
4. Department of Health
Office of Environmental Quality Control
5. Department of Land and Natural Resources
Land Management Division
6. Department of Land and Natural Resources
State Historic Preservation Office
7. Department of Transportation
Highway Division
Airports Division
8. Land Use Commission
9. Legislative Reference Bureau
10. Commission on Persons with Disabilities
11. Office of Hawaiian Affairs

C. County Agencies

1. Hawaii County Police Department, Kona District

County Agencies (cont'd)

2. Hawaii County Fire Department
Kona Fire Station
3. Planning Department
4. Board of Water Supply
5. Department of Public Works
Building Division
6. Department of Public Works
Engineering Division

D. Other Agencies/Organizations

1. Hawaii Electric Light Company (HELCO)
2. GTE Hawaiian Tel
3. Natural Energy Laboratory of Hawaii Authority (NELHA)
4. Kona Hawaiian Civic Club
5. Kona Palisades Community Association

APPENDIX A
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APPENDIX B
Flora Study

BOTANICAL RESOURCES STUDY
PROPOSED KEAHOLE RESERVOIR SITE
NORTH KONA DISTRICT, HAWAI'I

by

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Prepared for:
MPAC, INC.
Management Planning & Administration Consultants, Inc.

October 1997

BOTANICAL RESOURCES STUDY
PROPOSED KEAHOLE RESERVOIR SITE
NORTH KONA DISTRICT, HAWAII

INTRODUCTION

The proposed water reservoir site is located mauka of the existing reservoir which is found near the Hawaii Electric Light Company's (HELCO) Keahole Generating Station. The proposed reservoir site is approximately one acre in size. Access to the new reservoir will be from the 16-foot wide, paved "Reservoir Road" which services the HELCO generating station and the existing reservoir.

Field studies to assess the botanical resources found on the project site were conducted on 17 October 1997. The primary objectives of the survey were to:

- 1) provide a description of the vegetation on the site;
- 2) inventory the flora;
- 3) search for threatened and endangered species as well as species of concern; and
- 4) identify areas of potential environmental problems or concerns.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. A tax map of the site and soil survey maps (based on aerial photographs) were examined to determine vegetation cover patterns,

terrain characteristics, access, boundaries, and reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, drainage, exposure, disturbances, topography, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium (University of Hawai'i, Manoa -- HAW), and for comparison with the most recent taxonomic literature.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the survey. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

DESCRIPTION OF THE VEGETATION

Two earlier botanical studies have been conducted for the lands adjacent to the project site. These were for the Keahole Generating Station Expansion (Char 1992a) and for the State's West Hawai'i Boundary Review (Char 1992b). In both of these studies, the vegetation around the proposed reservoir site was described as fountain grass grassland, that is, somewhat sparsely vegetated lava fields dominated by fountain grass.

Fountain grass grassland also occurs on the proposed project site and is described in more detail below. A checklist of all the plant species which occur on the project site is presented at the end of this report.

Substrate on the proposed reservoir site consists of gently rolling pahoehoe lava (Sato et al. 1973) with very little soil

development. The few small pockets of soil are thin and occur in the cracks and crevices of the lava flow or in shallow depressions. Roughly 50 to 70% of the lava flow is covered by vegetation. Clumps of fountain grass (Pennisetum setaceum), 2 to 3 ft. tall, form the dominant plant cover. Other grasses which are found here in smaller numbers are Natal redbtop (Melinis repens) and pili (Heteropogon contortus).

Scattered through the grassland are a few shrubs of Christmas berry (Schinus terebinthifolius), koa haole (Leucaena leucocephala), and 'a'ali'i (Dodonaea viscosa), 3 to 6 ft. tall. Low-lying swale areas with thin soil support smaller shrubs (or subshrubs) and forbs such as 'uhaloa (Waltheria indica), indigo (Indigofera suffruticosa), partridge pea (Chamaecrista nictitans), and hairy spurge. During the rainy season, some of these plants such as the 'uhaloa, partridge pea, 'ilima (Sida fallax), and pili become locally common and occur in greater abundance.

One small shrub of the native caper or maiapilo (Capparis sandwichiana) is found near the northwest boundary, just outside of the project site. Larger plants are also found mauka of the project site near a collapsed lava tube. Maiapilo is considered a species of concern, but not a high priority species for study (U.S. Fish and Wildlife Service 1997). Species of concern are those plants for which there is some evidence of vulnerability, but for which there is not enough data to support listing proposals at present. Further biological research and field studies are needed.

DISCUSSION AND RECOMMENDATIONS

The vegetation on the project site is dominated by introduced or alien plant species. Introduced plants are all those plants which

were brought to the Hawaiian Islands by humans, intentionally or accidentally after Cook's discovery of the islands in 1778.

Fountain grass, the dominant component of the vegetation on the project site, is a native of northern Africa. Other introduced species which are common to occasional on the site include koa haole, partridge pea, indigo, Natal redtop grass, and Christmas berry.

The native species which are found on the ±1-acre project site are widespread throughout the Hawaiian Islands and can be found in similar dry, lowland environments. The native species which are found on the site are the koali 'awahia vine (Ipomoea indica), 'ilima (Sida fallax), alahe'e (Canthium odoratum), 'a'ali'i (Dodonaea viscosa), 'uhaloa (Waltheria indica) and pili grass (Heteropogon contortus). All of these plants are indigenous, that is, they are native to the Hawaiian Islands and also elsewhere.

None of the plants found during the field studies is a listed, proposed, or candidate threatened and endangered species; nor is any plant a species of concern (U.S. Fish and Wildlife Service 1997). One small shrub of maiapilo (Capparis sandwichiana), a species of concern, is found just outside of the project site.

The proposed project is not expected to have a significant negative impact on the botanical resources. Given the findings above, there are no botanical reasons to impose any restrictions, conditions, or impediments to the proposed use of the site for a water reservoir. No recommendations are proposed at this time.

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PLANT SPECIES LIST -- Keahole Reservoir, North Kona, Hawai'i

The following checklist is an inventory of all the plants observed on the proposed reservoir site. The plants are arranged alphabetically by families into each of two groups: Dicots and Monocots. The taxonomy and nomenclature of the flowering plants follows the most recent treatment of the Hawaiian flora by Wagner et al. (1990).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
 - I = indigenous = native to the Hawaiian Islands and also elsewhere.
 - I? = questionably indigenous = data not clear if dispersal to the Hawaiian Islands by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.
 - X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is, Cook's discovery of the islands in 1778.

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>
DICOTS		
ANACARDIACEAE (Mango family) Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X
CONVOLVULACEAE (Morning glory family) Ipomoea indica (J. Burm.) Merr.	koali 'awahia	I
EUPHORBIACEAE (Spurge family) Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X
FABACEAE (Pea family) Chamaecrista nictitans (L.) Moench	partridge pea, lauiki	X
Desmodium tortuosum (Sw.) DC	Florida beggarweed	X
Indigofera suffruticosa Mill.	indigo, 'iniko	X
Leucaena leucocephala (Lam.) de Wit	koa haole, ekoa	X
MALVACEAE (Mallow family) Sida fallax Walp.	'ilima	I
PROTEACEAE (Protea family) Grevillea robusta A. Cunn. ex R. Br.	ilk oak, 'oka kilika	X
RUBIACEAE (Coffee family) Canthium odoratum (C. Forster) Seem	alahe'e, walahe'e	I
SAPINDACEAE (Soapberry family) Dodonaea viscosa Jacq.	'a'ali'i	I
STERCULIACEAE (Cacao family) Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?
VERBENACEAE (Verbena family) Lantana camara L.	lantana, lakana	X

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>
MONOCOTS		
POACEAE (Grass family)		
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili, pili grass	I?
Melinis minutiflora P. Beauv.	molasses grass	X
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X

APPENDIX C
Archaeological Study

**ARCHAEOLOGICAL RECONNAISSANCE
OF A PROPOSED RESERVOIR SITE, MAUKA
OF THE KEAHOLE SUBSTATION, KALAOA,
KONA, HAWAII ISLAND (TMK: 7-3-10: 33)
*DRAFT***

by

Ian A. Masterson
Hallett H. Hammatt, Ph.D.

Prepared for

MPAC, Inc.

Cultural Surveys Hawaii
November 1997

ABSTRACT

An Archaeological Reconnaissance Survey of An approximately 1.7-acre proposed reservoir site (TMK: 7-03-10: 33) situated *mauka* of the Keahole Electric Substation in Kalaoa was conducted on October 30, 1997. The survey was completed for Dr. Ross Prizzia of Management Planning & Administration Consultants, Inc..

During the survey no archaeological sites were located within the project area. One lava tube system (SIHP 50-10-27-21299) with four sinks and several archaeological features was located east of the project area. The lava tube is briefly described within this report because of its proximity to the eastern edge of the present study parcel.

Due to the absence of archaeological sites within the project area no further archaeological work is recommended at this time. In the event any activity is to occur east of the project area further archaeological work should be conducted to record and determine the extent of the lava tube system designated SIHP -21299.

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I. INTRODUCTION

At the request of Dr. Ross Prizzia of Management Planning & Administration Consultants, Inc. an archaeological reconnaissance survey for a proposed water reservoir was conducted by Ian Masterson of Cultural Surveys Hawaii on October 30, 1997. The present project area comprises approximately 1.7-acres of "barren zone" lands situated east of the Keahole Electric Substation within the *ahupua`a* of Kalaoa 4 in the District of North Kona, Hawaii Island (TMK: 7-03-10: 33).

A. Project Area Description

The project area is situated at the east end of a small road servicing an existing water tank *mauka* of Queen Kaahumanu highway immediately across from the Keahole Airport access road. The water tank and existing fence surrounding the tank make up the southwestern portion of the project area. This entire portion and an area of approximately 50 feet surrounding the fence, has been bulldozed during reservoir construction activities. The remainder of the project area remains undisturbed by construction activity and is characterized by undulating pahoehoe lava gently sloping to the west and areas of `a`a lava. Several lava tube systems create rises in the terrain, but most are low or collapsed tube portions impassable to humans. Very little soil exists within the project area.

B. Scope of Work

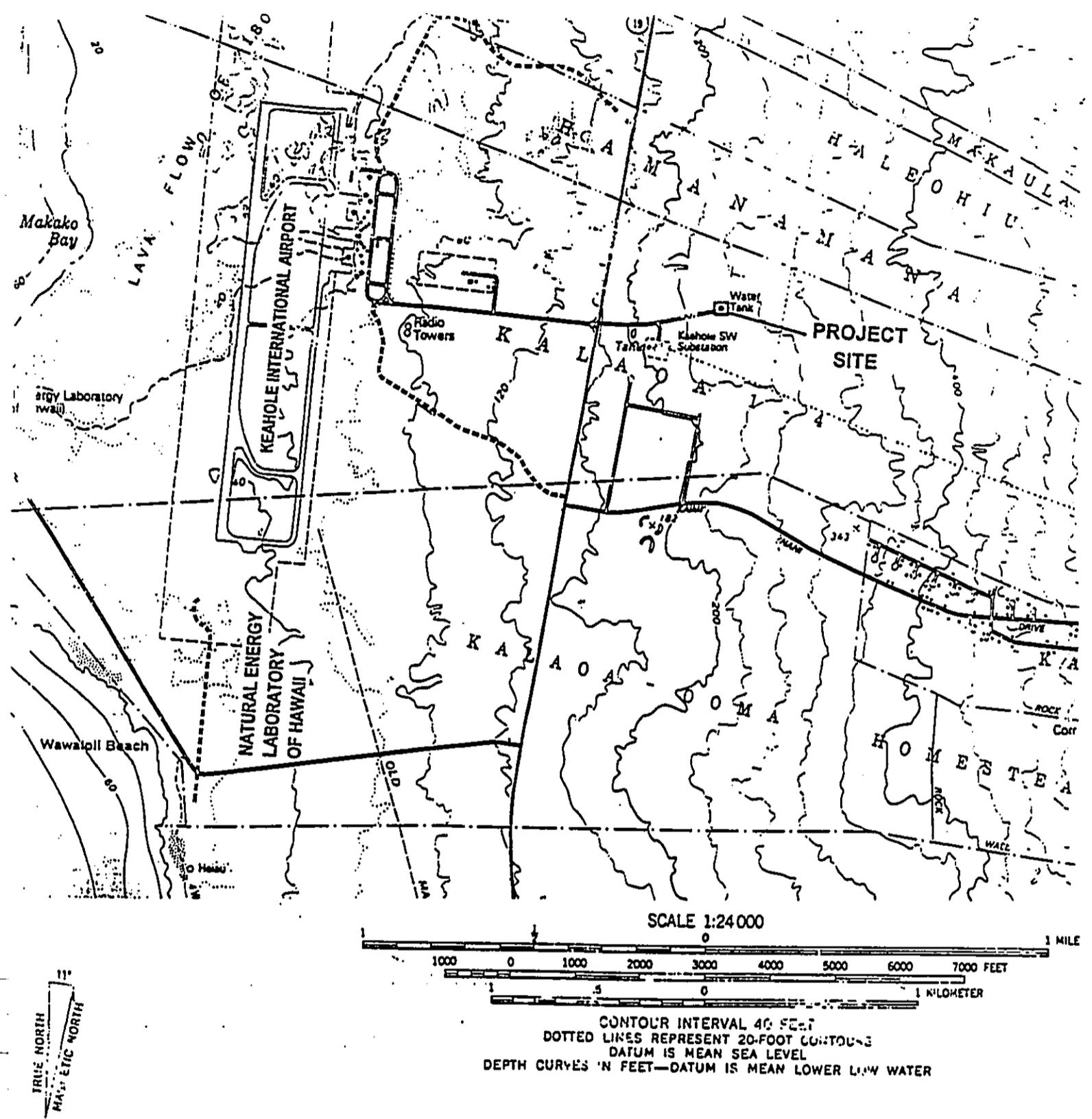
The scope of work would include the following:

1. Brief historic background research, including examination of previous archaeological studies in the area and other relevant maps, etc.
2. Field inspection including 100% coverage of the property for the purpose of locating archaeological sites (or determining that no sites are present).
3. Preparation of a short report which will include the results of the historic research and field work. This report should be sufficient for permit processing if no sites are present. However, if sites are located, a more thorough survey to describe and evaluate these sites will be recommended in the report.

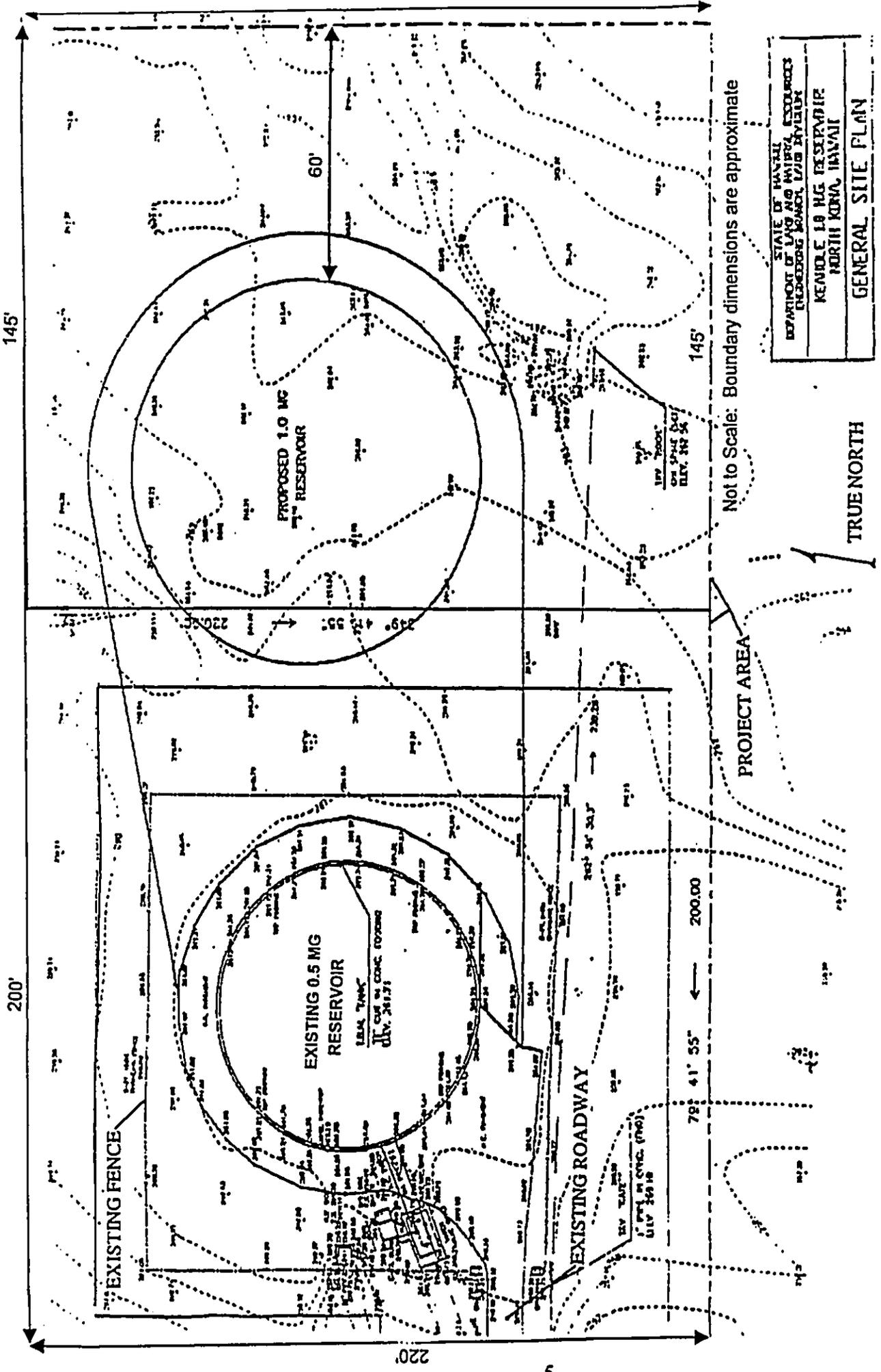
C. Methods

The methods employed during the archaeological reconnaissance survey were designed to meet the standards set forth in the scope of work. The property boundaries were located by measuring 200 ft. from the existing water tank fence corners, following the existing angles of the fence. Upon establishing the boundaries, 100% coverage of the project area was accomplished on foot by performing ten sweeps in an east/west direction at intervals of 40 ft.. Visibility was good to fair depending on the height of the grasses in low-lying areas within the generally barren lava terrain. One site was located, mapped, and described although it was later determined to be outside the project area boundary.

DOCUMENT CAPTURED AS RECEIVED



Portion of USGS Map, Keahole Quad, Showing Location of the Project Area



Project Map Showing Location of Present Water Reservoir Tank in Relation to the Proposed Water Reservoir Tank

II. NATURAL SETTING

The project area is situated at an elevation between 250 and 280 ft. a.m.s.l. in undulating lava fields which gently slope to the sea. The *Atlas of Hawaii* records average temperature, rainfall, and wind patterns for the region as varying between 65° and 85° Fahrenheit with 10 to 20 inches of rain annually. The winds are typically calm in the morning with onshore convection winds blowing in the afternoons (Armstrong, 1973:56-59). The entire region of Kekaha consists mostly of barren 'a'a and pahoehoe lava flows, the most recent flow being the *Huehue* lava flow of 1801. This flow devastated many of the natural resources and prehistoric habitation sites in the region, causing the greatest affect in the land-use pattern of the Kekaha Region since prehistoric times. The *Huehue* lava flow lies north of the present study parcel.

The Soil Survey of the Island of Hawaii describes 'a'a lava terrain as having "practically no soil covering and is bare of vegetation, except for mosses, lichens, ferns, and a few small *ohia* trees...This lava is rough and broken. It is a mass of clinkery, hard, glassy, sharp pieces piled in tumbled heaps" (Sato et al. 1973:34). The same study describes pahoehoe lavas as "a billowy, glassy surface that is relatively smooth. In some areas however, the surface is rough and broken and there are hummocks and pressure domes" (ibid).

Vegetation is typical of that characterized within the "barren-zone" and is identified as "Fountain Grass Grassland" in The Botanical Survey of the West Hawaii Boundary Review (Char and Associates 1992 quoted in Walsh and Hammatt 1995). This vegetation type typically consists of low tufts of grass with scattered shrubs and a few trees. *Pili* grass (*Heteropogon contortus*), Guinea grass (*Panicum maximum*), fountain grass (*Pennisetum setaceum*), *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena glauca*), and *a'ali'i* (*Dodonea sp.*) was observed within the present study parcel.

III. HISTORIC BACKGROUND

The background study for this project will focus on presenting a summary of previous studies with an emphasis on identifying land use and settlement patterns for the project area. A predictive model for the project area was formulated from the gathered historical and archaeological information. See Section IV: Previous Archaeology for a predictive model of land-use zones in the Kekaha region (Table I).

A. Mythological and Traditional Accounts

The project area is located within the Kekaha region of North Kona District. Based on a recent translation of the "Legend of Ka-Miki" by Kepa Maly (cited in Henry et al. 1993) the region or *'okana* of Kekaha extends from Keahuolu northward to the Kona-Kohala boundary. The Kekaha region is also called *Kekaha wai'ole*, or "waterless place", a name which reflects its dry and barren appearance. Despite its desolate appearance, legends and other traditional accounts indicate that Kekaha was once a populous and productive region. Referring to the lands between O'oma and Makaula, PHRI researchers Maly and Kalima summarize this point as follows:

To a contemporary visitor, the project area lands, and Kekaha in general, appear barren and desolate. It is difficult to believe that many people could have lived in the area without modern conveniences, but traditional accounts of this area describe numerous settlements, extensive agricultural fields and fishponds, and well-defined trails. There is also much praise of the fishing grounds of the region. (in Henry et al. 1993:20)

A great deal of primary research on legendary references and place names of Kekaha has been undertaken by Kepa Maly and Lehua Kalima. The results of some of this research can be found in "The Historical Documentary Research by Kepa Maly and Lehua Kalima" presented in PHRI report 1275-071493: *Archaeological Assessment Study, Kailua to Keahole Region State Lands LUC Project* (Henry et al. 1993).

B. Early Historic Period

Early historical references to Kekaha and North Kona, in general, tend to emphasize its barrenness, but also hint at traditional settlement, particularly along the coast. The following observations were made by visitors to the region between 1792 and 1840.

The naturalist, Archibald Menzies who traveled along the coast in 1792, described the area as "barren and rugged with volcanic dregs and fragments of black lava... in consequence of which the native inhabitants were obliged to have recourse to fishing for their sustenance" (1920:99).

Vancouver, referring to the North Kona coast in 1794 stated: the adjacent shores...[are] chiefly composed of volcanic matter, and producing only a few detached groves of cocoa nut trees, with the appearance of little cultivation, and very few inhabitants... (Vancouver 1798,III:62 quoted in Cordy 1985:34)

In 1823, William Ellis referred to the 1801 Huehue lava flow from Hualalai, which covered parts of Kekaha just to the north of the present project area, as having "inundated several villages, destroyed a number of plantations and extensive fish ponds, filled up a deep bay twenty miles in length and formed the present coast... stone walls, trees and houses all gave way before it" (Ellis 1963:30-31).

In 1840, the explorer C. Wilkes observed "a considerable trade is kept up between the north and south end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of the south, for food and clothes" (Wilkes 1845:91).

C. Mid-1800s (Land Commission Awards)

Historical data on land use and settlement for individual *ahupua`a* was generated during the Great Mahele land divisions of the mid-Nineteenth Century. Several previous archaeological and historical studies have compiled Mahele data for the *ahupua`a* in which the present project area lies. In general, land claim testimonies indicate that there were relatively few native tenants that made land claims and the majority of lands became the property of the government. Of the few land claims made, however, it appears that the cultivation of traditional crops within the upper elevations (the Upland Zone), including taro and sweet potatoes, was the predominate land use activity. Only one claimant indicated the cultivation of a commercial crop (coffee). Besides a claim made for "salt lands" at Keahuolu, and several other claims made for rights to fish pond resources, there is very little indication of land use throughout the intermediate and lower elevations, including an absence of claims made for house lots on the coast.

The Mahele data from the subject *ahupua`a* supports what Cordy found in his study of land claims made at Kaloko, namely, that by the time of the Mahele, "the coast was virtually abandoned [and] the economic focus in this area had shifted to the uplands, which may have been a non-traditional pattern in this area" (Cordy et al. 1991:421). The following is an excerpt from a previous study which provide a brief summary of the Mahele data for the subject *ahupua`a*. The excerpt is a direct quote compiled from the referenced report.

The Mahele saw all these *ahupua`a* (O`oma 1-2 and Kalaoa 1-5) become government lands (Indices 1929:31,35); evidently they were the king's lands which he passed to government control... Only two Land Commission Awards were given in this area (LCA 7899 and 7937), both in Kalaoa 5 but a series of Grants were issued in the *ahupua`a* from 1852-1864 -- evidently commoners acquiring lands. All these awards

were in the upland forest zone from the 800 to 2200 foot elevations... they would seem to be agricultural parcels. (Cordy 1985:35)

Settlement Pattern as shown by LCAs

The settlement pattern within the *ahupua`a* of Kalaoa as shown in the mid-1800s by claims for LCA's indicate that there was very little activity in the barren land zone which includes the present project area. Two claims made in Kalaoa were located in the upland forest zone. Being the King's land prior to the Mahele and becoming government lands indicates that no settlement would have occurred within the project area and at most temporary/recurrent habitation during times of travel would have been the primary function of any sites found within the project area.

D. Early 1900s To The Present

Following is a selection from a previous study which summarizes the historical developments that occurred within Kekaha and selected portions of the Kekaha region:

By the end of the 1800s, land use in North Kona had undergone significant alterations from the dryland cultivation and fishing practiced during prehistoric and proto-historic times. Maly summarizes the gradual replacement of Hawaiian lifestyle in this area as the result of two major factors: the 1801 eruption of Hualalai, and changing land use patterns over the last 150 years. The lava flows from Hualalai reclaimed much of the land used for settlement, agriculture and fishponds; reducing the land to a shadow of its former condition. Introduction of foreign plants and animals brought about additional changes, as once barren lava fields became overgrown with *kiawe* and other weedy shrubs, and goat and cattle raising became a mainstay of local industry. The 1850s saw the development of large-scale commercial ranching and agriculture as a result of the shift to private land ownership brought about by the Mahele and an 1850 law permitting foreigners to own land. Coffee, grazing land, tobacco and sugar cane gradually replaced traditional crops such as taro and *uala*; stripped the land of forests, and caused disruption of the water catchment systems...

Today, the upland and intermediate zones are covered with coffee plantations, housing developments, and light industry. On the coast are the Keahole Airport and the Natural Energy Laboratory. The coast has not been utilized for permanent human habitation since the 1801 lava flow. (Henry et al. 1993:50)

The change of settlement and land use in the Kekaha district affected the project area only slightly. The introduction of goat and cattle ranching within the vicinity possibly included the subject parcel. Goat and subsequently cattle were known to frequent the area as livestock and later as feral animals.

The urbanization of the Kona area and construction of the Keahole Airport and Industrial Ag Park have created the greatest change in land use in the *ahupua`a* of the project area,

and the greatest change in the region since the 1801 *Huehue* lava flow. In the immediate vicinity of the project area, east of Queen Kaahumanu Highway, are the Keahole Substation and Ag Park expansion. The airport road turn-off is directly across from the road which accesses the project area, and there is presently a water reservoir tank which supplies water to the Keahole Airport in the southwest portion of the project area. The Queen Kaahumanu Highway expansion project is also underway.

E. Summary

The land within which lies the present project area is Kekaha. Despite its desolate appearance, legends and other traditional accounts indicate that Kekaha was once a populous and productive region. As settlement patterns changed and the 1801 *Huehue* lava flow inundated much of the productive regions just north of the study parcel fewer people inhabited the region. These inhabitants of the barren zone were primarily focused on salt manufacture and fishing for subsistence and trade with travelers from more productive regions. After the Mahele, at which time the area became government lands, settlement continued to centralize around Kailua town while ranching activities ensued in the vicinity of the project area. Industrial expansion and the construction of the Keahole Airport caused the greatest change in land use within the region. Presently, the project area contains one water reservoir tank supplying the Keahole Airport.

IV. PREVIOUS ARCHAEOLOGICAL RESEARCH

Several archaeological studies have occurred over the last twenty years near the present project area that relate to industrial activity and development in the Kekaha region. Through these reports a more complete predictive model can be created for the present study. Several studies were accomplished for the Keahole Airport and the Natural Energy Lab. These studies occurred west of Queen Kaahumanu highway; through these studies land-use patterns for the Kekaha Region can be devised. The studies discussed below all occurred east of the highway; these reports assist in building a predictive model for the present project area as well as the region. Previous archaeological studies done in the vicinity of the present project area include Davis (1977), Hammatt and Folk (1980), Dowden and Graves (1992), Henry and Graves (1993), Head and Rosendahl (1993), and Walsh and Hammatt (1995). Individual findings for each report are briefly described below.

The Davis study (1977) was a reconnaissance survey conducted immediately south of and encompassing the southern half of the present project area. The study was done in conjunction with the development of the Keahole Agricultural Park. Twenty-two sites were located including lava tube systems, minor shelters in lava bubbles, a large *ahu* marking possible trail alignments, stone platforms and enclosures relating to historic homesteading, and an *ahupua'a* boundary wall. None of these sites are located near the present project area.

Hammatt and Folk (1980) completed excavations at selected sites within the Keahole Agricultural Park and did a reconnaissance of 370 acres located immediately north of and

encompassing the northern half of the present project area. The reconnaissance survey revealed 18 sites including several *ahu*, a wall segment, a circular enclosure, a platform, a trail, and four lava tubes (possibly including SIHP 21299). No site location map was given for the reconnaissance survey portion of the report. Testing in sites originally located by Davis (1977) revealed a radiocarbon date range of AD 1400-1700, therefore establishing prehistoric land use near the present project area.

In 1992, Dowden and Graves completed an inventory survey for the HELCO Keahole Substation situated southwest of the present project area along the same access road. The survey revealed four quarry sites consisting of seven pahoehoe excavations. Subsurface testing was not conducted due to a lack of soil and cultural deposits within the identified features.

Henry and Graves (1993) conducted an archaeological assessment of state owned property along the eastern edge of the Queen Ka'ahumanu highway between Kailua town and the Keahole Airport. The assessment was conducted to locate sites within a 69kV transmission line corridor. A total of 25 sites with sixty component features were located within the corridor. None of these sites were located within the Kalaoa *ahupua'a*.

Head and Rosendahl (1993) completed a survey of the Kailua to Keahole Region State Lands LUC Project - 500-acre University Site which encompasses a portion of the Kalaoa *ahupua'a* east of the proposed reservoir site. A total of 43 sites were located during the study. Although there are no sites in the vicinity of the present project area, a lava tube system along the western flank of the University Site project area (SIHP 15302) could possibly relate to the lava tube system SIHP 21299 considering the length of some known lava tubes within the Kona district.

Walsh and Hammatt (1995) recently completed an inventory survey of the New Queen Kaahumanu Right-of-way Between Palani Road and Keahole Airport which encompasses a large portion of the previously surveyed 69kV transmission line corridor. A total of seventeen sites, including five previously identified sites, were located during this survey. Three sites lie within the Kalaoa *ahupua'a*, including a utilized lava tube (SIHP 19943), two mounds (SIHP 19944), and a petroglyph site with two human figures (SIHP 19945).

Based on these archaeological and historical studies, numerous models of traditional and historic land use and settlement have been developed. In an archaeological assessment study of a project area that spanned multiple *ahupua'a* in the Kekaha region, PHRI presented and synthesized five of these models, providing the most current model to date (Henry et al. 1993:50-56). The five models analyzed by PHRI were those presented originally by Rosendahl (1973:60-61, 65-66); Davis (1977:19-21); Cordy (1985); Hammatt (1987:69-71); and Barrera (1987). These models were summarized as follows:

The preceding models, though varying in detail, have several common elements. First, there is a general agreement on separation of the region into three basic environmental zones: the coastal zone, the barren or intermediate zone, and the upland zone. Second, all five models associate the coastal zone with marine

exploitation and the upland zone with dryland cultivation. Depending on their proximity to the coast or uplands, sites within the barren zone are considered extensions of the two major patterns into marginal areas, or as sites related to travel between the two poles (e.g. trails, shelters, etc.). Third, and finally, all of the models posit some level of interaction between the coast and the uplands, although there is little agreement concerning the nature and intensity of this interaction. (Henry et al. 1993:55)

The following table (Table 1) summarizes some of the major characteristics of the three-zone model for the Kekaha region. It is based upon the most recent model posited by PHRI in which the five previous models are synthesized (Henry et al. 1993:55-56), with additional details from Cordy (Cordy et al. 1991:11-16) and other sources.

The present project area lies within the intermediate zone and, as such, was expected to exhibit the same range of characteristics as those outlined in the intermediate zone row of the following table.

1. Predictive Model

The predictive model for the present project area related to traditional Hawaiian settlement patterns would include minimal land use such as temporary habitation shelters, *mauka-makai* trails, and lava tubes utilization. However, modern land use has had direct impact related to the reservoir construction. Based on the background research few if any sites are anticipated because the majority of the present project area is an existing reservoir (i.e. water tank) surrounded by a fence. Previous archaeological studies completed in the area have encountered sites such as wall segments, *ahu*, trails, temporary habitation platforms and enclosures (Hammatt and Folk; 1980), quarry sites (Dowden and Graves; 1992), lava tube shelters (Head and Rosendahl; 1993), and petroglyphs (Walsh and Hammatt; 1995). It is possible that these types of sites may still be present within any undisturbed portions of the project area.

Table I: Summary of Zone Model Characteristics

Zone	Elevation	Topography	Climate	Present Vegetation	Occupation Activities (Traditional and Historic)	Site/Feature Types	Site Density/Distribution
Coastal	Coastline to 300 m. inland; 0 to 9 m. contour (0 to 30 feet)	Relatively flat to gradual slope (5-10%), undissected lavas, rocky, little or no soils; includes isolated bays, inland ponds	Central Kona patterns; Avg. Temp. range 67-83 F; Rainfall 10 inches/yr	Strand, pond & Kiawe thickets communities	Primary traditional use: permanent and temporary occupation & marine resource exploitation. Other uses: limited agriculture, quarrying, transportation, burials, art/communication	caves, cairns, enclosures, trails, midden scatters, modified outcrops, overhangs, pahoehoe excavations, petroglyphs, platforms, sinkholes, terraces, lava tubes, pavements	Moderate, concentrated along the shoreline and around inland ponds
Inter-mediate (Barren or Middle)	300-600 m. inland; 9-12m. contour (30-39 ft) to 130 m. contour (425 ft)	Gradual slope, undissected lavas, little or no soils	Central Kona Patterns; Rainfall 10-30 in./yr	Grasses dominate, some shrubs	Primary traditional use: temporary or transitory occupation. Other uses: habitation (mostly temporary or recurrent), transportation, quarrying, limited agriculture, burials art/communication, ranching	trails, pahoehoe excavations, cairns, midden scatters, platforms, terraces, enclosures, caves, mounds, walls	Very low and scattered, some concentrations along <i>mauka-makai</i> trails
Upland	Extends up to 6 km. inland from shore; 130 m. contour (425 ft) to 1030 m. contour (3379 ft)	Gradual slope, minimal soils below 800 ft. moderate to strong soil development above	Central Kona patterns; Rainfall 40-50+ in./yr	Non-native secondary forest dominates	Primary traditional use: permanent and temporary occupation & intensive dryland agriculture. Other uses: forest resource exploitation, ranching, commercial agriculture	upland agricultural features, platforms, mounds, walls, enclosures, cairns, terraces, trails, lava tubes, pahoehoe excavations	Medium to high, very high around 2000 ft elevation and 25 in/yr rainfall area

V. FINDINGS AND ARCHAEOLOGICAL INTERPRETATIONS

A survey of the project area was accomplished on October 30, 1997 which encompassed 100% of the project area. The survey was completed entirely on foot. Results of the survey determined that there are no archaeological sites present within the bounds of the present project area. The survey also revealed that an area of fifty feet surrounding the existing water tank fence was bulldozed for construction of the tank and fence (refer to Figure 4).

Lava tube systems were observed north and east of the project area, including SIHP 50-10-27-21299, which contains three sinks approximately 200 to 300 ft. east of the present project area boundary. The two southern sinks are connected by a collapsed tube portion. These sinks contain temporary/recurrent habitation features as well as cleared areas and pavements under the shelter of the tube edges. The southernmost tube goes southwest for approximately 40 meters before becoming inaccessible at the rear of a big chamber which drips water formed by condensation on the ceiling. The third and northernmost sink is accessible only with rope as it is a 4 by 8 meter opening which drops 4 meters to the tube floor. Further work to better record these sites is necessary if any development is planned east of the present project area.

Again, no archaeological sites are present within the bounds of the present project area.

VI. Conclusion

Literary references and the predictive model compiled from previous archaeological studies show that sites related to travel and temporary/recurrent habitation were expected to be found in the vicinity of the project area. A field survey completed for the project area concluded that there are no sites within the approximately 1.7-acre parcel. Based on the lack of sites within the present project area no further archaeological work is recommended at this time.

In the event plans for development are slated for the area east of the present project area, further archaeological work is necessary to better record the lava tube system designated SIHP -21299.

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APPENDIX D
Photos of Project Site

Viewers

Residents in the project vicinity and persons traveling on Queen Kaahumanu Highway represent the principle viewers of the proposed facility.

Key Views The Viewers Location Map presents locations of three views of the project site. The views are discussed in terms of the dominance of the facility in each view as follows.

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

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

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

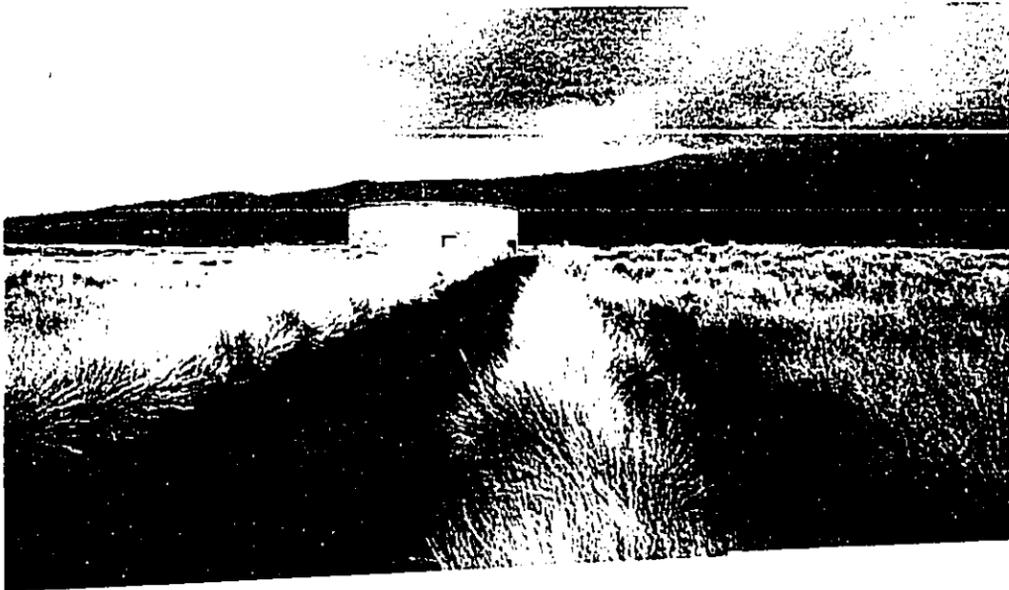
Views of the existing facilities are as follows:

View 1 The photograph was taken approximately 1 mile north of the site on the Queen Kaahumanu Highway, looking south. Principal features in this view include the highway and lava fields. The top of the existing 70-foot-high exhaust stack of the HELCO Keahole Generating Station is the only feature in the vicinity area that is visible. The existing 22-foot-high water reservoir is not visible and is characterized as subordinate from this viewing location.

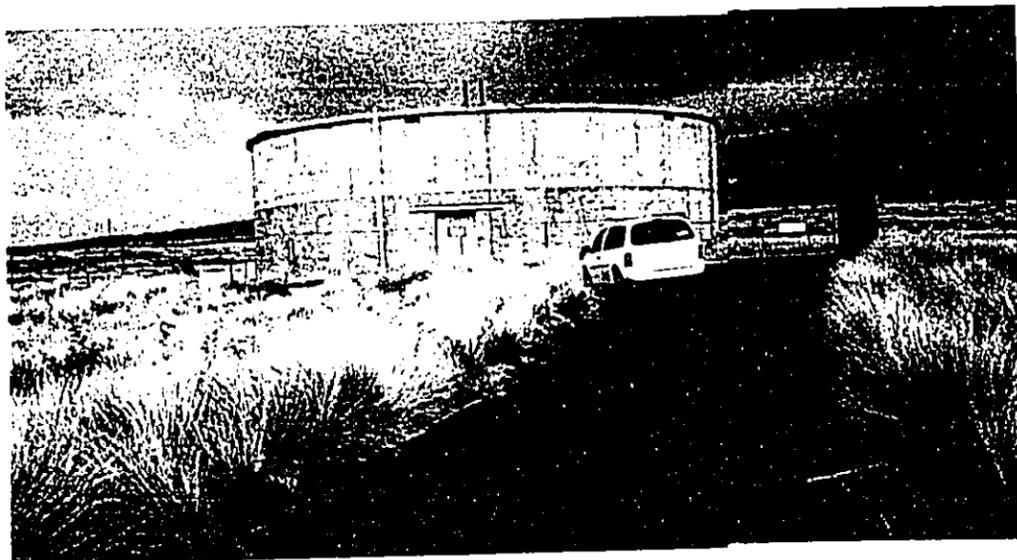
View 2 The photograph was taken approximately 1 mile east of the site along Kaiminani Drive near the Kona Palisades residential subdivision. The principal features in this photo are the grass and shrubs in the foreground, the gently sloping terrain, and the ocean in the background. The 70-foot-high exhaust stack from HELCO's combustion turbine and the six 40-foot-high stacks from the diesel engines are visible. The 22-foot-high existing water reservoir is not visible and is subordinate in the landscape from this viewing location.

View 3 The photograph was taken approximately 1 mile south of the site on Queen Kaahumanu Highway, looking north. The dominant features visible are the highway, transmission line poles adjacent to the highway, and the gently sloping terrain. The top portion of the 70-foot-high exhaust stack of the HELCO Generating Station is visible. The existing 22-foot-high water reservoir is not visible from this view and is subordinate to the other landscape features from this viewing location.

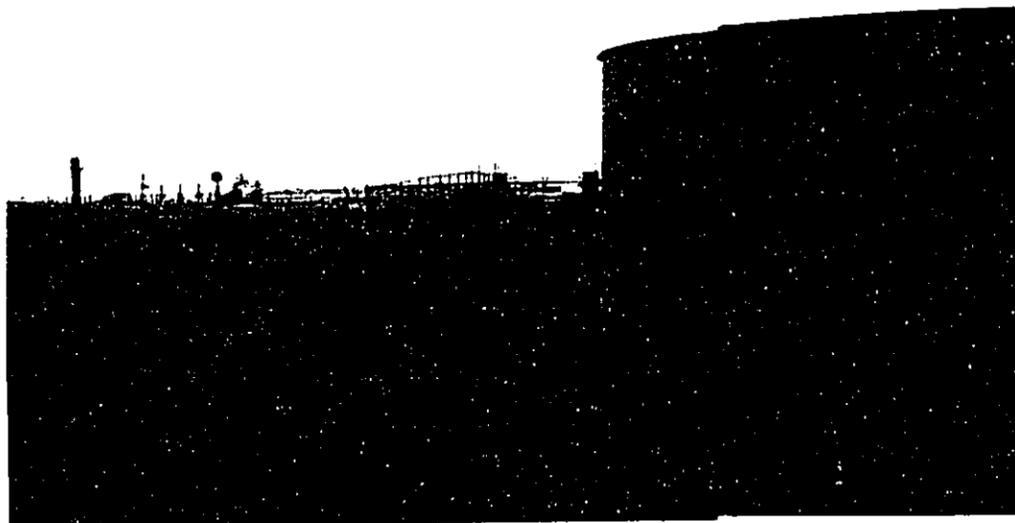
(Source: Revised Environmental Impact Statement, Keahole Generating Station Expansion, North Kona, Hawaii, Hawaii Electric Light Company, Inc., December 1993)



Facing mauka, paved road to existing water tank and project site is visible.

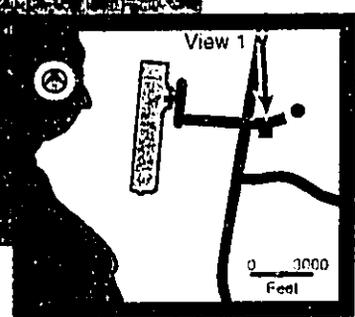
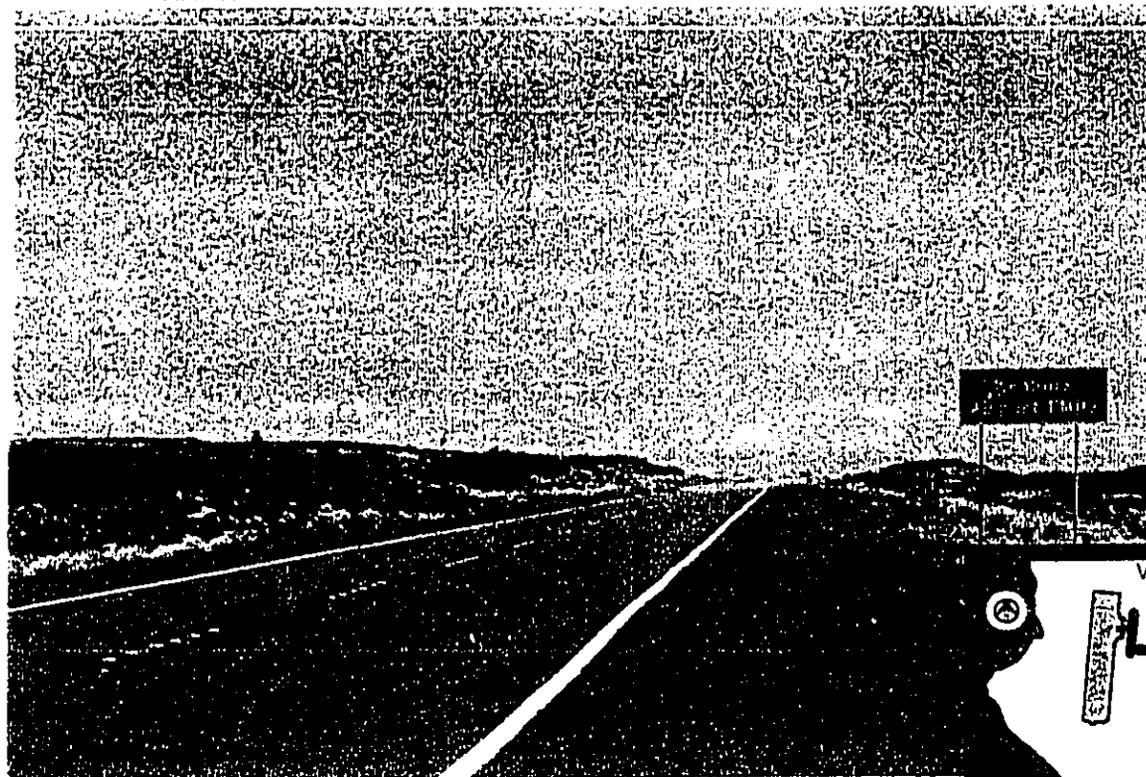


Facing mauka, existing .5 million gallon water tank surrounded by fence is visible. Project site of 1.0 million gallon reservoir is just mauka of existing tank and fenced area.

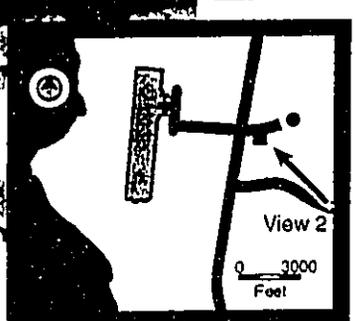


Facing makai from project site area, HELCO Generating Station makai of existing water tank is visible.

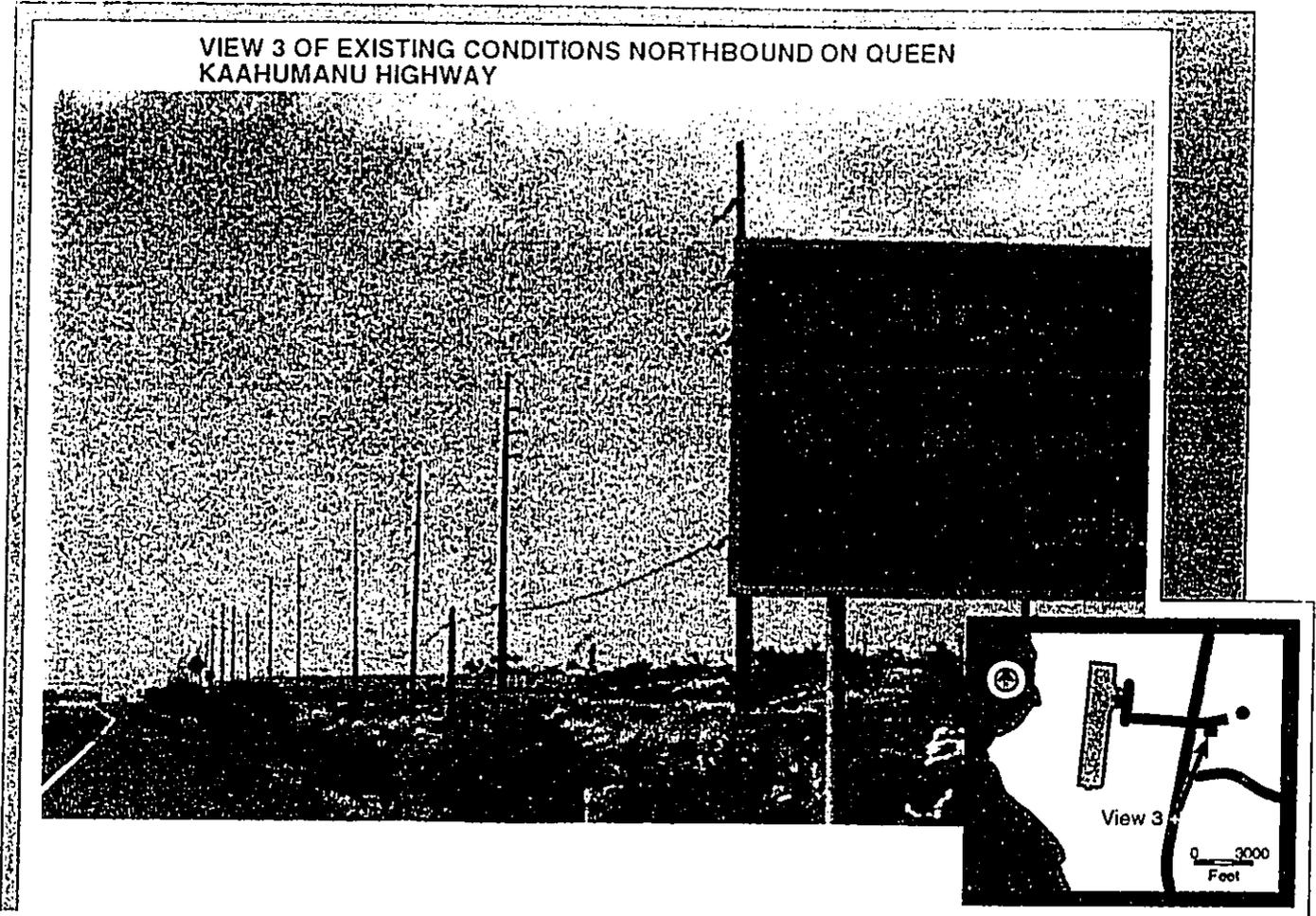
VIEW 1 OF EXISTING CONDITIONS SOUTHBOUND ON QUEEN
KAAHUMANU HIGHWAY



VIEW 2 OF EXISTING CONDITIONS WESTBOUND ON KAIMINANI DRIVE



(Source: Revised Final Environmental Impact Statement, Keahole Generating Station Expansion,
North Kona, Hawaii, Hawaii Electric Light Company, Inc., December 1993)



(Source: Revised Final Environmental Impact Statement, Keahole Generating Station Expansion,
North Kona, Hawaii, Hawaii Electric Light Company, Inc., December 1993)

APPENDIX E
Comments and Response Letters on Draft EA

BENJAMIN J. CAYETANO
GOVERNOR



GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

236 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4186
FACSIMILE (808) 586-4186

March 24, 1998

Mr. Michael Wilson, Chair
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

Subject: Draft Environmental Assessment for the Proposed Keahole Reservoir, Oahu

This is in response to the review of the subject document. We have the following questions and comments.

1. The primary purpose of this project is to provide adequate fire protection for the Keahole International Airport and the Natural Energy Lab of Hawaii. However, the reservoir can also be used as needed to provide water for future development. Please describe the extent of new development that can be supported by the proposed reservoir. Please disclose any proposed future development that is reasonably foreseeable at this time.
2. Please illustrate the visual impacts of the proposed reservoir from public places such as roads and lookouts. Photos of existing conditions taken from public view points are helpful in evaluating visual impacts. Renderings of future structures superimposed on photos of existing views should be provided. We recommend constructing and painting the reservoir with materials and colors that blend with the surroundings. We also recommend landscaping with native Hawaiian plants to reduce the visual impacts.
3. The Kona Palisades subdivision is located approximately 1 mile southeast of the reservoir site. Please consult with the Kona Palisades Community Association regarding this project.
4. Please describe the source of water for the proposed reservoir.

Mr. Wilson
Page 2

5. One small shrub of maiapilo, a species of concern, is found just outside of the project site. Please describe any mitigation measures to ensure that activities relating to the proposed project, such as staging construction equipment, do not adversely impact the plant.
6. Please discuss the findings and reasons for supporting the FONSI determination based on the significant criteria listed in §11-200-12 of the EIS rules. Please see the enclosed example.

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

Sincerely,



Gary Gill
Director

c: ~~Kukulu~~ Corporation

Attachment

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



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

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES
ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
ENGINEERING BRANCH
PLANNING BRANCH
TECHNICAL & SUPPORT BRANCH
STATE PARKS
WATER RESOURCE MANAGEMENT

Mr. Gary Gill, Director
Office of Environmental Quality Control
Department of Health
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Mr. Gill:

**Draft Environmental Assessment for the Proposed
Keahole Reservoir, Kona, Hawaii**

Thank you for your review and comments, on the subject document dated March 24, 1998. We have reviewed your comments and have prepared the following response.

Comment 1. The primary purpose of this project is to provide adequate fire protection for the Keahole International Airport and the Natural Energy Lab of Hawaii. However, the reservoir can also be used as needed to provide water for future development. Please describe the extent of new development that can be supported by the proposed reservoir. Please discuss any proposed future development that is reasonable foreseeable at this time.

Response: *The two reservoirs together will accommodate future water needs to the year 2015 for the Keahole International Airport and the Natural Energy Lab of Hawaii. Future development beyond 2015 will require construction of additional reservoirs, water sources, and transmission lines.*

Comment 2. Please illustrate the visual impacts of the proposed reservoir from public places, such as roads and lookouts. Photos of existing conditions taken from public viewpoints are helpful in evaluating visual impacts. Rendering of future structures superimposed on photos of existing views should be provided. We recommend constructing and painting the reservoir with materials and colors that blend with the surroundings. We also recommend landscaping with native Hawaiian Plants to reduce the visual impacts.

Response: The proposed 1 mg and existing 0.5 mg reservoirs will be painted to blend in with the surrounding area. The Department of Water Supply has indicated they prefer not to landscape the reservoir site because it is in a remote area and water availability to irrigate landscaping is low in this area. The visual impact of the proposed reservoir from relevant public places will be illustrated and included in Appendix D, Photos of the Project Site, as part of the Final Environmental Assessment (FEA) document. However, it should be noted that the project will not impact scenic views of the ocean or any ridge lines in the area. The visual character of the area will not change with the addition of a water reservoir, which will be of the same height as the existing water reservoir and will be mostly hidden and blocked by the existing reservoir from most viewpoints from the public highway. Also, the new water reservoir will be less visible than the existing reservoir from mauka viewpoints of the Kona Palisades Community because of the natural terrain and slope. Moreover, the new water reservoir will be much less visible than the existing smoke stacks of the HELCO Keahole Generating Station, which adjoins the project site.

Comment 3. The Kona Palisades subdivision is located approximately one (1) mile southeast of the reservoir site. Please consult with the Kona Palisades Community Association regarding this project.

Response: The Kona Palisades Community Association have been contacted by phone and mail. Comments, if any, made by this association's leaders or any of its members will be included in the FEA.

Comment 4. Please describe the source of water for the proposed reservoir.

Response: The source of water for the proposed reservoir is the Kahaluu Shaft, located near the intersection of Kuakini Highway and Kamehameha III Road.

Comment 5. One small shrub of maiapilo or puapiolo (*Sandwichiana capparidifolia*, Hawaiian Caper), a species of concern, is found just outside of the project site. Please describe any mitigation measures to ensure that activities relating to the proposed project, such as staging construction equipment, do not adversely impact the plant.

Response: According to Winona Char of Char and Associates, who conducted the flora study and made note of the shrub, no mitigation measure is necessary because contact with the shrub is easily avoidable. The shrub is not on the project site and is located some 15 feet, or more, away from the site boundary. The construction of

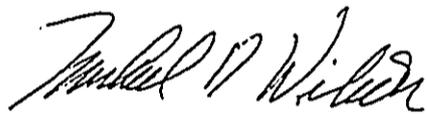
Mr. Gary Gill, Director
Page 3

the reservoir will take place well within the boundary and will not adversely impact the plant. Moreover, it should be noted that this articular plant (maiapilo) is not protected by Federal or State or any other statutes. There are several of these plants in the general area--but none on the project site. Those who study flora for a living are asked to keep an eye on them and, therefore, some concern was noted in the study.

Comment 6. Please discuss the findings and reasons for supporting the FONSI determination, based on the significant criteria listed in Section 11-200-12 of the EIS rules. Please see the enclosed example.

Response: *Thank you for providing the sample. The findings and reasons for supporting the FONIS determination, based on the significant criteria listed in Section 11-200-12 of the EIS rules will be addressed accordingly in the format provided in Section V.A. of the FEA document.*

Sincerely,



MICHAEL D. WILSON

cc: Kukulū Corporation /
Hawaii Department of Water Supply



STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAII 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865
March 17, 1998

Doc. EIS 157

Mr. Ed Iida
Kukulu Corporation
420 Waiakamilo Rd., Suite 411
Honolulu, HI 96817

Subject: Draft Environmental Assessment (DEA) for the Proposed Keahole Reservoir,
Kona, Island of Hawaii

Dear Mr. Iida:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for the Proposed Keahole Reservoir, Kona, Island of Hawaii. The State of Hawaii proposes to build a 1.0 million gallon reservoir in an area situated at the east end of a small road servicing an existing water reservoir mauka of Queen Kaahumanu Highway immediately across from the Keahoke International Airport Access Road.

The Office of Hawaiian Affairs (OHA) has no objections at this time to the proposed reservoir. Based on information contained in the DEA, the reservoir apparently bears no adverse impacts on Queen Kaahumanu Highway, the Keahole International Airport, adjacent lands, or existing flora or fauna. No known archaeological remains exist. The tank structure will be approximately 22 feet in height and will not adversely impact the local scenery.

However, although barren in appearance, the area of the project was in the past part of the Kekaha region which was once populous and productive. Therefore, OHA urges the applicant to seek consultation with the Kona Hawaiian Civic Club to ensure that the proposed development does not conflict with spiritual and religious practices.

Letter to Mr. Ed Iida
March 17, 1998
Page 2

Please contact Colin Kippen (594-1938), Officer of the Land and Natural Resources Division, or Luis A. Manrique (594-1758), should you have any questions on this matter.

Sincerely yours,



Randall Ogata
Administrator



Colin Kippen
Officer, LNR

cc Board of Trustees
CAC, Island of Kauai
Gene Leslie

Kukulu Corporation

420 WAIAKAMILO ROAD, ROOM 411
HONOLULU, HAWAII 96817

April 6, 1998

Mr. Randall Ogata, Administrator
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813-5249

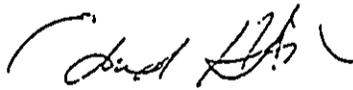
Subject: Draft Environmental Assessment for the Proposed Keahole Reservoir
Kona, Island of Hawaii

Dear Mr. Ogata,

Thank you for your comments on the Draft Environmental Assessment (DEA) for the Proposed Keahole Reservoir, Kona, Island of Hawaii which noted that the Office of Hawaiian Affairs (OHA) at this time, has no objections to the proposed reservoir. In response to your request, consultation was sought with the Kona Hawaiian Civic Club, through their President Gene Leslie. Mr. Leslie requested and was sent a copy of the archaeological study of the proposed site conducted by Dr. Hallett H. Hammatt, along with a copy of your letter. After a review of the study, Mr. Leslie indicated in a phone conversation with Dr. Ross Prizzia, Management Planning & Administration Consultants, Inc., on April 3, 1998, that the Kona Hawaiian Civic Club concurs with OHA's review of the DEA and have no objections to the proposed project.

Very truly yours,

KUKULU CORPORATION



Edward H. Iida

cc: Hiram Young, DLNR
Ross Prizzia, MPAC ✓

MPAC

MANAGEMENT PLANNING & ADMINISTRATION CONSULTANTS, INC.

April 6, 1998

Mr. Roy Mushrush
Kona Palisades Estate Community Association
73-1325 Alakea Street
Kailua-Kona, HI 96740

Dear Mr. Mushrush,

We have been unsuccessful in trying to contact the Kona Palisades Community Association by phone for several days at (808) 325-0717. We were requested by the State Office of Environmental Quality Control (OEQC) to attempt to consult with your organization regarding the Proposed Keahole Reservoir Project. The proposed project will involve the construction of a water tank along side the existing tank in Keahole about one mile makai of the Kona Palisades Community. The project will involve one acre of land just mauka of the existing HELCO Keahole Generating Station. The new tank will be of the same height as the existing tank. Please review the enclosed summary and call or write any comments to those contact numbers and addresses listed in the public notice. We will include your comments, if any, in the Final Environmental Assessment even if they come in after March 25, 1998.

Thank you for your attention to this matter.

Sincerely,



Ross Prizzia

Enclosure

cc: Kona Palisades Estate Community Association
P. Pomdrio, President
R. Damron

Century Center, Suite 3539
1750 Kalakaua Avenue
Honolulu, Hawaii 96826
Telephone (808) 533-7749

Leeward Oahu Office:
99-446 B Fernridge Place
Aiea, Hawaii 96701
Telephone (808) 488-3912

Downtown Honolulu Office:
1387 Queen Emma Street
Honolulu, Hawaii 96813
Telephone (808) 945-1045

Maul Office:
270 Hookahi Street, Suite 206
Wailuku, Hawaii 96793
Telephone (808) 244-7099

