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ENVIRONMENTAL ASSESSMENT IN SUPPORT OF A
CONSERVATION DISTRICT USE PERMIT APPLICATION

OFFSITE INFRASTRUCTURE IMPROVEMENTS KOHANAIKI RESORT

Land Divisions of Kau and Ooma 2, North Kona, Hawaii
TMKs: 7-2-5:1 & 7-3-9:5

June 1990

Helber Hastert & Kimura
Planners

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Prepared For:
Nansay Hawaii, Inc.

Prepared By:
Helber Hastert & Kimura, Planners

For Submittal To:
State Department of Land and Natural Resources

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1.0 INTRODUCTION AND SUMMARY

1.1 Purpose and Content

This Environmental Assessment (EA) has been prepared for Nansay Hawaii, Inc. ("applicant"), in support of a Conservation District Use Application (CDUA) to the State Department of Land and Natural Resources (DLNR) for the development of two utility corridors proposed for construction on lands within the land divisions of Kau and 'O'oma 2, between the Queen Kaahumanu and Mamalahoa Highways in North Kona, Hawaii (the "proposed action"). The proposed utility corridors will accommodate potable and brackish irrigation water wells, water transmission lines, water reservoirs, pressure breaker tanks, overhead power and telemetry lines, an electric/telephone substation and paved service roads. The lower reaches of both the Kau and 'O'oma 2 parcels lie within the State Conservation District, and the entire 'O'oma 2 parcel is State-owned. Accordingly, this EA addresses the probable impacts associated with the development of (1) proposed infrastructure within Conservation-zoned lands at Kau, and (2) proposed infrastructure on State-owned and Conservation-zoned lands at 'O'oma 2. A copy of the CDUA is reproduced as Appendix A.

The proposed off-site infrastructure will serve a planned resort at Kohanaiki located on the coast between Honokohau Small Boat Harbor and the Keahole Airport, about 2 miles south of the airport and 5 miles north of Kailua. The proposed 450-acre Kohanaiki Resort was designated Urban by the State Land Use Commission in January 1987 and subsequently received General Plan and zoning approvals from the Hawaii County Council to allow the development of three hotel sites, a golf course, a large commercial village complex and various multi- and single-family residential sites. A full environmental impact statement of the Kohanaiki Resort was accepted by the Hawaii County Planning Department in September 1986. The entire 450-acre site received zoning approvals for proposed resort uses from the Hawaii County Council in October 1988. The Hawaii County Planning Department is presently reviewing a Special Management Area (SMA) Use Permit petition submitted by the applicant requesting SMA approvals for the development of major on-site infrastructure, two hotel sites, an 18-hole golf course, single- and multi-family residential uses, a public park and related public access improvements, and various resort commercial, recreational and ancillary facilities.

The Kau parcel (999.028 acres, identified as TMK 7-2-05:1) is owned in fee by the applicant. The parcel is rectangular in shape, with the long axis extending from the Mamalahoa Highway to the Queen Kaahumanu Highway, a distance of some 18,000 lineal feet. The lower third of the parcel lies within the State Conservation District. The 'O'oma 2 parcel (903.789 acres, identified as TMK 7-3-09:5) is owned by the State of Hawaii. The parcel is also rectangular in shape with its long axis extending some 11,000 lineal feet mauka of its frontage along Queen Kaahumanu Highway. The lower half of the parcel lies within the State Conservation District.

A number of agencies and organizations were consulted during the preparation of this EA. The applicant has discussed the proposed action with residents living in the vicinity of the Kau wellfield and will continue to keep them informed of the project status. Consulted parties and written comments submitted by the parties are reproduced in Section 6.0.

1.2. Project Summary

Project Title:	Off-Site Infrastructure Improvements for Kohanaiki Resort, North Kona, Hawaii	
Applicant/ Developer:	Nansay Hawaii, Inc. P.O. Box 111222, Suite 727 Kamuela, Hawaii 96743	
Preparer of Environmental Assessment:	Helber, Hastert & Kimura, Planners 733 Bishop Street, Suite 2590 Honolulu, Hawaii 96813	
Proposed Action:	Construction of two utility corridors and an electrical/telephone substation. Portions of these systems are located within the State Conservation District and/or on State-owned lands.	
Request/ Approving Agency:	Application to the State Department of Land and Natural Resources for a Conservation District Use Permit.	
<u>Parcel Data:</u>	<u>Kau Parcel</u>	<u>'O'oma 2 Parcel</u>
Owner:	Nansay Hawaii, Inc.	State of Hawaii
Location:	North Kona, Hawaii	North Kona, Hawaii
Tax Map Key:	7-2-05: 1	7-3-09: 5
Parcel Size:	999.028 Acres	903.789 Acres
Existing Land Use Regulations:		
State Land Use:	Cons./Ag.	Cons./Ag.
General Plan:	Urban Expansion	Urban Expansion
Zoning:	Open/Ag-3	Open/Unplanned
Existing Land Uses:	Vacant	Vacant

1.3 Determination

Based on the information presented within this EA describing the nature and scope of the proposed action, its potential primary, secondary and cumulative impacts, and its potential short- and long-term impacts, and in light of the mitigation measures proposed herein, the applicant has determined that the development of the proposed action would not have a significant adverse impact on the environment and that the preparation of an environmental impact statement (EIS)

is not required. The applicant therefore respectfully requests that the accepting agency concur with this assessment and issue a negative declaration to the Office of Environmental Quality Control (OEQC) stating that an EIS is not required for the proposed action.

2.0 DESCRIPTION OF PROPOSED ACTION

A description of proposed improvements for both the Kau and 'O'oma 2 parcels are presented below.

2.1 Kau Parcel Improvements

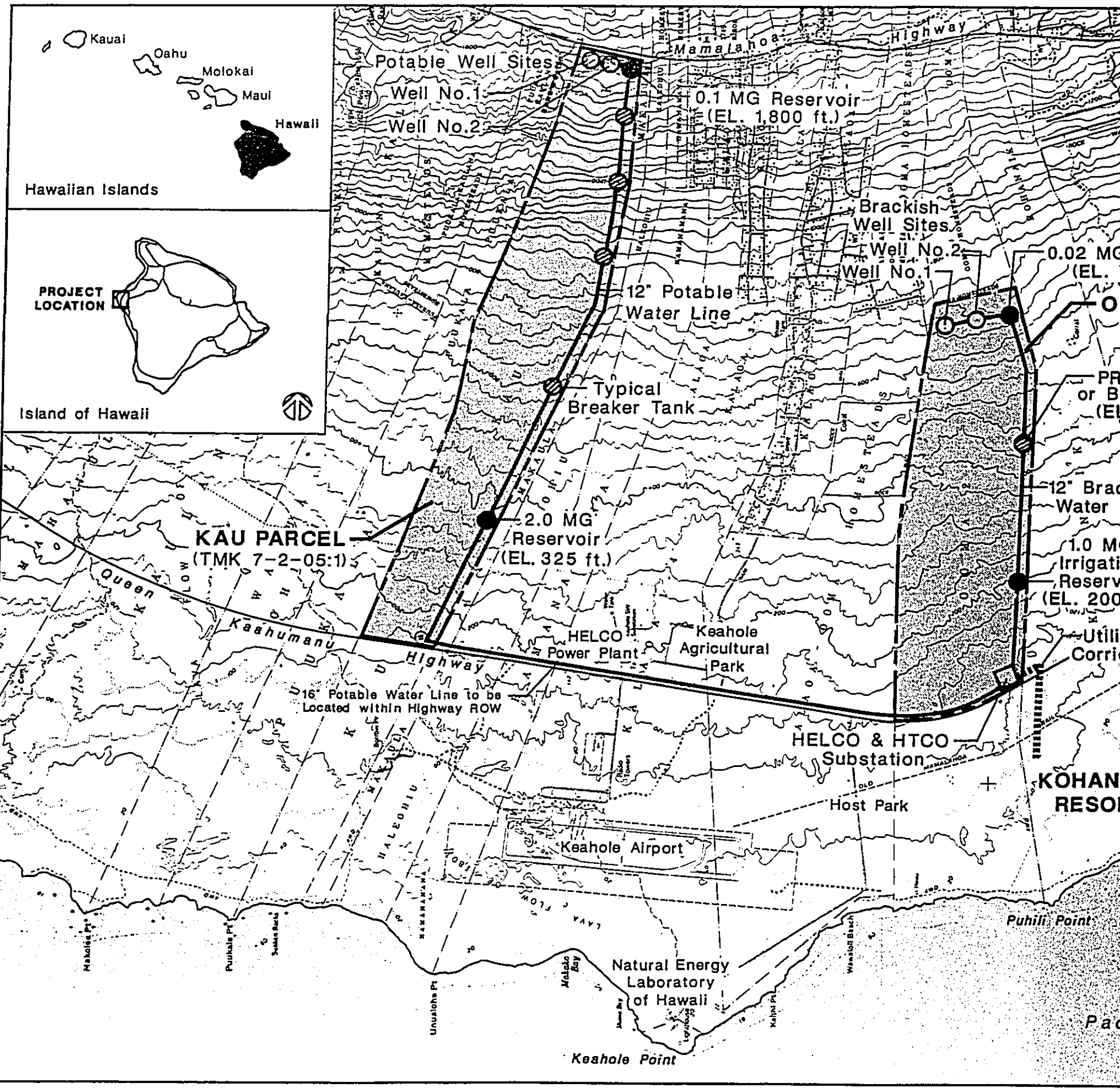
The utility corridor on the Kau parcel is intended to deliver potable water to the Kohanaiki Resort and will traverse the length of the parcel, from wells located at the 1,800-foot elevation adjacent to the Mamalahoa Highway, down to the Queen Kaahumanu Highway frontage (about the 170-foot elevation), a distance of about 18,000 lineal feet. The lower third, or approximately 5,300 lineal feet of the corridor is within the State Conservation District (General Subzone). The proposed utility corridor follows the southern boundary of the parcel.

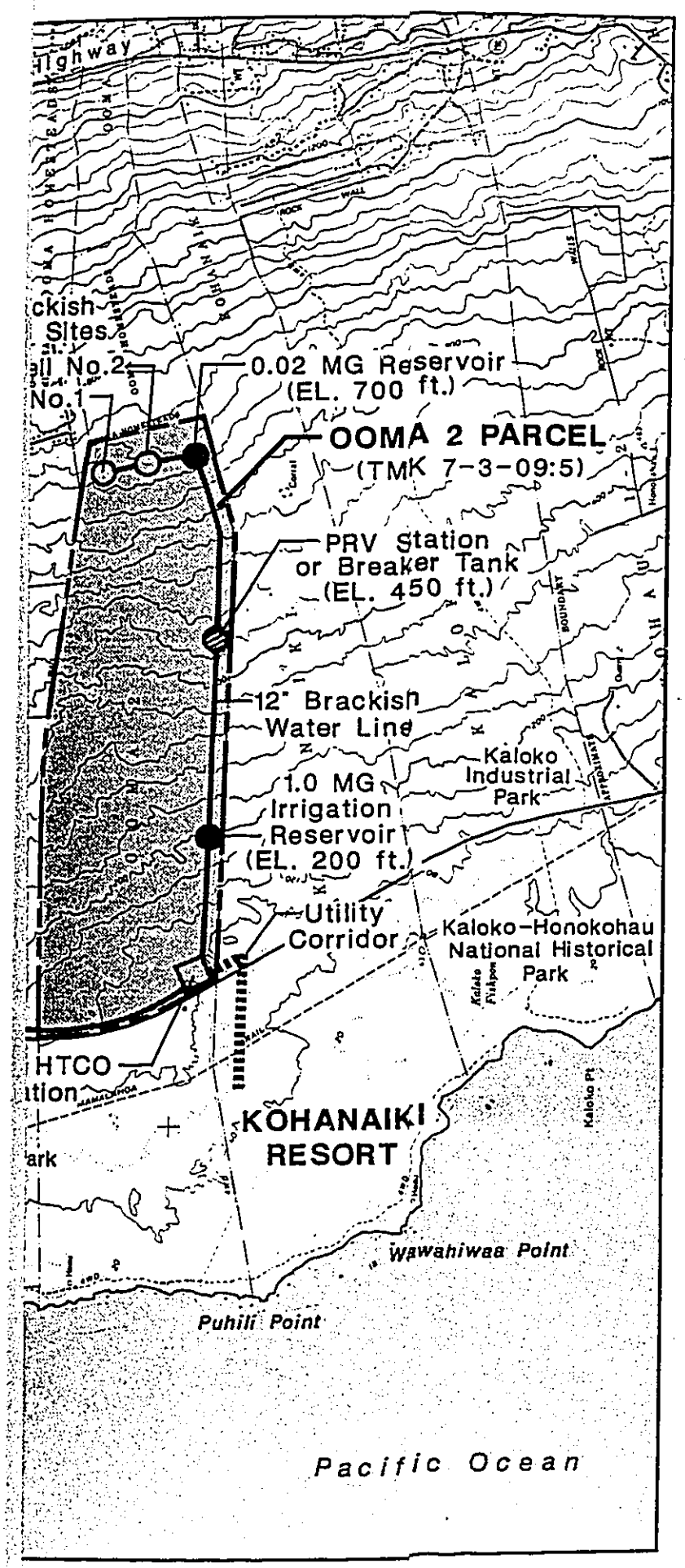
The utility corridor will be approximately 30 feet in width, consisting of a 12-foot paved roadway, 4-foot unpaved shoulders, and an approximate ten-foot allowance for changes in topography. The access road will intersect with both the Mamalahoa Highway and the Queen Kaahumanu Highway at access points approved by the DOT Highways Division. When the Queen Kaahumanu Highway is upgraded to freeway configuration, access to the Kau site will be via a frontage road linked to a proposed grade-separated interchange at the Keahole Airport.

The physical improvements to be located within the utility corridor include a 12-inch below-grade water transmission line, several pressure breaker tanks located along the transmission line, a 2.0 million gallon (MG) concrete reservoir at an overflow elevation of 325± feet, the 12-foot wide paved service road and overhead power and telemetry lines to service the utility corridor. The breaker tanks will be spaced approximately at each 300-foot change in elevation and are designed to reduce the pressure that builds up within the water lines due to the flow of the water and forces of gravity. Preliminary plans call for a breaker tank capacity of approximately 20,000 gallons each (each tank would be about 15 feet high and 15 feet in diameter), and for the 2.0 MG reservoir to be about 20 feet high and 130 feet in diameter. A 100,000 gallon reservoir will be located at the well site for chlorination of the water.

The State Commission on Water Resource Management (CWRM) granted approval to drill and test two 1,800-foot elevation wells on the Kau parcel (located within the State Agricultural District) in September 1989. The wells are planned to provide about 1.6 million gallons per day (MGD) for the Kohanaiki Resort and 0.16 MGD for the County water supply system for a total of 1.76 MGD. Pump installation permits will be sought from the CWRM upon completion of well testing.

The Kau water system will be linked to the Kohanaiki Resort via a 16,000-foot long, 16-inch transmission line proposed to be buried within the Queen Kaahumanu


Kauai
Oahu
Molokai
Maui
Hawaii
Hawaiian Islands
PROJECT LOCATION
Island of Hawaii
Potable Well Sites
Well No.1
Well No.2
0.1 MG Reservoir
(EL. 1,800 ft.)
Mamalahoa Highway
Brackish Well Sites
Well No.2
Well No.1
0.02 MG
(EL.
12" Potable Water Line
Typical Breaker Tank
2.0 MG Reservoir
(EL. 325 ft.)
KAU PARCEL
(TMK 7-2-05:1)
Queen Kaahumanu Highway
HELCO Power Plant
Keahole Agricultural Park
16" Potable Water Line to be Located within Highway ROW
HELCO & HTCO Substation
Host Park
Keahole Airport
Natural Energy Laboratory of Hawaii
Puhili Point
Keahole Point
12" Brac
Water
1.0 M
Irrigati
Reserv
(EL. 200
Utili
Corri
KOHAN
RESO



Nansay Hawaii, Inc.

Figure: 1

PROJECT LOCATION MAP

Offsite Infrastructure Assessment:
Resort at Kohanaiki
North Kona, Hawaii

0 3000
Feet

May 1990

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Highway right-of-way, outside of the edge of the pavement at a location approved by the DOT Highways Division. Approvals for any proposed work within State Highway rights-of-way, including this segment of the waterline, will have to be secured from the DOT Highways Division. The applicant intends to dedicate the entire Kau potable water system to the County of Hawaii.

2.2 'O'oma 2 Parcel Improvements

Two brackish wells are proposed for development on State-owned land at about the 700-foot elevation within the 'O'oma 2 parcel. The well sites are located within the State Agricultural District. The two wells are intended to supply the irrigation requirements for the planned golf course and landscaping at the Kohanaiki Resort. Applications for well drilling permits for the two brackish wells are now being reviewed by the CWRM.

The 'O'oma 2 utility corridor will extend from the 700-foot elevation wells to the Queen Kaahumanu Highway frontage (approximately 80-foot elevation), a distance of approximately 11,000 lineal feet. The lower 4,500 feet of this corridor is within the State Conservation District (General Subzone). Similar in design to the Kau utility corridor, the 'O'oma 2 corridor will be approximately 30 feet in width, consisting of a 12-foot paved roadway, 4-foot unpaved shoulders and an approximate ten-foot allowance for changes in topography. The access road will intersect with the Queen Kaahumanu Highway at an access point approved by the DOT Highways Division. When the Queen Kaahumanu Highway is upgraded to freeway configuration, access to the 'O'oma 2 site will be via a frontage road linked to proposed grade-separated interchanges at Kealakehe to the south and the Keahole Airport to the north.

Brackish water will be delivered from the two wells into a 20,000 gallon reservoir at the well site, then, via a 12-inch, 8,000-foot underground transmission line paralleling the access road to a 1.0 million gallon reservoir located at the 200-foot elevation. There will be a pressure reducing valve station or breaker tank at the approximately 450-foot elevation. The reservoir will be connected to the resort via approximately 3,000 feet of underground transmission line.

The electrical/telephone substation will be located immediately mauka of and adjacent to the Queen Kaahumanu Highway right-of-way, at the south-west corner of the 'O'oma 2 parcel. The substation site will be approximately 300 feet square, occupying a site of about 90,000 square feet. In addition to providing telephone service to the resort, primary power voltage will be transformed from the 69 KV transmission lines running along the Queen Kaahumanu Highway shoulder, to a distribution rating of 12 KV to service the resort. A reinforced concrete pad will support the substation transformer and associated switch gear. In addition, the substation will be fully enclosed with high voltage warning signs and grounding system. Care will be exercised in siting, landscaping and designing the facility to minimize visual impacts to motorists traveling along the Queen Kaahumanu Highway. Access to the substation will be from the Queen Kaahumanu Highway via the main utility access road. The access road to the substation will be constructed in accordance with State Highway standards.

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Socio-Economic Environment

The two utility corridors are proposed for development in a sparsely populated area of the growing North Kona District. The North Kona District experienced a 308 percent population increase between 1970 and 1986, with population in 1986 estimated at 19,700. The County of Hawaii projects that this population trend will continue (OSP, 1989). The only residential uses in the vicinity of any of the development contemplated under the proposed action are at the Mamalahoa Highway frontage of the Kau parcel, near the proposed Kau potable wells.

The visitor industry has surpassed agriculture as the major source of economic activity within North Kona. There are now more than 4,500 hotel and condominium visitor units in the District.

3.2 Geology and Topography

The geology of the area is dominated by the last historic eruption of the Hualalai volcano, which occurred in 1800-1801. The Hualalai volcano makes up about half of the Kona District, with lavas predominantly 1,000-3,000 years old. The appearance of the lava flows on the flank of Hualalai suggests that during the latter part of the life of the volcano, eruptions have been rather infrequent, perhaps at intervals of hundreds of years.

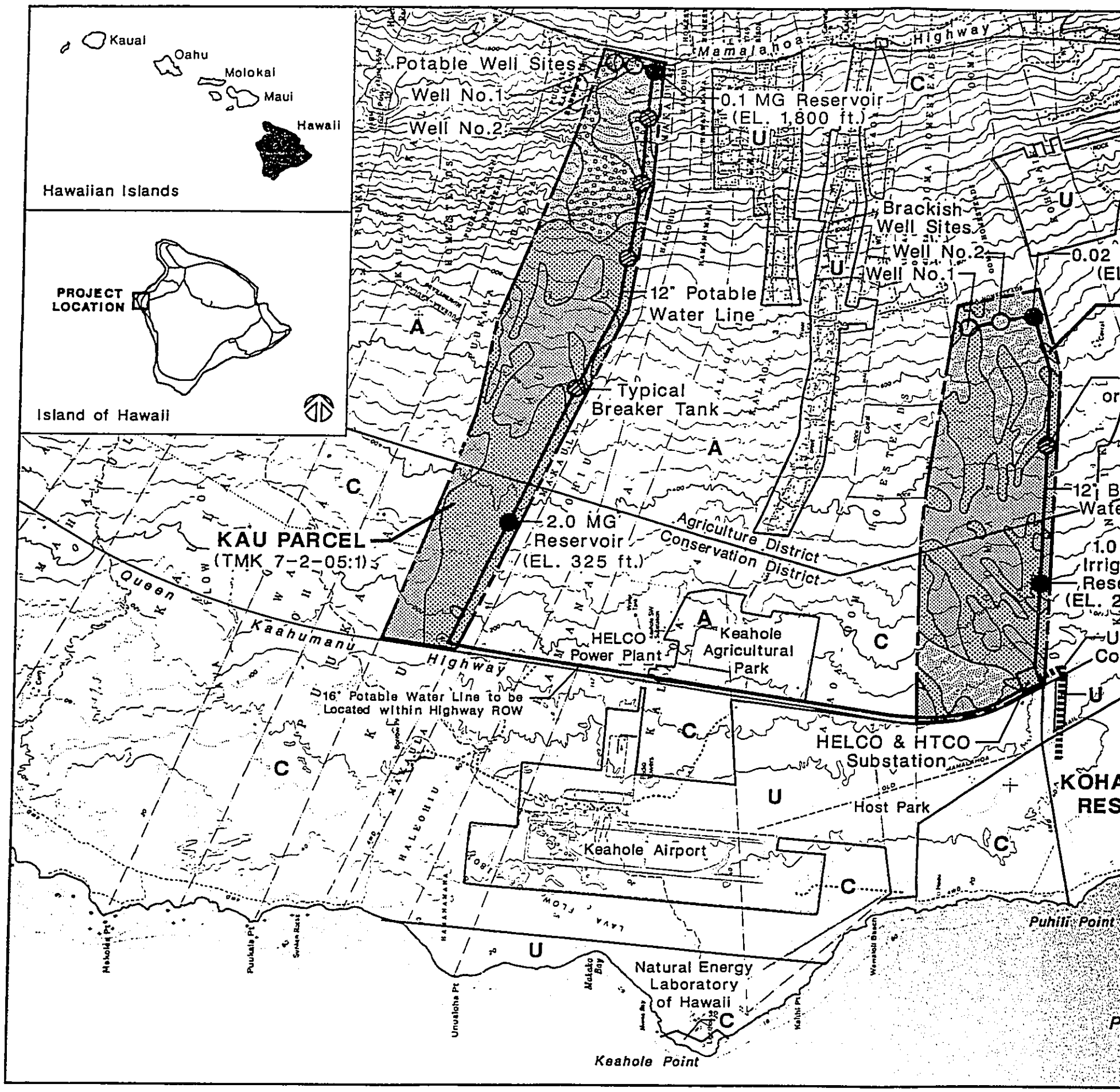
The Kau utility corridor runs from the 1,800-foot elevation potable wellfield adjacent to the Mamalahoa Highway, down to the Queen Kaahumanu frontage of the parcel at the 170-foot elevation. The corridor traverses a total length of approximately 18,000 lineal feet with an average slope of about nine percent.

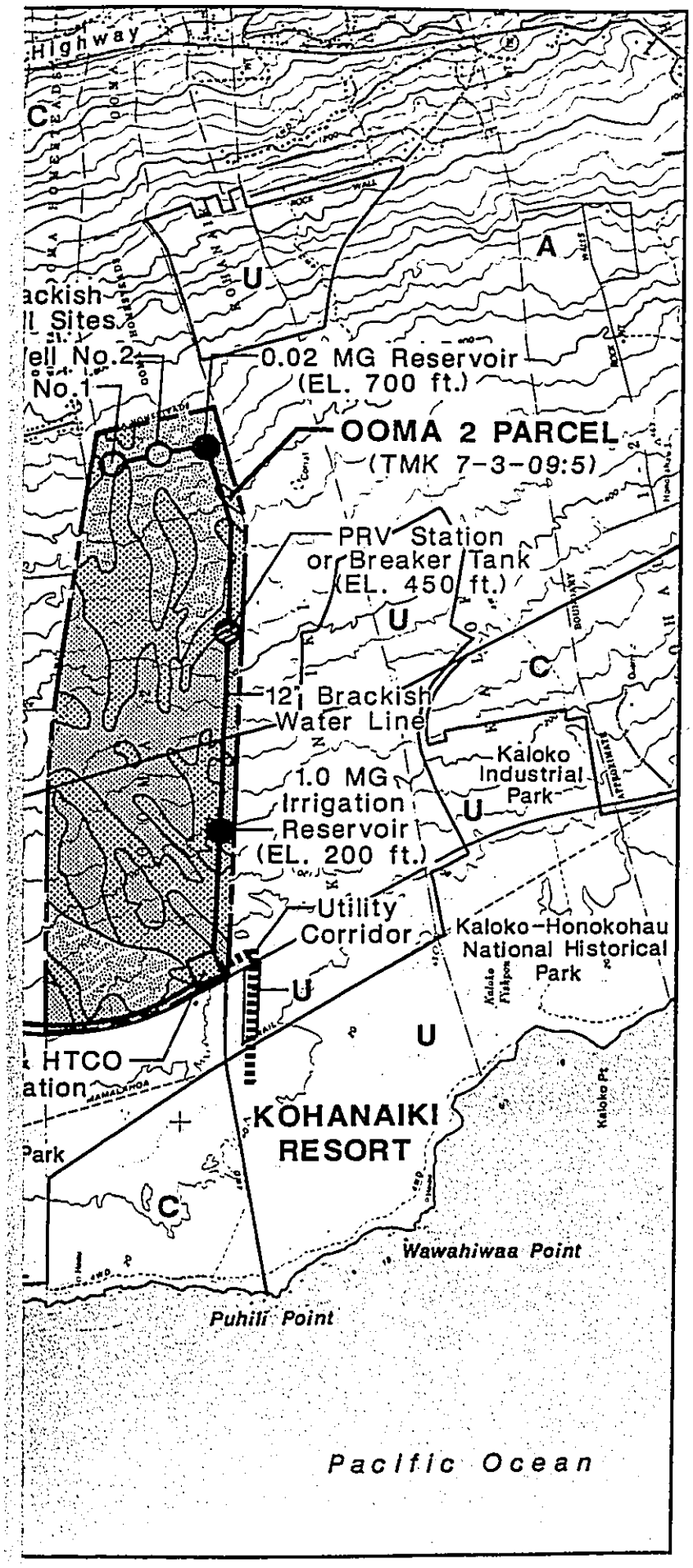
The 'O'oma 2 utility corridor runs from the 700-foot elevation brackish wellfield, down to the Queen Kaahumanu frontage of the parcel at the 80-foot elevation. The corridor traverses a total length of approximately 11,000 lineal feet with an average slope of about between five and six percent.

3.3 Soils and Agricultural Potential

The soils of the Kau and the 'O'oma 2 parcels have been identified by the U.S. Department of Agriculture Soil Conservation Service (Soil Conservation Service, 1973). The parcels share three soils types as described below, with a fourth type, Kaimu Extremely Stony Peat, found only on the Kau parcel. None of the four are agriculturally significant (Figure 2).

Kaimu Extremely Stony Peat (rKED). This soil is one of the soils in the Kaimu Series, which consist of well-drained, thin organic soils over A'a lava. Natural vegetation consists of Christmas berry, guava, guinea grass and lantana. This particular soil is found at low elevations on Mauna Loa. The surface layer is very dark brown, extremely stony peat, about three inches thick. Permeability is rapid, runoff is slow and erosion hazard is slight. This soil is not suitable for cultivation, with a capability subclass of VIIs, denoting severe limitations that make them


Kauai
Oahu
Molokai
Maui
Hawaii
Hawaiian Islands
PROJECT LOCATION
Island of Hawaii
Potable Well Sites
Well No.1
Well No.2
0.1 MG Reservoir
(EL. 1,800 ft.)
Mamalahoa Highway
Brackish Well Sites
Well No.2
Well No.1
12" Potable Water Line
Typical Breaker Tank
KAU PARCEL
(TMK 7-2-05:1)
2.0 MG Reservoir
(EL. 325 ft.)
Agriculture District
Conservation District
Queen Kaahumanu Highway
HELCO Power Plant
Keahole Agricultural Park
16" Potable Water Line to be Located within Highway ROW
HELCO & HTCO Substation
Host Park
Keahole Airport
Natural Energy Laboratory of Hawaii
Keahole Point
Puhili Point
A
C
U



Nansay Hawaii, Inc.

Figure: 2

SOILS AND STATE LAND USE

LEGEND

Soils

- Pahoehoe
- A'a
- Punaluu Extremely Rocky Peat
- Kaimu Extremely Stony Peat

(U.S. Soil Conservation Service, 1973)

State Land Use

- A — Agriculture
- C — Conservation
- U — Urban

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unsuited to cultivation and that restrict its use largely to pasture or range, woodland and wildlife.

Punaluu Extremely Rocky Peat (rPYD). This soil is part of the Punaluu Series, which consist of well-drained, thin organic soils over pahoehoe bedrock. Characteristically, they are gently to moderately sloped, found from sea level to about 1,000 feet in elevation. Natural vegetation consists of koa haole, Christmas berry, guinea grass, natal, redtop and sand bur. This particular soil is found low on the leeward slopes of Mauna Loa, with rock outcrops occupying 40 to 50 percent of the surface. The surface layer is black peat, about 4 inches thick, underlain by pahoehoe bedrock. Permeability is rapid, runoff is slow and erosion hazard is slight. This soil also a capability subclass of VIIs.

A'a Lava Flows (rLV). This lava has practically no soil covering and is bare of vegetation, except for mosses, lichens, ferns and a few small ohia trees. The lava itself is rough and broken, with sharp pieces piled in tumbled heaps that are difficult to traverse on foot. In areas of high rainfall, this lava contributes substantially to underground water supply, and is used for watershed. The capability subclass is VIIIs, which denotes limitations that preclude use for commercial plants and restrict use to recreation, wildlife, water supply or aesthetic purposes.

Pahoehoe Lava Flows (rLW). This lava has billowy, glassy surfaces that are relatively smooth, with no soil covering and typically bare of vegetation except for mosses and lichens. In areas of higher rainfall, scattered ohia, ohelo berry and aalii have gained a foothold in cracks and crevices. Similar to A'a lava, in areas of higher rainfall, Pahoehoe lava contributes substantially to the ground water supply. Also similar to A'a lava, Pahoehoe has a capability subclass of VIIIs.

Agriculturally, the Land Study Bureau's Detailed Land Classification (LSB, 1972), classifies both parcels as predominantly E289, E320 and E319. These classifications indicate the soil's lack of suitability for agricultural purposes. There is a small area of the Kau parcel, just makai of the Mamalahoa Highway, which has a scattering of C55 and D267 classifications, which generally follow an "Other Lands of Importance" classification established by the Agricultural Lands of Importance to the State of Hawaii System (ALISH). These lands fall within the State Agricultural District.

3.4 Climate and Meteorology

Both the Kau and the 'O'oma 2 parcels lie within an area between Honokohau and Anaehoomalu called "Kekaha", meaning dry, sunbaked land. Rainfall at the coast averages only 7 to 8 inches per year, while rainfall near Mamalahoa Highway is closer to 40 inches per year, with the average rainfall gradually increasing with elevation gain.

The average annual temperature of North Kona is 75 degrees Fahrenheit (F) with an average high of 83 degrees F and an average low of 67 degrees F. These temperatures will be about 4-5 degrees lower at the upper elevations of the Kau parcel, as that portion of the property is at 1,800 feet (with temperature generally falling about 3 degrees F for each 1,000 feet of vertical elevation gain).

The area is sheltered from the predominant trade wind system by the land masses of Mauna Loa, Mauna Kea and Hualalai. The prevailing pattern is diurnal, with on-shore winds in the morning and early afternoon, before returning to offshore breezes in the late afternoon and evening.

3.5 Air and Noise Quality

The existing air quality in the region is good most of the time. Exceptions occur during periods of heavy volcanic activity and weather patterns which inhibit the movement of particulates offshore. In addition to increasing particulate levels, substantial increases in ambient concentrations of mercury and sulphur dioxide have been recorded during eruptions.

The existing noise quality of the two parcels is good with some adverse influence from motor vehicular traffic movement along Queen Kaahumanu Highway and along Mamalahoa Highway on the upper reaches of the Kau parcel. To a lesser degree, natural factors, such as wind moving across natural features such as vegetation and rock formations also contribute to the existing noise quality. It is presumed that these "ambient" noise levels are in the 30 to 50 dBa range (dBa is the unit of measurement for the total sound level of all noises using a sound meter which uses the "A" weighting network), depending on the time of day and levels of traffic along the two highways.

3.6 Natural Hazards

Potential natural hazards to which the Kau and 'O'oma 2 parcels could be subjected include earthquakes and volcanic eruptions. Because of the well-drained nature of the land and soil types, floods due to rainwater surface runoff are unlikely to occur.

Volcanic hazards associated with Hualalai have been studied in detail (Mullineaux, et al, 1987, Moore, et al, 1987). There have been four major eruptions of Hualalai during the last 1,000 years, the last of which occurred in 1800-1801. The last magma-related seismic activity occurred in 1929, when an intense swarm of earthquakes, lasting several months, affected Hualalai. It seems likely that magma intruded close to the surface at that time. An eruption of Hualalai is highly probable within the next 200 years, although Mullineaux reported in 1974 that Hualalai is regarded as having a lower overall risk of eruption than either Kilauea or Mauna Loa.

3.7 Visual Attributes

Both the Kau and 'O'oma 2 parcels are vacant, characterized by sparsely vegetated, recent lava flows, with the exception of the upper portions of the Kau parcel, which are more lushly vegetated as the result of the existence of more substantial soils and frequent rainfall. The most prominent man-made features associated with the two parcels are the presence of overhead transmission lines. Power lines are present immediately adjacent to the 'O'oma 2 parcel frontage along the Queen Kaahumanu Highway. The power line corridor then sets back from the Queen Kaahumanu Highway right-of-way in the vicinity of the Keahole Airport into a

corridor which crosses the Kau parcel some 2,500 feet mauka of the Queen Kaahumanu Highway right-of-way (at about the 250-foot elevation contour).

Principal public views of the proposed development sites were identified along Queen Kaahumanu and Mamalahoa Highways. Driving along the Queen Kaahumanu Highway between the Kau parcel and Honokohau Harbor, one is struck by the overall starkness of the landscape, which is dominated by the darkish colors of recent lava flows. In many cases, visibility mauka and makai is restricted by the presence of lava berms or vegetation alongside the highway which prevent visual contact with the ocean and lower mountain slopes. In addition, the overhead lines on the mauka side of the highway intrude into the viewer's line of sight--especially in the vicinity of the 'O'oma 2 parcel (Figure 3).

Other reminders of the built environment along Queen Kaahumanu Highway include the Keahole Airport, the HELCO power plant almost directly mauka of the airport, the Natural Energy Laboratory of Hawaii, the Keahole Agricultural Park, the Kaloko Industrial Park, the quarrying operations mauka of the Honokohau Small Boat Harbor and the Harbor itself. In addition, subdivisions immediately downslope of the Mamalahoa Highway are visible on the hillside. Local variations in terrain at lower elevations create some rolling hills, often obscuring many of the views of the lower slopes immediately mauka of Queen Kaahumanu Highway, especially long-range views.

The views along Mamalahoa Highway are dominated by the presence of dense vegetation, including many trees over 10 feet in height. For the most part, views downslope are completely obscured, except for fleeting glimpses during breaks in the vegetation at entrances to subdivisions or individual house sites.

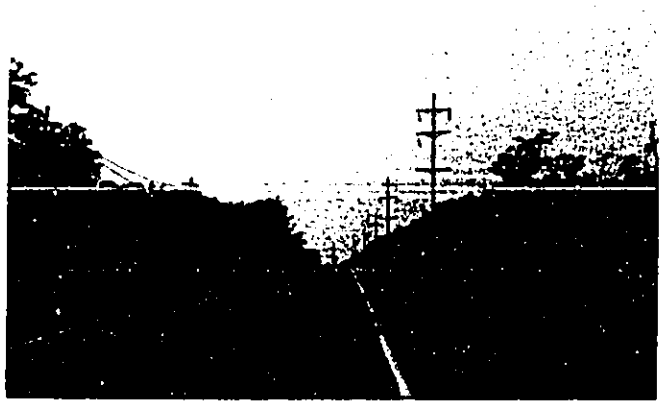
3.8 Groundwater

The proposed Kau and 'O'oma wells are situated above the State Department of Health's Underground Injection Control (UIC) line. Land areas above the UIC line are generally considered to contain underground drinking water, and therefore these areas should be protected against all sources of groundwater contamination. Accordingly, the Kau and 'O'oma 2 wells will be designed to prevent the possibility of groundwater contamination.

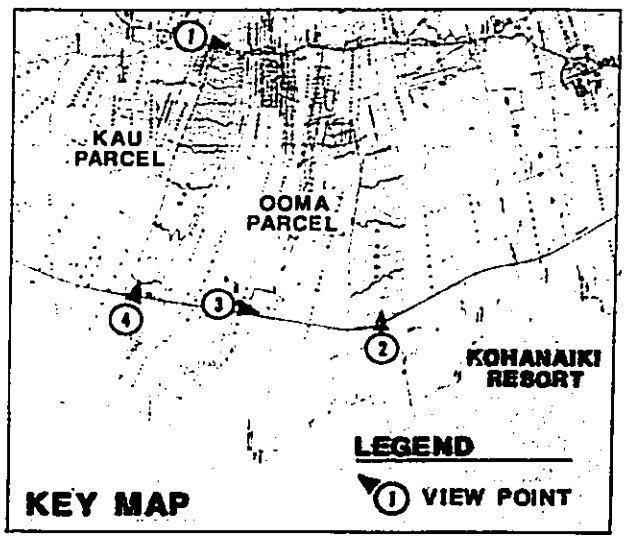
3.9 Flora and Fauna

Three separate field surveys have been conducted of the Kau and 'O'oma 2 waterline/roadway corridors, and the 'O'oma 2 wellfield to identify and describe the flora and fauna of the project area, and to determine probable impacts from implementation of the proposed action. Botanical surveys have been conducted by Char & Associates. Avifauna/feral mammal surveys have been conducted by Philip Bruner and Andrew Berger. Summaries of the descriptions and findings of the various reports are provided below. The full text of the reports are provided in Appendices B (Kau Parcel) and C ('O'oma 2 parcel).

VIEWPOINT 1



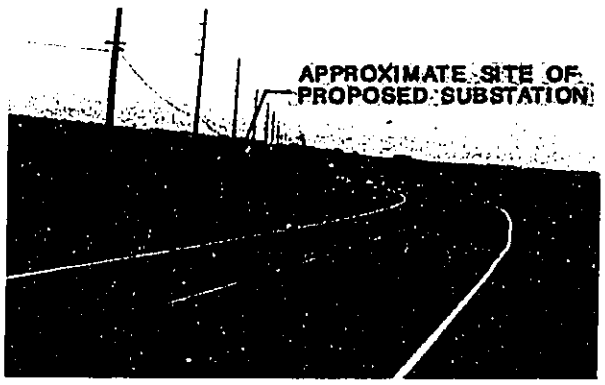
TYPICAL VIEW SOUTH ALONG MAMALAHOA HIGHWAY, WITH POWER LINES AND VEGETATION DOMINATING THE LINE-OF-SIGHT (KAU FRONTAGE ON RIGHT)



VIEWPOINT 2

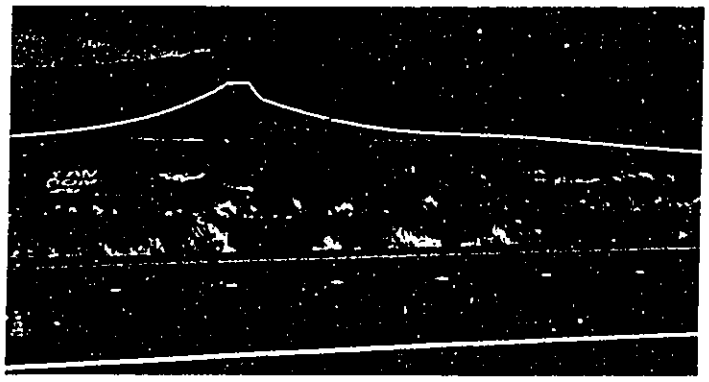
VIEW MAUKA ALONG OOMA 2/ KOHANAIKI BORDER, SHOWING EXISTING POWER LINES AND APPROXIMATE LOCATION OF PROPOSED OOMA 2 HELCO/ HTCO SUBSTATION

VIEWPOINT 3



TYPICAL VIEW SOUTH ALONG QUEEN KAAHUMANU HIGHWAY, WITH POWER LINES MAUKA OF HIGHWAY, SHOWING APPROXIMATE SITE OF OOMA 2 HELCO/HTCO SUBSTATION

VIEWPOINT 4



VIEW MAUKA ACROSS QUEEN KAAHUMANU HIGHWAY, LOOKING AT APPROXIMATE LOCATION OF KAU PARCEL AND EXISTING POWERLINE CORRIDOR

Nansay Hawaii, Inc.

VISUAL ANALYSIS

Kohanaiki, North Kona, Hawaii

Figure: **3**

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3.9.1 Kau Parcel

Flora. A botanical survey of the proposed Kau utility corridor was conducted by Char & Associates in February 1990. Their full report is attached as Appendix B1. A total of 100 plant species were found during the survey. Of these, 60 are introduced or alien; 5 are originally of Polynesian introduction and 35 are native. Of the native species, 18 are indigenous (native to the Hawaiian Islands and elsewhere) and 17 are endemic (native only to the islands). The native species inventoried occur throughout dry forests on the leeward sides of most of the main Hawaiian Islands. None are officially listed as threatened or endangered species by the Federal and/or State governments. A candidate endangered species, the 'aiea (Nothocestrum breviflolium), occurs in the general area. One plant was found just outside the study area on its southern boundary.

The proposed corridor passes through four different vegetation types or plant communities as it ascends upslope. Vegetation cover is sparse on the a'a lava flow nearest Queen Kaahumanu Highway, but fountain grass and various shrubs soon increase in numbers as one moves upslope. Plant cover becomes dense at about the 600-foot elevation forming an open to closed shrubland. From about the 800-foot elevation level on, a dense forest composed principally of Christmas berry and silk oak characterizes the vegetation cover. A complete description of species types and population counts are listed in the full report.

Fauna. An avifauna and feral mammal survey of the proposed Kau utility corridor was conducted by Philip L. Bruner in February 1990. Mr. Bruner's full report is attached as Appendix B2. Generally, the site provides a range of habitats which are utilized by the typical array of exotic species of birds one would expect in these types of environments in Hawaii. Nineteen (19) species of birds were observed during the survey, two of which were native species. These were the Common Amakihi (Hemignathus virens), a resident endemic (native) forest bird which was observed foraging in Silk Oak and Ohia trees and the Pacific Golden Plover (Pluvialis fulva), a migratory indigenous (native) shorebird which winters in Hawaii and was observed either flying over the property or loafing on lava flows. No other native species were observed.

A total of 17 species of exotic birds were recorded during the survey, with the most abundant species being the House Finch (Carpodacus mexicanus), the Yellow-fronted Canary (Serinus mozambicus), the Japanese White-eye (Zosterops japonicus) and the Zebra Dove (Geopelia striata).

Small Indian Mongoose were observed, in addition to the skeletal remains of Feral Goats (Capra hircus). No rats, mice or cats were recorded, but the author (Bruner) believes it would be highly unusual if these ubiquitous animals did not occur on the property. No other mammals were observed.

3.9.2 'O'oma 2 Parcel

Flora. Two separate botanical assessments have been conducted by Char & Associates for the 'O'oma 2 parcel: a November 1988 assessment of the proposed waterline corridor along the entire length of the southern boundary (Queen Kaahumanu Highway frontage to the top of the property); and a May 1990

assessment of the proposed wellfield area at the 700 foot elevation. Both reports are attached as Appendices C1 and C4 respectively, and summarized below. No officially listed or proposed threatened and endangered plant species were found within either of the study areas.

Within the waterline corridor study area, the most abundant components of the vegetation are introduced species, i.e., fountain grass (Pennisetum staceum) and Christmas berry (Schinus terebinthifolius). A'a lava flows, largely devoid of vegetation, cover the lower elevations of the study area. Of a total of 41 species inventoried, 29 (71%) are introduced; 9 (22%) are indigenous, i.e., native to the Hawaiian Islands and elsewhere; 2 (5%) are endemic, i.e., native only to the islands; and 1 (2%) is originally of Polynesian introduction.

The well field study area is characterized as an open shrubland, vegetated primarily with Christmas berry and dense fountain grass. Native species are occasional to locally common in some places. A few scattered plants of ko'oko'olau (Bidens micrantha ssp. ctneophylla) were found on the southern half of the study area. Bidens has recently been downgraded to a Category 2, candidate endangered species. Plants in this category show some evidence of vulnerability, but there are not enough data to support listing proposals at this time. It is recommended that, if possible, the well site be placed to avoid these plants. It should be noted that Bidens can also be found outside of the corridor. Thus even if a few plants within the study area were to be lost during construction, the population would still remain viable on certain other portions of the parcel. Other much larger populations of Bidens can be found on the leeward slopes of Hualalai.

Fauna. A terrestrial vertebrate animal survey of the 'O'oma 2 waterline corridor was conducted by Dr. Andrew J. Berger in November 1988. A similar survey was conducted for the 700-foot elevation wellfield area by Phillip L. Bruner in May 1990. Reports of both surveys are attached as Appendices C2 and C5, respectively, and summarized below.

Mr. Berger found the wellfield corridor site to be sparsely populated by animal life. Only two species of birds were observed on the project site, the Japanese White-eye (Zosterops japonicus) and the yellow-billed Cardinal (Paroaria capitata), both introduced species. No indigenous bird species inhabit the waterline study area. Berger believes it is possible that two species of endemic birds may sometimes fly over the area (the Hawaiian Hawk and the Hawaiian Owl). No mammals were sighted, although goat droppings and cat scat were found in the study area.

The wellfield area surveyed by Mr. Bruner was found to provide a limited range of living spaces which are utilized by the typical array of exotic birds one would expect to find at the 700-foot elevation in this type of environment. No endemic birds were found and it is unlikely that any would occur within the study area given its location and type of habitat. Development of the wellfield will alter the existing habitat. Species which require dense brush for cover, i.e., Northern Cardinal (Cardinalis cardinalis) and Yellow-billed cardinal (Paroaria capitata), will decline while more urban species such as House Sparrow (Passer doesticus) and Common Myna (Acridotheres tristis), should increase in abundance. No endangered terrestrial mammals were observed.

3.10 Historical and Archaeological Resources

Three separate archaeological inventory surveys have been conducted of the Kau and 'O'oma 2 waterline/roadway corridors and the 'O'oma 2 wellfield to identify and describe all sites of potential significance present within the various project areas. The basic objectives of the inventory surveys are four-fold: (a) to identify (find and locate) all sites and site complexes present within a specified project area; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impact of proposed development upon the identified remains; and (d) to define the general scope of any subsequent intensive data collection and/or other mitigation work that might be necessary or appropriate. The inventory surveys have been carried out in accordance with the standards for inventory-level survey recommended by the Hawaii State Department of Land and Natural Resources--Historic Sites Section/State Historic Preservation Office (DLNR-HSS/SHPO). The full text of the reports are provided in Appendices B (Kau Parcel) and C ('O'oma 2 parcel).

3.10.1 Kau Parcel

Phase I (site identification) of an archaeological inventory survey of the proposed Kau utility corridor was conducted by Paul H. Rosendahl, Inc. (PHRI) in February 1990. The full report prepared by PHRI is attached as Appendix B3. The overall objective of the investigation was to identify (presence/absence determination) any sites of such obvious high significance as to seriously constrain or prevent future development. During the course of the survey, an old bulldozer-cut road, overgrown with vegetation, was identified within the study area, extending between c. 700 - 1,000 foot elevations.

During the survey, 25 sites containing 96+ component features were identified within or immediately adjacent to the corridor. The principal types of sites and features identified were mounds of varying sizes related to agricultural activities. Several mounds may also have functioned as burial features. Twenty-three of the 25 identified sites (94+ of the 96+ features) are located within the inland portion of the corridor, above the 700-foot elevation. Although inventory-level recording was not carried out as part of the investigation, the study concludes that if such work were performed, most of the sites and features would be evaluated as significant only in terms of information content (research value), and that after appropriate data collection, their physical preservation would not be required. Several sites and features (possible burials, a trail and selected agricultural habitation features) would also be evaluated as culturally significant and significant as an excellent example of a site type (interpretive value).

3.10.2 'O'oma 2 Parcel

Two separate archaeological inventory surveys have been conducted by Paul H. Rosendahl, Inc. (PHRI) for the 'O'oma 2 parcel: a January 1989 inventory of the proposed waterline corridor and a May 1990 inventory of the proposed wellfield study area. The full PHRI reports are attached as Appendix C3 and C6, respectively.

Waterline Corridor. The January 1989 inventory survey of the waterline corridor identified four sites within the study area. The sites consist of both single and multiple features. Feature types in the study area include pits, wall, cave, rockshelter, terraces and papamu. Functional types include ceremonial, quarrying, marker and boundary or agriculture. Three of the four sites appear to be prehistoric. These sites are determined to be significant solely for information content and no further work is recommended for these sites. The fourth site, identified as site 5697, is a complex which includes a cave, a rock shelter, two terraces, an enclosing alignment/wall and a papamu (see Figure 4 of PHRI's report in Appendix C3). This site may have been used for ceremonial purposes and is assessed as significant for information content, cultural value and interpretive value. On the basis of the field work and discussions with Dr. Ross Cordy, Chief Archaeologist of the Department of Land and Natural Resources, the site is recommended for "preservation as is."

Wellfield. The May 1990 inventory survey of the wellfield study area identified a total of 13 sites containing 27+ component features. The principal types of sites and features identified were mounds of varying sizes possibly related to agricultural activities. Several caves (one containing human burial remains), enclosures, cairns, a trail segment, a boulder alignment, and a terrace were also noted. Eleven of the 13 sites have been assessed as significant solely for scientific information content. Subject to data collection in accordance with DLNR-HSS/SHPO procedures, it would be anticipated that no further work would be necessary for these sites. The remaining two sites have been assessed as culturally significant and significant for information content. Feature B of Site 5 is a short secondary trail segment. Site 7 is a burial cave.

Prior to any development work, it is recommended that all identified sites first be accurately plotted by professional surveyors, with the aid of an archaeologist, on an appropriate scale topographic map of the area. This will allow the designers to plot the route of the various utility systems and wellfields to avoid the identified sites. If it is determined that it is not feasible to avoid the identified sites, then it is recommended that a data collection phase be implemented.

3.11 Public Utilities and Infrastructure

Highways. The Queen Kaahumanu Highway provides the principal access to the region. Presently the Highway is a two-lane roadway lying within a 300-foot right-of-way. The present pavement runs along the makai side of the 300-foot right-of-way. The State Department of Transportation Highways Division has recently announced plans to upgrade highway to freeway configuration, including a phased increase in the number of travel lanes from the present two lanes to four and eventually six lanes, with two-lane frontage roads running along both sides of the freeway. Access to the freeway will be limited to three grade-separated interchanges at the Keahole Airport, Kealakehe, and Palani Road intersection.

Power. The Hawaii Electric and Light Company, Inc. (HELCO) provides electrical power to the Kona area via three 69KV transmission lines. One 69KV line runs along the Mamalahoa Highway above the Kau parcel. Another follows the Queen Kaahumanu Highway right-of-way, crossing the Kau parcel approximately 1,000 feet from its highway frontage and crossing the 'O'oma 2 parcel at its highway

frontage. The third 69KV line enters Kona from the south via the Mamalahoa Highway. Preliminary analysis conducted by HELCO (see HELCO letter reproduced in Section 6.0) indicates that two or more additional 69KV lines will be needed when the area between Kailua and Keahole is fully developed. One or more 69KV transmission line corridors will be required between Keahole and Kailua to accommodate these new lines.

Water Supply. The Hawaii County Department of Water Supply maintains the North Kona Water System servicing the area between Keahole Airport and Kealakekua. The system is presently supplied by four wells and a shaft located at Kahaluu, situated between Kailua and Keauhou Bay at the 600-foot level, one to one and one-half miles inland from the ocean. The general project area is serviced by an upper transmission system along the Mamalahoa Highway and a lower transmission system along the Queen Kaahumanu Highway. The upper system consists of an 8-inch transmission line which extends from the vicinity of Kaimi Nani Drive and terminates approximately one mile south of the proposed Kau system. The lower system consists of a 12-inch transmission line which extends from the Honokohau Small Boat Harbor, terminating at the Keahole Airport, about one mile south of the proposed Kau system.

3.12 Public Policies

3.12.1 Hawaii State Plan

The Hawaii State Plan (Chapter 226, HRS, as amended) represents public consensus regarding future expectations of Hawaii's future. The plan establishes a set of goals, objectives and policies which serve as a long-range guidelines for growth and development of the State. The plan was substantially revised in 1986 to reflect changes in public priorities. A review of the overall themes, goals objectives, policies and priority guidelines of the revised plan was made to determine the consistency of the proposed action with the plan. The review indicates that the proposed action is in conformance with the Hawaii State Plan.

3.12.2 State Functional Plans

The Hawaii State Plan directs the appropriate State agencies to prepare functional plans for their respective program areas. The plans set forth "...the policies, statewide guidelines, and priorities within a specified field of activity, when such activity is proposed, administered, or funded by any agency of the State" (Section 226-2 (10), HRS, as amended. Each functional plan contains objectives to be achieved and policies to be pursued within the specified areas. The Hawaii State Plan directs that "...County general plans and development plans shall be taken into consideration in formulation and amendment of the state functional plans" (Section 226-52(a)(por. 3), HRS, as amended).

To date, twelve Functional Plans have been adopted by Legislative Resolution. All twelve plans were reviewed to determine consistency with the proposed action. Relevant plans examined included the State Conservation Land Functional Plan and the State Historical Preservation Functional Plan prepared by the State Department of Land and Natural Resources, the State Health Functional Plan prepared by the Department of Health and the State Tourism Plan prepared by the

Department of Business and Economic Development. The review indicated that the proposed action is in general conformance with objectives, policies and implementing actions of the twelve plans.

3.12.3 State Land Use Law

All lands within the State have been classified into one of four land use districts: urban, rural, agriculture and conservation, by the Hawaii State Land Use Commission pursuant to Chapter 205, HRS, the State Land Use Law. The lower third of the Kau parcel and the lower half of the 'O'oma 2 parcel are within the Conservation District, with the remainder of both parcels falling within the Agricultural District. All uses within the Conservation district fall under the jurisdiction of the State Department of Land and Natural Resources and are subject to the Administrative Rules of the DLNR providing for land use within the Conservation District pursuant to Section 183-41, HRS, as amended.

The administrative rules of the Department of Land and Natural Resources, Title 13, Chapter 2, contain the regulations which govern land use within the State Conservation District. The Conservation lands within both the Kau and 'O'oma 2 parcels fall within the General (G) Subzone. The objective of the General Subzone is to "...designate open space where specific conservation uses may not be defined, but where urban uses would be premature" (Section 13-2-14(a), Administrative Rules). Within this subzone, the development of water collection, pumping, storage, control and transmission uses are permitted (Section 13-2-14(c)(2), Administrative Rules).

3.12.4 Coastal Zone Management/Special Management Area Rules

The objectives and policies of the Hawaii Coastal Zone Management (CZM) program are included in the Shoreline Protection Act of 1975 (Chapter 205A-2, Hawaii Revised Statutes, Part 1). All of the island of Hawaii lies within the CZM area except for the forest reserve areas. Relevant CZM objectives and policies pertaining to the proposed action are as follows:

"(b)(5)(A) Provide public or private facilities and improvements important to the State's economy in suitable locations."

Comment: The proposed uses will contribute to the diversification of the regional economic base and will provide a more central location to serve the needs of the growing local population.

"(c)(3)(D) Encourage those developments which are not coastal dependent to locate in inland areas."

Comment: The project does not require locating in the coastal area. The shortest distance from any of the proposed improvements to the coastline is 3,500 feet.

The project site does not lie within the Special Management Area as defined by the County of Hawaii, and therefore does not require a Special Management Area Use Permit.

3.12.5 County General Plan

The Hawaii County General Plan is the policy document for the long range comprehensive development Hawaii County. The plan contains goals, policies and standards concerning 13 elements (i.e., economic, energy, natural beauty, transportation, etc.), as well as a series of land use maps referred to as General Plan Land Use Allocation Guide (LUPAG) maps. The LUPAG maps delineate 13 different land use categories throughout the County.

On November 14, 1989, the Hawaii County Council approved a revised Hawaii County General Plan. The revised LUPAG maps show both the Kau and 'O'oma 2 parcels as lying within the "urban expansion" district (March 27, 1990 letter from Hawaii County Planning Director--reproduced in Section 6.0). The maps also show a narrow "Open" corridor running parallel to the Queen Kaahumanu right-of-way, traversing the roadway frontages of both parcels. No narrative description of this "Open" corridor is presented in the General Plan. A description is provided in the current draft of the County's Keahole to Kailua Development Plan discussed in Section 3.12.8 below.

In May 1987, the General Plan was amended to identify the Kohanaiki Resort site as an "Intermediate Resort." The construction of the proposed action is represents a major step in implementing the General Plan policy of establishing the Kohanaiki Resort.

3.12.6 County Zoning

The Kau parcel is split-zoned Open/Agriculture - 3 Acres, and the 'O'oma 2 parcel is split zoned Open/Unplanned, following the split in State land use boundaries. Under the provisions of Subsection 25-51(a) of the Hawaii County Zoning Ordinance, "communication, transmission, and power lines of public and private utilities and governmental agencies are permitted uses within any district." This language covers all aspects of the proposed action with the exception of the HELCO/HTCO substation, which falls under the provisions of Subsection 25-51(b). This subsection notes that "substations used by public utilities for the purposes of furnishing telephone, gas, electricity or water shall be permitted uses where the director finds that the same are not hazardous, dangerous, or a nuisance to surrounding areas and has granted plan approval therefore." Accordingly, Plan Approval will be required for the substation.

3.12.7 West Hawaii Regional Plan

In November 1989, the Office of State Planning (OSP) published the West Hawaii Regional Plan, a document which is intended to provide policy guidance for the State in order to most effectively meet the region's present and emerging needs. The West Hawaii Regional Plan is intended to complement the County of Hawaii's General Plan and Community Development Plans. One of the primary assumptions of the plan is the establishment of "Resort Destination Nodes" within the region. The primary purpose of establishing these nodes is the opportunity to locate resort development in such a manner to share the availability of public services. The proposed Kohanaiki Resort is located within the Keahole/Keahou Resort Destination Node.

3.12.8 Draft Keahole to Kailua Development Plan

In September 1989, the County of Hawaii circulated a Draft Keahole to Kailua Development Plan, the overall goal for which is to:

> "To develop a mixed residential, commercial, resort, industrial and recreational community, with approximately 8,000 or more residential units, in a functional, attractive, and financially viable manner. The community will include appropriate shoreline uses, public facilities, and infrastructure and will be built out over the next 20 years."

The "Land Use/Roadway Plan" element of the plan was revised in late February, prior to presentation to the Hawaii County Planning Commission. Significant proposals within the plan include the upgrading of the present Queen Kaahumanu Highway to freeway configuration, and a phased increase in the number of travel lanes from the present two lanes to four and eventually six lanes, with two-lane frontage roads running along both sides of the freeway. Access to the freeway will be limited to grade-separated interchanges at the Keahole Airport, Kealakehe, and Palani Road intersection.

The Kohanaiki Resort is located within the Coastal Development Zone identified in the Plan, which is "planned primarily for public recreational facilities, parks and open space, and resort development." Further, the Kohanaiki Resort is considered as part of the overall development scheme for the planning area.

4.0 PROBABLE IMPACTS OF THE PROPOSED ACTION AND PROPOSED MITIGATION MEASURES

4.1 Socio-Economic

The applicant has met with a group of interested residents living in the vicinity of the proposed Kau wells to brief them on the proposed action. The major issue raised at the meeting related to the possibility of obtaining potable water service from the new well field. The applicant will continue to keep them informed of project status.

Development of the two utility corridors as independent actions are not expected to have significant effects on the social characteristics of the North Kona District and the immediate project environs. Indirectly however, development of the utility corridors will fulfill the offsite water system requirements of the proposed Kohanaiki Resort which is expected to have significant social and economic effects on the North Kona region as discussed in the 1986 FEIS. The FEIS provided a full discussion of physical, socioeconomic and environmental impacts of the project, together with mitigating measures to minimize adverse impacts. Based on these disclosures and proposed mitigating measures, the Hawaii County Planning Department accepted the FEIS in September 1986. Based on the accepted FEIS and subsequent permit applications, State and County land use plans and policies have subsequently been amended to support the resort development.

The economic characteristics of the proposed action are expected to be positive in both the short- and the long-term. In the short-term, the development of the utility corridors will provide construction-related employment. In the long-term, employment opportunities associated with the maintenance and operation of the water wells and transmission system will be created. The development of the off-site water system will also indirectly support the creation of significant new employment opportunities at the Kohanaiki Resort. The development of the resort would result in increased real property tax, transient accommodations tax, and general excise revenues.

Another major significant attribute of the proposed system, is that it will provide a needed link in a municipal water system for the North Kona area, as it will join the municipal water system presently in service along the Queen Kaahumanu and Mamalahoa Highways through the Kau site.

As described, the development of the two utility corridors, in and of themselves, are not expected to have significant adverse impacts on the environment. The completion of the utility corridors is expected to have a positive impact on the environment for the following reasons:

- With the delivery of potable and irrigation water, the development of the Kohanaiki Resort may proceed. The development of this project is consistent with approved State and County land-use decisions for the region.

- The development of the Kohanaiki Resort will create long-term employment opportunities as well as increase real property revenues for the County and general excise revenues for the State.

- A lesser number of long-term employment opportunities would be created in the operation and maintenance of the transmission lines, the wells and the substations.

- The County will be able to complete a key link in the North Kona Municipal water system by interconnecting the upper and lower elevation water systems via the proposed Kau water line.

4.2 Erosion/Drainage

As discussed previously, the North Kona area is considered dry and arid with light rainfall. Presently there are no established drainage ways or structures located on either parcel. The natural drainage system consists of rainfall percolating through layers of porous lava to the underground water table. Nevertheless, the applicant will abide by all requirements of the County grading regulations, utilizing necessary erosion control measures during construction.

4.3 Agricultural Resources

The U.S. Department of Agriculture Soil Conservation Service has classified the soils on both parcels as being dominated by the presence of recent lava flows and having limited soil cover. The Kaimu Extremely Stony Peat and the Punaluu Extremely Rocky Peat soils have a capability subclass rating of VIIs, which denotes severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland and wildlife. The other two soils types, A'a and Pahoehoe lava flows share a capability subclass of VIIIs, which precludes use to recreation, wildlife, water supply or aesthetic purposes.

Both the ALISH system and Land Study Bureau classification system show the two parcels lack of suitability for agricultural purposes. Overall, these lands have little or no value for agricultural activities. Therefore, their use for the proposed action will not preempt future agricultural uses.

4.4 Air and Noise Quality

Impacts to the air and noise quality for the area will be generated by vehicular movements to and from the property and construction activities. Because of the anticipated short period of construction, and the small number of vehicles that will be added to traffic flow, it is expected that adverse impacts to the air and noise quality of the area will be minimal.

The proposed utility corridors would be classified as "indirect sources" of air pollution, as defined in the federal Clean Air Act of 1977. This is because their primary association with air pollution would be due to the generation of motor vehicle activity, otherwise referred to as a "mobile source." There would also be short-term impacts during the construction phase of the project due to grading and clearing and vehicular movement. Air quality impacts generated by the construction activity will be short-term in nature, and will include automotive pollutant concentrations from vehicle movement to and from the property and the generation of particulate emissions and fugitive dust during site preparation work and earth movement.

Because of the small number of vehicles involved, the additional traffic associated with the proposed action should not violate Federal or State air quality standards. Short-term impacts resulting from particulate emissions and fugitive dust can be minimized by dust control measures (frequent watering) during the construction period.

Impacts to the noise quality of the area will be associated with the increased traffic volume, both during and after the short-term construction period. Traffic-generated noise levels, both on- and off-site, are expected to be in the range of 40 to 50 Leq (energy equivalent sound level for a given time period) at 50 feet. Similar noise levels are typical of a business/residential/resort environment.

Mitigation

Except for approximately 10 dwellings immediately south of the mauka regions of the Kau parcel, there are no other residences within a minimum of 1,000 feet of

the study areas. Consequently, noise generated by the proposed action from construction or operational activities will be remote from areas of human habitation. At the present time, there are no community noise standards for areas outside of Oahu (i.e., Hawaii County has not adopted regulations governing noise generation). However, the applicant will require that contractors minimize noise to the extent possible by insuring that mechanical equipment is in good repair and that working hours are limited to daylight hours Monday through Saturday.

4.5 Water Supply

As discussed previously, it is estimated that groundwater resources in the Kona approximate 100 MGD. It has also been estimated that only 11.5 MGD have been developed as a deliverable water source for the region, with an average daily drawdown of 7.7 MGD. The development of the proposed action will result in an addition of only 1.76 MGD to the developed water sources (including 0.16 MGD for municipal use), representing only 1.8% of the estimated total developable resource.

Further, as a significant positive impact, the County will be able to fully integrate its delivery and transmission system for the North Kona area with the completion of the transmission lines through the Kau parcel.

4.6 Groundwater

Construction of wells and the irrigation of golf courses have the potential for adversely impacting groundwater resources. As noted in Section 3.8, both the proposed Kau and 'O'oma wells are located above the UIC line. In order to prevent possible contamination of the underlying groundwater, all wells will be designed and constructed to mitigate possible adverse impacts on the groundwater. For example, each well will be contained within a concrete pad and full grouting to prevent seepage or floodwaters from migrating down the shaft well. The use of the Kau wells as a source of drinking water, will require compliance with the State Department of Health's Administrative Rules, Title 11, Chapter 20, "Potable Water Systems." Section 11-20-30 of Chapter 20 requires that new or substantially modified distribution systems for public water systems be approved by the State Health Director. Water systems under the jurisdiction of the County of Hawaii are subject to the review and approval of the Department of Water Supply.

The proposed 'O'oma 2 water system will deliver brackish irrigation water to the Kohanaiki Resort to augment irrigation for the proposed golf course and resort landscaping. The brackish water will supplement the use of secondary-treated sewage effluent generated by the wastewater treatment plant at the Kohanaiki Resort. Potable and non-potable water systems will be carefully designed and operated to prevent cross-connections and backflow conditions. The two systems will be clearly labeled and physically separated by air gaps or reduced pressure principle backflow preventers to avoid contaminating the potable water supply.

The State Department of Health comments on the proposed action (see comments reproduced in Section 6.0) also included eight (8) conditions applicable to the construction, maintenance, and operation of the golf course to be built at the Kohanaiki Resort. The conditions represent certain mitigative measures to insure that groundwater contamination will not occur. Although the proposed golf course

is not part of the "proposed action," it is indirectly connected because a primary purpose of the developing the 'O'oma 2 wellfield will be to fulfill the irrigation requirements of the proposed golf course. The eight conditions provided by the DOH regarding the construction, maintenance, and operation of the Kohanaiki golf course will be complied with.

4.7 Natural Hazards

Because the proposed utility corridors could be affected by volcanic events, such as earthquakes and lava flows, appropriate design, engineering and construction measures will be employed to minimize potential risks related to such hazards. These measures will include adherence to engineering design standards in accordance with Federal, State and County rules and regulations.

4.8 Visual Attributes

As discussed above, views of the utility corridors including the reservoirs and breaker tanks, from public viewing areas are minimal. This is due to a combination of lava berms and vegetation along Queen Kaahumanu Highway, vegetation along Mamalahoa Highway, the presence of rolling hills on the lower slopes mauka of Queen Kaahumanu Highway, the existence of overhead transmission along both highways, and other reminders of the built environment. The substation will be located in an area which has greater visibility because of its proximity to Queen Kaahumanu Highway and the open nature of the terrain immediately mauka of the highway. However, the substation should not be visible from the highway except for views within the immediate vicinity of the substation. This is because the substation site is depressed relative to the highway in both directions, with long-views of the site blocked by hills on either side of the site. Consequently, with the exception of the substation, no significant visual impacts will be generated by the development of the proposed action.

Mitigation

Visual impacts that may be caused by the development of the proposed action will be appropriately mitigated. Pressure breaker tanks and the reservoirs will be painted to be compatible with their physical environment. The siting of the proposed substation will be coordinated with the Hawaii County Planning Department through the Plan Approval process. This coordination will also be required to determine compatibility with the "Open" zone designated along both sides of the Queen Kaahumanu Highway on the recently revised Land Use Pattern Allocation Guide Maps of the Hawaii County General Plan.

The applicant recognizes the limitations of HELCO in maintaining a high level of landscaping to buffer the facility from the nearby highway. Accordingly, the applicant will assume responsibility for maintaining the landscape buffer at a high level, complementing resort landscaping at the proposed entrance of the resort.

4.9. Flora and Fauna

The surveys conducted which inventoried the flora and fauna of the study areas indicate that no significant impacts will be generated by the proposed action. No

species are located within the areas proposed for development which are officially listed as threatened or endangered by the Federal and/or State governments. It is expected that the Pacific Golden Plover, a native migratory shorebird, will experience an increase in habitat with the construction of the access road on the Kau parcel, as the species prefers lawns and roadsides where it can forage for insects.

Only one rare plant, the 'aiea, was observed in the general area, just outside the southern boundary of the Kau parcel study area. A few scattered plants of ko'oko'olau (plant shows some evidence of vulnerability) were found in the vicinity of the 'O'oma 2 well field. Much of the lower slopes of both parcels are dominated by the presence of recent lava flows which are sparsely vegetated, and the upper slopes of the Kau parcel study area have been altered by the construction of a bulldozed road. This road, approximately 12 to 15 feet wide, is now overgrown by weedy plant species.

Mitigation

In an attempt to avoid many larger 'ohi'a trees and the 'aiea plant found on the lower slopes of the Kau parcel study area, it is recommended that the utility corridor alignment follow the middle of the southern property boundary on the lower two-thirds property. It is further recommended that the final utility corridor alignment on the upper one-third of the Kau parcel follow the already existing bulldozed roadway. Construction activities within the 'O'oma 2 wellfield area will be planned to avoid adverse impacts to the ko'oko'olau plants. These recommendations are consistent with similar conclusions reached concerning archaeological resources (see Section 4.10).

4.10 Historic and Archaeological Resources

Impacts

Several significant sites have been identified within both the Kau and 'O'oma 2 study areas. The construction of the utility corridors could impact these sites unless mitigation measures are taken.

Mitigation

All identified sites have been marked with bright pink flagging tape and an aluminum tag denoting the specific site number, among other data, and will therefore be readily identifiable by construction crews. Final utility corridor alignments will be routed to avoid all significant sites. A qualified archaeologist will conduct construction period monitoring in order to assure that these recommendations are implemented.

4.11 Public Policies

As discussed in Section 3.12, above, pertinent State and County land use plans include the Kohanaiki Resort as a future resort. Many of these plans recognize the region between Keahole Airport and Kailua-Kona as an area of expanded growth. Therefore, the proposed resort complements and implements adopted land use

policies. The construction of the proposed action is an integral part of the development plan for the resort, and also can be seen as implementing adopted land use policies.

4.12 Fire Hazard

The natural conditions within the proposed utility corridors consist mainly of dry grasses and other combustible vegetative materials. Due to the relatively arid conditions of the area, a potential fire hazard therefore exists from the proposed development activities. Potential sources of ignition starts include catalytic converters attached to motor vehicles and inadvertent actions of construction personnel.

Mitigation

Fire prevention practices will be established by the contractor to minimize the potential for fire starts. Areas will be appropriately cleared of combustible materials prior to commencement of construction activities. Personnel working in the area will be advised of the fire hazard potential and instructed on how to avoid ignition starts. In recognition of the potential fire hazard, personnel will be trained in the use of fire suppression methods and how to avoid injury from the fire. Water sources such as tanker trucks used for dust control will be a primary source of immediate suppression. Should a fire actually break out, the Kona Fire Department will be notified immediately via telephone.

5.0 ALTERNATIVES CONSIDERED

In order to develop the proposed Kohanaiki Resort, it is necessary to locate and develop water sources capable of supplying potable and irrigation water to meet projected resort demands. It is also necessary to develop an electrical power/telecommunications substation to meet related power and telecommunications demands. In this light, feasible alternatives to the proposed action are limited to those that will fulfill these demand requirements, while minimizing adverse environmental impacts.

No Action. The alternative of no action was considered and rejected because the absence of the proposed action, the water, power and telecommunication demands of the Kohanaiki Resort could not be met.

Alternative Water Source, Storage and Transmission Sites. One alternative to the proposed action would have been to relocate the utility corridors elsewhere within the North Kona region. The major locational requirements of the offsite water system include the development of sustainable producing wells (within the vicinity of the resort) connected to the Resort via utility corridors capable of receiving the necessary transmission and storage facilites. It is believed that the Kau and 'O'oma 2 parcels are the only sites within the vicinity of the proposed resort which meet these locational requirements.

A variation of this alternative would be to identify alternative corridors within the Kau and 'O'oma 2 parcels. This variant was rejected because any relocation of the utility corridors would have moved them further away from the eventual

destination of the water (the Kohanaiki Resort), thereby failing to meet one of the objectives of the proposed action, which is to deliver water as efficiently as possible. Furthermore, locating the waterline corridors within the interior of parcels (as opposed to parcel perimeters as is now proposed) could adversely limit development options within the parcels themselves.

Alternative Irrigation Water Source. One alternative to developing the 'O'oma 2 brackish water system would be to desalinate (or blend with potable water) brackish water from a well developed within the Kohanaiki Resort. This scenario would involve drilling a well at the upper northeast corner of the Resort site (approximately 80-foot elevation). In order to make such water usable for irrigation it would have to be blended with potable water, or desalinated. In the former case, this would have committed potable water sources for irrigation purposes, and for this reason it was rejected. In the latter case, the economic costs and associated electrical power requirements of the desalination process outweighed its benefits, and for this reason was rejected.

Based on an analyses of the various alternatives, it was determined that developing two separate water systems would provide the most efficient means of delivering water to the Kohanaiki Resort, with the least adverse impact, and using the least amount of potable water.

Alternative Substation Sites. The proposed substation is necessary to meet the electrical power and telecommunications requirements of the proposed resort. The present source of electrical power and telecommunications is from the overhead transmission lines running along the mauka frontage of the Queen Kaahumanu Highway right-of-way, directly upslope of the proposed resort. The most efficient location for the substation would be adjacent to the transmission lines, directly adjacent to the highway. Indeed, this is the location for other substations in the vicinity of the resort. Alternate locations such as within the resort property (i.e., makai of the Highway) or further upslope of the highway involve extremely costly construction without significantly decreasing the potential for adverse visual impact. In recognition of the potential adverse visual impacts associated with the development of a substation, the applicant will work closely with the Hawaii County Planning Department through the Plan Approval process in siting, landscaping and screening the facility to mitigate potential adverse visual impacts.

6.0 CONSULTED PARTIES

The following parties were consulted during the preparation of this Environmental Assessment:

State Agencies
Department of Health
Department of Land and Natural Resources
Department of Transportation

Hawaii County
Department of Planning
Department of Public Works
Department of Water Supply

Public Utilities
Hawaii Electric and Light Company
Hawaiian Telephone Company

Copies of a summary of the proposed action, including a brief discussion of the scope and content of the EA, were submitted to the eight agencies listed above. A copy of the summary is attached as Appendix D. Seven of the eight agencies provided written comments which are reproduced following the summary, together with applicant responses. GTE Hawaiian Tel did not have any comments on the proposed action at this time and did not submit written comments.

The applicant held a public informational meeting with residents in the vicinity of the Kau wells in March 1990 to generally review the proposed action and solicit comments or concerns. The major issue raised at the meeting related to the possibility of obtaining potable water service from the new well field. The applicant will continue to keep this group informed as the project progresses.

7.0 REFERENCES

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APPENDICES

A. CDUP Application Form and OEQC Form 89-01

B. Kau Parcel

(1) Botanical Survey, Kau Ahupua'a Waterline/Roadway Corridor North Kona, Island of Hawaii. Char & Associates. March 1990.

(2) Survey of the Avifauna and Feral Mammals at a Proposed Road/Waterline Corridor in Kau Ahupua'a, North Kona, Hawaii. Phil L. Bruner. February 1990.

(3) Archaeological Inventory Survey, Phase I-Site Identification, Kau Waterline/Roadway Project Area. Paul H. Rosendahl, Ph.D., Inc. March 1990.

C. 'O'oma 2 Parcel

(1) Botanical Survey, Kohana-Iki Resort Project, Water Source Development. Char & Associates. November 1988.

(2) Terrestrial Vertebrate Animals of the Kohanaiki Development Site. Andrew J. Berger. November 1988

(3) Archaeological Inventory Survey, Kohana-Iki Resort Water Development Project Area. Paul H. Rosendahl, Ph.D., Inc. January 1989.

(4) Botanical Assessment, 'O'oma 2 Wellfield Site, North Kona, Island of Hawaii. Char & Associates. May 1990.

(5) Survey of the Avifauna and Feral Mammals at 'O'oma 2, North Kona, Hawaii. Philip L. Bruner. May 1990.

(6) Archaeological Inventory Survey, Phase I-Site Identification, Water System Development Project Area, Land of 'O'oma 2nd, North Kona District, Island of Hawaii. Paul H. Rosendahl, Ph.D., Inc. May 1990.

D. Consulted Parties Correspondence.

APPENDIX A

CDUP Application Form and OEQC Form 89-01

February 1983

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

FOR DLNR USE ONLY
Reviewed by _____
Date _____
Accepted by _____
Date _____
Docket/File No. _____
180-Day Exp. _____
EIS Required _____
PH Required _____
Board Approved _____
Disapproved _____
Well No. _____

DEPARTMENT MASTER APPLICATION FORM

(Print or Type)

I. LANDOWNER/WATER SOURCE OWNER (If State land, to be filled in by Government Agency in control of property)

Name Thomas H. Yamamoto
Nansay Hawaii, Inc.

Address P.O. Box 111222, Suite 727
Kamuela, HI 96743

Telephone No. 808/ 885-5300

SIGNATURE [signature]

Date 5/31/90

II. APPLICANT (Water Use, omit if applicant is landowner)

Name _____

Address _____

Telephone No. _____

Interest in Property _____

(Indicate interest in property; submit written evidence of this interest)

*SIGNATURE _____

Date _____

*If for a Corporation, Partnership, Agency or Organization, must be signed by an authorized officer.

III. TYPE OF PERMIT(S) APPLYING FOR

(XX) A. State Lands
(XX) B. Conservation District Use
( ) C. Withdraw Water From A Ground Water Control Area
( ) D. Supply Water From A Ground Water Control Area
( ) E. Well Drilling/Modification

IV. WELL OR LAND PARCEL LOCATION REQUESTED

District _____

Island _____

County _____

Tax Map Key _____

Area of Parcel _____ (Indicate in acres or sq. ft.)

Term (if lease) _____

V. Environmental Requirements

Pursuant to Chapter 343, Hawaii Revised Statutes, and in accordance with Title 11; Chapter 200, Environmental Impact Statement Rules for applicant actions, an Environmental assessment of the proposed use must be attached. the Environmental assessment shall include, but not be limited to the following:

(1) Identification of applicant or proposing agency;

(2) Identification of approving agency, if applicable;

(3) Identification of agencies consulted in making assessment;

(4) General description of the action's technical, economic, social, and environmental characteristics;

(5) Summary description of the affected environment, including suitable and adequate location and site maps;

(6) Identification and summary of major impacts and alternatives considered, if any;

(7) Proposed mitigation measures, if any;

(8) Determination;

(9) Findings and reasons supporting determination; and

(10) Agencies to be consulted in the preparation of the EIS, if applicable.

VI. Summary of Proposed Use (what is proposed)

SEE ATTACHED ENVIRONMENTAL ASSESSMENT

INFORMATION REQUIRED FOR ALL USES

I. Description of Parcel

See Attached Addendum

A. Existing structures/Use. (Attach description or map).

B. Existing utilities. (If available, indicate size and location on map. Include electricity, water, telephone, drainage, and sewarage).

C. Existing access. (Provide map showing roadways, trails, if any. Give street name. Indicate width, type of paving and ownership).

D. Vegetation. (Describe or provide map showing location and types of vegetation. Indicate if rare native plants are present).

E. Topography; if ocean area, give depths. (Submit contour maps for ocean areas and areas where slopes are 40% or more. Contour maps will also be required for uses involving tall structures, gravity flow and other special cases).

F. If shoreline area, describe shoreline. (Indicate if shoreline is sandy, muddy, rocky, etc. Indicate cliffs, reefs, or other features such as access to shoreline).

G. Existing covenants, easements, restrictions. (If State lands, indicate present encumbrances.)

H. Historic sites affected. (If applicable, attach map and descriptions).

II. Description: Describe the activity proposed, its purpose and all operations to be conducted. (Use additional sheets as necessary).

III. Commencement Date: Upon Approval

Completion Date: _____

IV. TYPE OF USE REQUESTED (Mark where appropriate) (Please refer to Title 13, Chapter 2)

1. Permitted Use (exception occasional use);
DLNR Title 13, Chapter 2, Section 13-2-14; Subzone G.

2. Accessory Use (accessory to a permitted use):
DLNR Title 13, Chapter 2, Section _____; Subzone _____.

3. Occasional Use: Subzone _____.

4. Temporary Variance: Subzone _____.

5. Conditional Use: Subzone _____.

Area of Proposed Use 999.028 Acres & 903.789 Acres
(Indicate in acres or sq. ft.)

Name & Distance of Nearest Town or Landmark
Kailua, 5 miles

Boundary Interpretation (If the area is within 40 feet of the boundary of the Conservation District, include map showing interpretation of the boundary by the State Land Use Commission).

Conservation District Subzone General
County General Plan Designation Urban Expansion

V. FILING FEE

1. Enclose $50.00. All fees shall be in the form of cash, certified or cashier's check, and payable to the State of Hawaii.

2. If use is commercial, as defined, submit additional public hearing fee of $50.00.

INFORMATION REQUIRED FOR CONDITIONAL USE ONLY

I. Plans: (All plans should include north arrow and graphic scale).

A. Area Plan: Area plan should include but not be limited to relationship of proposed uses to existing and future uses in abutting parcels; identification of major existing facilities; names and addresses of adjacent property owners.

B. Site Plan: Site plan (maps) should include, but not be limited to, dimensions and shape of lot; metes and bounds, including easements and their use; existing features, including vegetation, water area, roads, and utilities.

C. Construction Plan: Construction plans should include, but not be limited to, existing and proposed changes in contours; all buildings and structures with indicated use and critical dimensions (including floor plans); open space and recreation areas; landscaping, including buffers; roadways, including widths; offstreet parking area; existing and proposed drainage; proposed utilities and other improvements; revegetation plans; drainage plans including erosion sedimentation controls; and grading, trenching, filling, dredging or soil disposal.

D. Maintenance Plans: For all uses involving power transmission, fuel lines, drainage systems, unmanned communication facilities and roadways not maintained by a public agency, plans for maintenance shall be included.

E. Management Plans: For any appropriate use of animal, plant, or mineral resources, management plans are required.

F. Historic or Archaeological Site Plan: Where there exists historic or archaeological sites on the State or Federal Register, a plan must be submitted including a survey of the site(s); significant features; protection, salvage, or restoration plans.

II. Subzone Objective: Demonstrate that the intended use is consistent with the objective of the subject Conservation District Subzone (as stated in Title 13, Chapter 2).

ADDENDUM TO PAGE 3 OF DLNR MASTER APPLICATION FORM

I. Description of Parcel

A. See Section 1.2 of the Environmental Assessment

B. None presently available

C. See Figure 1 of the Environmental Assessment

D. See Section 3.10 of the Environmental Assessment

E. See Section 3.2 and Figure 1 of the Environmental Assessment

F. Not applicable

G. No known encumbrances

H. See Section 3.11 of the Environmental Assessment

II. Description of Activity Proposed

See Section 2.0 of Environmental Assessment

DOCUMENT FOR PUBLICATION IN THE OEQC BULLETIN

Date: 5/31/90 Prepared by: Helber Hastert & Kimura, Planners

The document is a (check all that apply)

Chapter 205A Document	( )	Negative Declaration	(XX)
Chapter 343 Document	(XX)	EIS Preparation Notice	( )
NEPA Document	( )	Draft EIS	( )
		Final EIS	( )
		Acceptance Notice	( )

Is the document a supplemental EIS? Yes ( ) No (XX)

Title of Proposed Action or Project: Environmental Assessment: Off-site Infrastructure: Kohanaiki Resort

Location: Island Hawaii District North Kona

Type of Action (check one): Applicant (XX) Agency ( )

Name of Proposing Applicant or Agency: Nansay Hawaii, Inc.
Name of Contact: Tom Yamamoto, Chief Operating Officer
Address: P. O. Box 111222, Suite 727
City: Kamuela State: Hawaii Zip Code: 96743
Phone: (808) 885-5300

Name of Preparer or Consultant: Helber Hastert & Kimura, Planners
Name of Contact: Tom Fee, Vice President
Address: 733 Bishop St., Suite 2590
City: Honolulu State: Hawaii Zip Code: 96813
Phone: (808) 545-2055

Accepting Authority: DLNR

Estimated Project Cost:
Federal Funds $
State Funds $
County Funds $
Private Funds $ Undetermined
TOTAL $

Document Preparation Cost:
Neg Dec/EA $
Draft EIS $
Sup Draft EIS $
Sup Final EIS $
TOTAL $

EA Trigger (check all that apply)
(XX) Use of State or County Lands or Funds
(XX) Use of Conservation District Lands
( ) Use of Shoreline Setback Area
( ) Use of Historic Site or District
( ) Use of Lands in the Waikiki Special District
( ) Use Requiring an Amendment to a County General Plan

NOTE: For answers to any question on Page 10 or 11, please contact the Office of Environmental Quality Control at (808) 548-6915.

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Page 1 of 2]

( ) Use Requiring the Reclassification of Conservation Lands
( ) Construction or Modification of Helicopter Facilities
( ) Other _____

Brief Description of the Proposed Action or Project which will be Published in the OEQC Bulletin (limit of 500 words or less):

The applicant is requesting a CDUP to permit the development of two utility corridors proposed for construction within the land divisions of Kau (TMK 7-2-5:1) and 'O'oma 2 (TMK 7-2-9:5) in North Kona, Hawaii (the "proposed action"). The proposed improvements will serve the proposed Kohanaiki Resort located approximately two miles south of the Keahole Airport. The proposed Kau utility corridor will accommodate a potable water wells, water transmission lines, a reservoir, pressure breaker tanks, overhead power and telemetry lines, and a paved service road. The Kau water system will be dedicated to the County of Hawaii and interconnected with the existing municipal water system. The proposed 'O'oma 2 utility corridor will accommodate brackish irrigation water wells, a brackish water transmission line, a reservoir, overhead power and telemetry lines, an electric/telephone substation and a paved service road. The 'O'oma 2 water system will be privately operated. The lower reaches of both the Kau and 'O'oma 2 parcels lie within the State Conservation District, and the entire 'O'oma 2 parcel is State-owned.

Tax Map Key(s): 3-7-2-5:1 _____ _____
3-7-3-9:5 _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____

FOR OEQC USE ONLY

Date of Submission:
Date of Publication:
Last Day for Consulted Party Request:
Comment Period Ends:
Acceptance Date:
Publication Date of Acceptance:

OEQC # _____
Planner:

[OEQC Form 89-01 (1/89)
Page 2 of 2]

APPENDIX B

Kau Parcel

(1) Botanical Survey, Kau Ahupua'a Waterline/Roadway Corridor North Kona, Island of Hawaii. Char & Associates. March 1990.

(2) Survey of the Avifauna and Feral Mammals at a Proposed Road/Waterline Corridor in Kau Ahupua'a, North Kona, Hawaii. Phil L. Bruner. February 1990.

(3) Archaeological Inventory Survey, Phase I-Site Identification, Kau Waterline/Roadway Project Area. Paul H. Rosendahl, Ph.D., Inc. March 1990.

BOTANICAL SURVEY
KAU AHUPUA'A WATERLINE/ROADWAY CORRIDOR
NORTH KONA, ISLAND OF HAWAI'I

by

Winona P. Char

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawai'i

Prepared for: HELBER, HASTERT & KIMURA

March 1990

TABLE OF CONTENTS

BOTANICAL SURVEY
KAU AHUPUA'A WATERLINE/ROADWAY CORRIDOR
NORTH KONA, ISLAND OF HAWAI'I

INTRODUCTION

The Kau Ahupua'a waterline and roadway corridor extends from the Queen Ka'ahumanu Highway, at about the 160-foot elevation, to the mauka wellfield sites located near Mamalahoa Highway (or Belt Road), at about the 1,800-foot elevation. The corridor study area follows along the southern boundary of the Kau Ahupua'a parcel (TMK 7-2-5:1) and is roughly 18,000 feet long by 100 feet wide except at the 250-foot elevation level where it encompasses an area 500 feet wide by 250 feet long. A 1.5 millon gallon reservoir will be developed at the 250-foot elevation along the waterline corridor.

The proposed corridor passes through four different vegetation types or plant communities as it ascends upslope. Vegetation cover is sparse on the 'a'a lava flow nearest the Queen Ka'ahumanu Highway but fountain grass and various shrubs soon increase in numbers as one moves upslope. Plant cover becomes dense at about the 600-foot elevation, forming an open to closed shrubland. From about the 800-foot elevation level on, a dense forest composed principally of Christmas berry and silk oak characterizes the vegetation cover.

Field studies to assess the botanical resources along the corridor were conducted on the 19th and 20th of February, 1990. The primary objectives of the field studies were to (1) describe the major vegetation types along the corridor; (2) inventory the flora; and (3) search for threatened and endangered plants. Three botanists were used to gather the technical data presented in this report.

SURVEY METHODS

Prior to the field studies, a search was made of the pertinent literature to familiarize the botanists with other botanical studies conducted in the general area. A recent colored aerial photograph as well as topographic maps were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points. Contact was made with the field survey engineer who flagged and staked the southern corridor alignment.

Access to the lower two-thirds of the corridor was from the Queen Ka'ahumanu Highway. Access onto the upper one-third portion of the corridor was from the first side road off Makaula Road and then along a rockwall. From the end of the rockwall, a very overgrown bull-dozed road follows along most of the southern boundary corridor.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, topography, exposure, etc. Species were identified in the field; plants which could not be positively identified were collected for later determination in the herbarium and for comparison with the recent taxonomic literature.

DESCRIPTION OF THE CORRIDOR VEGETATION

There have been several botanical studies conducted on the vegetation in the general area. Studies relevant to the corridor area include those conducted around the HELCO power plant and along the powerline which services homes in the Kalaoa 3 area (Char 1988), as well as studies on the proposed Pu'uhonua subdivision located adjacent to the Kona Palisades subdivision (Linney and Char 1988). In addition, an assessment of the vegetation found on the Kau Ahupua'a wellfield sites was made by Char in December 1989. These areas support vegetation similar to that found along

the proposed waterline/roadway corridor. One officially listed endangered plant species, the uhiuhi (Caesalpinia kavaiensis), occurs on the Pu'uhonua parcel.

Four vegetation types or plant communities occur along the proposed corridor and are described in detail below. A list of all those plant species found during the field studies is presented at the end of this report. Distribution of these plant communities is largely influenced by the rainfall gradient, although substrate age is also a factor along the lower portion of the corridor.

Lava Flow

From the Queen Ka'ahumanu Highway terminus, at the 160-foot elevation, to just below the powerline which crosses the corridor at about the 250-foot elevation, the substrate is a geologically recent 'a'a lava flow consisting of jagged and spiny, jumbled clinker -- this is "mean, boot-eating 'a'a". The average annual rainfall along this lower one-third of the corridor is about 10 inches (State of Hawaii 1970).

Vegetation is very sparse, about 3 to 5% cover, with small patches of plants, usually fountain grass (Pennisetum setaceum), occurring mainly in depressions. Other species which may be encountered include shrubs of indigo (Indigofera suffruticosa), 'uhaloa (Waltheria indica), pluchea (Pluchea symphytifolia), and maiapilo (Capparis sandwichiana). Scattered trees of 'ohi'a (Metrosideros polymorpha) and naio (Myoporum sandwicense) are less frequently encountered. Moist and shady cracks and crevices provide habitat for ferns such as laua'e (Phymatosorus scolopendria), hairy swordfern (Nephrolepis multiflora), and kumu-niu (Doryopteris decipiens).

Fountain Grass Grassland

Above the powerline, the substrate is older and more weathered

'a'a with patches of pahoehoe or shelly pahoehoe lava also frequent. Fountain grass becomes denser and plant cover is 40 to 50%. Other grasses which can be found in this plant community are pili (Heteropogon contortus), lovegrass (Eragrostis tenella), Natal redtop (Rhynchelytrum repens), and molassesgrass (Melinis minutiflora).

Shrubs of indigo and a'ali'i (Dodonaea viscosa) are occasional to locally abundant. Rocky outcroppings support a few trees and shrubs of lama (Diospyros sandwicensis), 'ohi'a, maiapilo, koa-haole (Leucaena leucocephala), mamane (Sophora chrysophylla), maua (Xylosma hawaiiensis), and noni (Morinda citrifolia). One tree of 'aiea (Nothocestrum brevifolium) is found on the edge of the corridor, between the surveyor's stakes 39 and 40. Locally common on large 'a'a outcroppings are spurflower (Plectranthus parviflorus) and koali (Ipomoea indica).

Mixed Shrubland

There is no sharp boundary between the grassland and shrubland; grassland gradually grades into shrubland. The substrate is primarily weathered pahoehoe and average annual rainfall increases as one proceeds upslope. Rainfall is roughly 30 inches per year at about the 600-foot elevation, becoming almost 40 inches per year at the Belt Road (State of Hawaii 1970).

Open mixed shrubland is composed chiefly of a'ali'i shrubs, 3 to 6 feet tall, with scattered trees and other shrubs which include 'ohi'a, wiliwili (Erythrina sandwicensis), silk oak (Grevillea robusta), kolomona (Senna gaudichaudii), lama, lantana (Lantana camara), alahe'e (Canthium odoratum), and mamane. Fountain grass fills in the matrix between the woody plants. Because the shrub-land is open, with woody cover 40 to 50%, surveying is not too difficult. However, as rainfall and elevation increase, the shrubs become dense and closed; shrub species mentioned previously be-come 9 to 12 feet tall. Christmas berry (Schinus terebinthifolius)

and alahe'e shrubs become more numerous and the huehue vine (Cocculus trilobus) forms dense tangles.

Christmas Berry/Silk Oak Forest

Mixed shrubland quickly passes into a dense forest from about the 800-foot elevetion to the the wellfield sites. Substrate throughout the majority of the forest is 'a'a, which in most places is very loose and steeply sloping making surveying precarious.

This vegetation type is the most diverse of the four types found along the corridor. The forest is composed of dense Christmas berry thickets, 12 to 15 feet tall, with emergent trees of silk oak, 20 to 30 feet tall. Other introduced trees and shrubs found in this vegetation type include jacaranda (Jacaranda mimosifolia), lantana, koa-haole, coffee (Coffea arabica), and guava (Psidium guajava). Large trees of kukui (Aleurites moluccana), 25 to 40 feet tall, are locally abundant and form fairly large stands. Also locally abundant are denses stands of alahe'e, a native member of the coffee family. Other native components of this forest include trees and shrubs of hame (Antidesma pulvinatum), 'ohe (Reynoldsia sandwicensis), kulu'i (Nothotrichium sandwicensis), papala (Charpentiera obovata), mamane, 'ohi'a, olopua (Nestegis sandwicensis), and mamaki (Pipturus albidus). Ground cover in these forested areas is usually sparse because of the heavy shade. Where the canopy is open or thinned out, air plant (Kalanchoe pinnata), moa (Psilotum nudum), Spanish clover (Desmodium incanum), ti (Cordyline fruticosa), and lantana are dense.

An overgrown bull-dozed road follows along most of the southern boundary on this upper portion of the corridor; the road is about 12 to 15 feet wide. Although plants from the surrounding forested area have restablished themselves along this road in places, it is largely vegetated by more weedy species such as air plant, lantana, koa-haole, indigo, two species of vervain (Stachytarpheta

dichotoma, S. urticifolia), greater roving sailor, molassesgrass, Guinea grass (Panicum maximum), thimbleberry (Rubus rosaefolius), and comb hyptis (Hyptis pectinata). The native 'ilima (Sida fallax) and koali may be locally abundant in areas.

THREATENED AND ENDANGERED PLANTS

No officially listed threatened or endangered plants protected by federal and/or state endangered species laws occur along or near the corridor (U. S. Fish and Wildlife Service 1985; Herbst 1987).

One plant of a category 1 candidate endangered species, the 'aiea (Nothocestrum brevifolium), a small tree 15 to 30 feet tall, found in dry forest areas from the Ka'u District north to Waimea, occurs just outside the 100-foot wide corridor, between the surveyor's stakes 39 and 40. A category 1 plant is one for which the U. S. Fish and Wildlife Service has enough information on file to support the appropriateness of proposing to list it as endangered or threatened.

Five trees of 'ohe (Reynoldsia sandwicensis) are found near the overgrown bull-dozed road, between the surveyor's stakes 1-N and 1-O. The 'ohe was being reviewed as a candidate for threatened or endangered status in the earlier 1980 U. S. Fish and Wildlife Service Listing but is no longer being considered as such since the species has proven to be more abundant or widespread than was believed. In the most recent taxonomic treatment (Wagner et al. in press), the twelve species and varieties have been "lumped" into one broad species which is found on the islands of O'ahu, Moloka'i, Lana'i, Maui, and Hawai'i.

DISCUSSION AND RECOMMENDATIONS

A walk-through botanical survey was made of the 100-foot wide

corridor for which a waterline/roadway alignment is proposed. A total of 100 plant species were inventoried. Of these, 60 are introduced or alien; 5 are originally of Polynesian introduction; and 35 are native. Of the natives, 18 are indigenous, that is, they are native to the Hawaiian Islands and elsewhere, and 17 are endemic, that is, they are native only to the islands. The native species inventoried occur throughout dry forests on the leeward sides of most of the main Hawaiian Islands. None are officially listed as threatened or endangered species by the federal and/or state governments. A candidate endangered species, the 'aiea (Nothocestrum brevifolium), occurs in the general area. One plant was found just outside the corridor on its southern boundary.

The proposed waterline and access roadway along with powerlines is expected to be 30 feet wide at its maximum. Proper siting of the alignment can avoid a number of botanical concerns. The following recommendations are offered.

- Along the lower two-thirds of the corridor, an alignment down the middle of the 100-foot wide corridor will avoid many of the larger 'ohi'a trees and be well away from the 'aiea.

- An alignment following along the already existing bull-dozed road on the upper one-third of the corridor will have the least impact on vegetation in that area. The disturbed bull-dozed area is largely overgrown with weedy species.

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PLANT SPECIES LIST -- Kau Ahupua'a Waterline/Roadway Corridor

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of three groups: Ferns and Fern Allies, Monocots, and Dicots. Taxonomy and nomenclature of the Ferns and Fern Allies follow Lamoureux (1984); the flowering plants are in accordance with Wagner et al. (in press). In most cases, common English and/or Hawaiian names given follow St. John (1973) or Porter (1972).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands
   - I = indigenous = native to the islands and also to one or more other geographic area(s)
   - P = Polynesian = plants of Polynesian introduction prior to Western contact (1778); not native
   - X = introduced or alien = all those plants introduced either intentionally or accidentally after Western contact; not native.
4. Presence (+) or absence (-) of a particular species within each of four vegetation types recognized along the proposed waterline/roadway corridor (see text for descriptions).
   - 1 = Lava Flow
   - g = Fountain Grass Grassland
   - s = Mixed Shrubland
   - f = Christmas Berry/ Silk Oak Forest

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE l	g	s	f
FERNS AND FERN ALLIES						
HYMENOPHYLLACEAE (Filmy Fern Family)						
Gonocormus minutus (Blume) v.d. Bosch		I	-	-	-	+
NEPHROLEPIDACEAE (Sword Fern Family)						
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy sword fern, kupukupu	X	+	-	-	+
POLYPODIACEAE (Common Fern Family)						
Phymatosorus scolopendria (Burm.) Pic.-Ser.	laua'e, lauwa'e	X	+	+	-	+
PSILOTACEAE (Psilotum Family)						
Psilotum nudum (L.) Beauv.	moa, pipi	I	-	-	-	+
SINOPTERIDACEAE (Cliffbrake Fern Family)						
Doryopteris decipiens (Hook.) J. Sm.	kumu-niu, 'iwa'iwa	E	+	-	-	-
MONOCOTS						
AGAVACEAE (Agave Family)						
Cordyline fruticosa (L.) A. Chev.	ti, ki	P	-	-	-	+
Pleomele hawaiiensis Degener & I. Degener	halapepe	E	-	-	+	-
COMMELINACEAE (Spiderwort Family)						
Commelina diffusa N. L. Burm.	honohono	X	-	-	-	+
Rhoeo spathacea (Sw.) Stern	tradescantia	X	-	-	-	+
DIOSCOREACEAE (Yam Family)						
Dioscorea bulbifera L.	bitter yam, pi'oi	P	-	-	-	+

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE l	g	s	f
LILIACEAE (Lily Family)						
Asparagus setaceus (Kunth) Jessop	asparagus fern	X	-	-	-	+
POACEAE (Grass Family)						
Digitaria setigera Roth	kukaipua'a	I	+	-	-	-
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	lovegrass	X	-	+	-	-
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili, pili grass	I	-	+	-	-
Melinis minutiflora P. Beauv.	molassesgrass	X	+	+	+	+
Oplismenus hirtellus (L.) Beauv.	basketgrass	X	-	-	-	+
Panicum maximum Jacq.	Guinea grass	X	-	-	-	+
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X	+	+	+	+
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	X	+	+	+	-
DICOTS						
AMARANTHACEAE (Amaranthus Family)						
Charpentiera obovata Gaud.	papala	E	-	-	-	+
Nothotrichium sandwicensis (A. Gray) Hillebr.	kulu'i	E	-	-	-	+
ANACARDIACEAE (Mango Family)						
Mangifera indica L.	mango, manako	X	-	-	-	+
Schinus terebinthifolius Raddi	Christmas berry	X	+	+	+	+
APOCYNACEAE (Dogbane Family)						
Catharanthus roseus (L.) G. Don	Madagascar periwinkle	X	-	-	+	-
ARALIACEAE (Ginseng Family)						
Reynoldsia sandwicensis A. Gray	'ohe	E	-	-	-	+

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE l	g	s	f
ASTERACEAE (Sunflower Family)						
Ageratum conyzoides L.	maile hohono	X	+	-	-	-
Cirsium vulgare (Savi) Ten.	bull thistle	X	-	-	+	-
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X	-	-	-	+
Emilia fosbergii Nicolson	pualele	X	-	-	-	+
Hypochoeris radicata L.	hairy cats-ear, gosmore	X	-	-	-	+
Pluchea symphytifolia (Mill.) Gillis	pluchea, sourbush	X	+	+	+	+
Senecio mikanioides Otto ex Walp.	German ivy	X	-	-	-	+
Sonchus oleraceus L.	sow thistle, pualele	X	-	-	-	+
BALSAMINACEAE (Balsam Family)						
Impatiens wallerana J. D. Hook.	impatiens	X	-	-	-	+
BIGNONIACEAE (Bignonia Family)						
Jacaranda mimosifolia D. Don	jacaranda	X	-	-	-	+
BUDDLEJACEAE (Butterfly Bush Family)						
Buddleia asiatica Lour.	Asiatic butterfly bush, huelo-'ilio	X	-	-	-	+
CACTACEAE (Cactus Family)						
Opuntia ficus-indica (L.) Mill.	panini, papipi	X	+	-	-	-
CAPPARACEAE (Caper Family)						
Capparis sandwichiana DC.	maiapilo	E	+	+	-	-
CARICACEAE (Papaya Family)						
Carica papaya L.	papaya, mikana	X	-	-	-	+
CLUSIACEAE (Mangosteen Family)						
Clusia rosea Jacq.	autograph tree, copey	X	-	-	-	+
CONVOLVULACEAE (Morning-glory Family)						
Ipomoea indica (J. Burm.) Merr.	koali-'awania	I	+	+	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE l	g	s	f
CRASSULACEAE (Orpine Family)						
Kalanchoe pinnata (Lam.) Pers.	air plant	X	-	-	-	+
CUCURBITACEAE (Gourd Family)						
Momordica charantia L.	wild bittermelon	X	-	-	-	+
EBENACEAE (Ebony Family)						
Diospyros sandwicensis (A. DC.) Fosb.	lama	E	-	+	-	+
EUPHORBIACEAE (Spurge Family)						
Aleurites moluccana (L.) Willd.	kukui, tutui	P	-	-	-	+
Antidesma pulvinatum Hillerb.	hame, mehame, ha'a	E	-	-	-	+
Ricinus communis L.	castor bean, koli	X	-	-	-	+
FABACEAE (Pea Family)						
Caesalpinia bonduc (L.) Roxb.	kakalaioa, hihikolo	I	-	-	-	+
Canavalia sp.		E?	-	-	-	+
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X	-	-	+	-
Desmodium incanum DC.	Spanish clover, ka'imi	X	-	-	-	+
Desmodium sandwicense E. Mey.	Spanish clover	X	-	-	-	+
Desmodium tortuosum (Sw.) DC.	Florida beggarweed	X	-	-	-	+
Erythrina sandwicensis Degener	wiliwili	E	-	-	+	+
Indigofera suffruticosa Mill.	indigo, 'iniko	X	+	+	+	+
Leucaena leucocephala (Lam.) de Wit	koa-haole	X	-	+	+	+
Senna gaudichaudii (Hook. & Arnott) H. Irwin & Barneby	kolomona	I	-	-	+	-
Senna septemtrionalis (Viv.) H. Irwin & Barneby	senna, kolomona	X	-	-	-	+
Sophora chrysophylla (Salisb.) Seem.	mamane	E	-	+	+	+
FLACOURTIACEAE (Flacourtia Family)						
Xylosma hawaiiensis Seem.	maua	E	-	+	-	-

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE			
			l	g	s	f
LAMIACEAE (Mint Family)						
Hyptis pectinata (L.) Poit.	comb hyptis	X	-	-	-	+
Plectranthus parviflorus Willd.	spurflower	I	-	+	-	-
Salvia coccinea Juss. ex J. Murray	scarlet sage	X	-	-	-	+
Salvia occidentalis Sw.	West Indian sage	X	+	-	-	-
MALVACEAE (Mallow Family)						
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X	-	-	-	+
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	-	-	+	-
Sida fallax Walp.	'ilima	I	-	+	-	+
Sida spinosa L.	prickly sida	X	-	-	-	+
MENISPERMACEAE (Moonseed Family)						
Cocculus trilobus (Thunb.) DC.	huehue	I	+	-	+	+
MYOPORACEAE (Naio Family)						
Myoporum sandwicense A. Gray	naio	I	+	+	+	-
MYRTACEAE (Myrtle Family)						
Metrosideros polymorpha Gaud.	'ohi'a, 'ohi'a lehua	E	+	+	+	+
Psidium guajava L.	guava, kuawa	X	-	-	+	+
NYCTAGINACEAE (Four-o'clock Family)						
Boerhavia repens L.	alena, anena	I	+	+	-	-
OLEACEAE (Olive Family)						
Nestegis sandwicensis (A. Gray) Degener, I. Degener & L. Johnson	olopua, pua	E	-	-	-	+
OXALIDACEAE (Wood Sorrel Family)						
Oxalis corniculata L.	yellow wood sorrel, 'ihi'ai	P?	-	-	-	+

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE 1	g	s	f
PAPAVERACEAE (Poppy Family)						
Argemone glauca (Nutt. ex Prain) Pope	pua-kala, native poppy	E	+	-	+	-
PASSIFLORACEAE (Passion Flower Family)						
Passiflora edulis Sims	*passion fruit, liliko'i*	X	-	-	-	+
Passiflora foetida L.	pohapoha	X	-	-	+	-
Passiflora ligularis Juss.	lemiwai, sweet granadilla	X	-	-	-	+
PHYTOLACCACEAE (Pokeweed Family)						
Rivina humilis L.	rouge plant, coral berry	X	-	-	-	+
PIPERACEAE (Pepper Family)						
Peperomia leptostachya Hook. & Arnott	'ala'ala-wai-nui	I	-	+	-	-
PLUMBAGINACEAE (Leadwort Family)						
Plumbago zeylanica L.	'ilie'e	I	-	-	+	-
PORTULACACEAE (Purslane Family)						
Portulaca oleracea L.	common purslane, pigweed	X	+	-	-	-
PROTEACEAE (Protea Family)						
Grevillea robusta A. Cunn.	silk oak, 'oka-kalika	X	+	+	+	+
ROSACEAE (Rose Family)						
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei	I	-	-	-	+
Rubus rosifolius Sm.	thimbleberry	X	-	-	-	+
RUBIACEAE (Coffee Family)						
Canthium odoratum (G. Forster) Seem.	alahe'e, walahe'e	I	-	+	+	+
Coffea arabica L.	Arabian coffee	X	-	-	-	+
Morinda citrifolia L.	noni	P	+	+	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE			
			l	g	s	f
SAPINDACEAE (Soapberry Family)						
Dodonaea viscosa Jacq.	a'ali'i	I	+	+	+	-
SCROPHULARIACEAE (Snapdragon Family)						
Lophospermum erubescens D. Don	larger roving sailor, creeping gloxinia	X	-	-	+	+
SOLANACEAE (Tomato Family)						
Nothocestrum brevifolium A. Gray	'aiea	E	-	+	-	-
Physalis peruviana L.	poha	X	-	-	-	+
STERCULIACEAE (Cacao Family)						
Waltheria indica L.	'uhaloa, hi'aloa	I?	+	+	-	-
TILIACEAE (Linden Family)						
Triumfetta semitriloba Jacq.	burbush	X	-	-	-	+
URTICACEAE (Nettle Family)						
Pipturus albidus (Hook. & Arnott) A. Gray	mamaki	E	-	-	-	+
VERBENACEAE (Verbena Family)						
Lantana camara L.	lantana, lakana	X	+	+	+	+
Stachytarpheta dichotoma (Ruiz & Pav.) Vahl	vervain	X	-	-	-	+
Stachytarpheta urticifolia (Salisb.) Sims	nettle-leaved vervain	X	-	-	+	+
Verbena litoralis Kunth	owi, oi	X	-	-	-	+

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT A PROPOSED ROAD/WATERLINE CORRIDOR IN KAU AHUPUA'A, NORTH KONA, HAWAII

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28 February 1990

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT A PROPOSED ROAD/WATERLINE CORRIDOR IN KAU AHUPUA'A, NORTH KONA, HAWAII

INTRODUCTION

The purpose of this report is to summarize the findings of a two day (24, 25 February 1990) bird and mammal field survey of property proposed for a waterline and service road located at Kau Ahupua'a, North Kona, Hawaii (see Fig.1). Also included are references to pertinent literature as well as unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or may likely occur given the type of habitat available.

2- Provide some baseline data on the relative abundance of each species.

3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened". If such occur or may likely be found on the property identify what if any features of the habitat may

be essential for these species.

4- Determine if the property contains any special habitats that if lost or altered by development might result in a significant impact on the fauna in this region of the island.

GENERAL SITE DESCRIPTION

The project site is located at Kau Ahupua'a in North Kona, Hawaii (see Fig.1). The proposed corridor for the waterline and service road traverses open barren lava fields, grassland and a forest of mixed native and introduced trees such as Silk or Silver Oak (Grevillea robusta), Kukui (Aleurites moluccana) and Christmas Berry (Schinus terebinthifolius).

Weather during the field survey was cloudy with light showers. Winds were light 0-5 mph from the north.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. These observations were concentrated during the peak bird activity periods of early morning and late afternoon. Attention was also paid to the presence of

tracks, scats and skeletal remains as indicators of bird activity.

At various locations (see Fig.1) eight minute counts were made of all birds seen or heard. Between these counts stations walking tallys of birds seen or heard were also kept. These counts provide the basis for the relative abundance estimates given in this report. Unpublished reports of birds known from similar habitat on lands elsewhere in West Hawaii were also consulted in order to acquire a more complete picture of possible avifaunal activity (Bruner 1988a, 1988b, 1989a, 1989b, 1989c, 1989d, 1990). Observations of feral mammals were limited to visual sighthings and evidence in the form of scats, tracks and skeletal remains. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution. Two evenings were devoted to searching for the presence of owls and the Hawaiian Hoary Bat (Lasiurus cinerus semotus).

Scientific names used herein follow those given in the most recent American Ornithologist's Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1989), A Field Guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987), Mammal Species of the World (Honacki et al. 1982) and Hawaiian Forest Plants (Merlin 1980).

RESULT AND DISCUSSION

Resident Endemic (Native) Land and Water Birds:

Common Amakihi (Hemignathus virens) -

This native forest bird is not endangered and along with its relative the Apapane (Himatione sanguinea) it has managed to survive in good numbers where other related species in the sub-family Drepanidinae have not faired so well. Part of its success lies in its generalized feeding patterns which have allowed it, to range outside of native forest and forage in exotic trees. A total of 26 Amakihi were recorded over the two days of the survey. All were found foraging in Silk Oak and Ohia (Metrosideros collina polymorpha).

No other endemic birds were recorded on the survey. Other possible species which may occur in the area from time to time or are resident at this site but went undetected on the survey include: Hawaiian Owl or Pueo (Asio flammeus sandwichensis) and Hawaiian Hawk or 'Io (Buteo solitarius).

Migratory Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. Some juveniles will stay over the summer months as well (Johnson et al. 1981, 1983, 1989). Of all the shorebird species which winter in Hawaii the Pacific Golden

Plover (Pluvialis fulva) is the most abundant. Plovers prefer open areas such as mud flats, lawns, pastures, plowed fields and roadsides. They arrive in Hawaii in early August and depart to their arctic breeding grounds during the last week of April (Johnson et al. 1981). Bruner (1983) has also shown plover are extremely site-faithful (returning each day and each year to the same spot) on their wintering grounds and many establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years (Johnson et al. 1989). A total of 15 plover were recorded during the survey. These birds were either observed flying over the property or loafing on lava flows. The mauka portion of the corridor is unsuitable for plover. Several plover were also heard calling after dark. Apparently they leave their foraging grounds along the coast and aggregate at night on barren lava flows. This behavior probably is an antipredator strategy similar to rooftop roosting which has been observed on Oahu (Johnson and Nakamura 1982). The only other migratory bird likely to occur with any frequency on the property would be the Ruddy Turnstone (Arenaria interpres).

Resident Indigenous (Native) Birds:

This category includes only those species which are native but not endemic such as the Black-crowned Night Heron (Nycticorax

nycticorax). No indigenous species were recorded nor would any be expected at this site.

Resident Indigenous (Native) Seabirds:

None were observed on the property. Some seabirds nest and roost in upland habitats in Hawaii, but at much higher elevations than this property (Pratt et al. 1987).

Exotic (Introduced) Birds:

A total of 17 species of exotic birds were recorded during the field survey. Table One shows the relative abundance of each species. The most abundant species were House Finch (Carpodacus mexicanus), Yellow-fronted Canary (Serinus mozambicus), Japanese White-eye (Zosterops japonicus) and Zebra Dove (Geopelia striata). Given the present habitat and its location, and data from other surveys (Bruner 1988a, 1988b, 1989a, 1989b, 1989c, 1989d, 1990) as well as information provided in Pratt et al. (1987) and Hawaii Audubon Society (1989) the following exotic bird species might also be expected to occasionally occur on or near the property: Common Barn Owl (Tyto alba), California Quail (Callipepla californica), Japanese Quail (Coturnix japonica), and Lavender Waxbill (Estrilda caerulescens).

Feral Mammals:

Skeletal remains of Feral Goats (Capra hircus) were observed

on the makai portion of the site. Small Indian Mongoose (Herpestes auropunctatus) was seen but no rats, mice or cats were recorded, however, it would be highly unusual if these ubuquitous animals did not occur on the property. Without a trapping program it is difficult to conclude much about the relative abundance of these species.

Records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinerus semotus) are sketchy but the species has been reported from Hawaii (Tomich 1986). None were observed on this field survey despite two nights of observations. This species roosts solitarily in trees. Much remains to be known about the natural history of this bat and its ecological requirements here in Hawaii. Bruner (1984) found bats on the Sheraton Waikoloa Beach Resort property which is located makai and to the north of this property. Hannah K. Springer, a life long resident of North Kona, reports seeing bats frequently in the upper Kaupulehu area (pers. comm.).

CONCLUSION

A brief field survey can at best provide only a limited perspective of the wildlife present in any given area. Not all species will necessarily be observed and information on their use of the site must be sketched together from brief observations,

the available literature and from reports by people familiar with the region. The number of species and the relative abundance of each species may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the faunal picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987). Thus only long term studies can provide an in depth view of the bird and mammal populations in a particular area. However, when brief field studies are coupled with data gathered from other similar habitats the values of the conclusions drawn can be significantly increased.

The following are some general conclusions related to bird and mammal activity on this property.

1- The site provides a range of habitats which are utilized by the typical array of exotic species of birds one would expect in these types of environments in Hawaii. No unusual concentrations of any exotic species were discovered. However, some species typically found in this habitat were not recorded. This could have been due to the fact that the survey was too brief or that their numbers are so low that they went undetected or a combination of these and other factors.

2- Only one endemic species was recorded. This property does not offer anything unusual or unique for these birds.

Abundant habitat of the type found on this site occurs in the North Kona and South Kohala region.

3- The proposed corridor (road/waterline) will alter existing habitats but the adverse impact on the fauna of this region of West Hawaii should be neglible.

4- One native bird which will profit by the opening up of the habitat is the Pacific Golden Plover. This species prefers lawns and roadsides where it can forage for insects. It would not be surprising to find more plover at this site in future years due to the presence of the road. However, if the road becomes overgrown plover would not be able to forage and would abandon the area.

5- In order to obtain more definitive data on mammals, a trapping program would be required. No endangered species were observed.

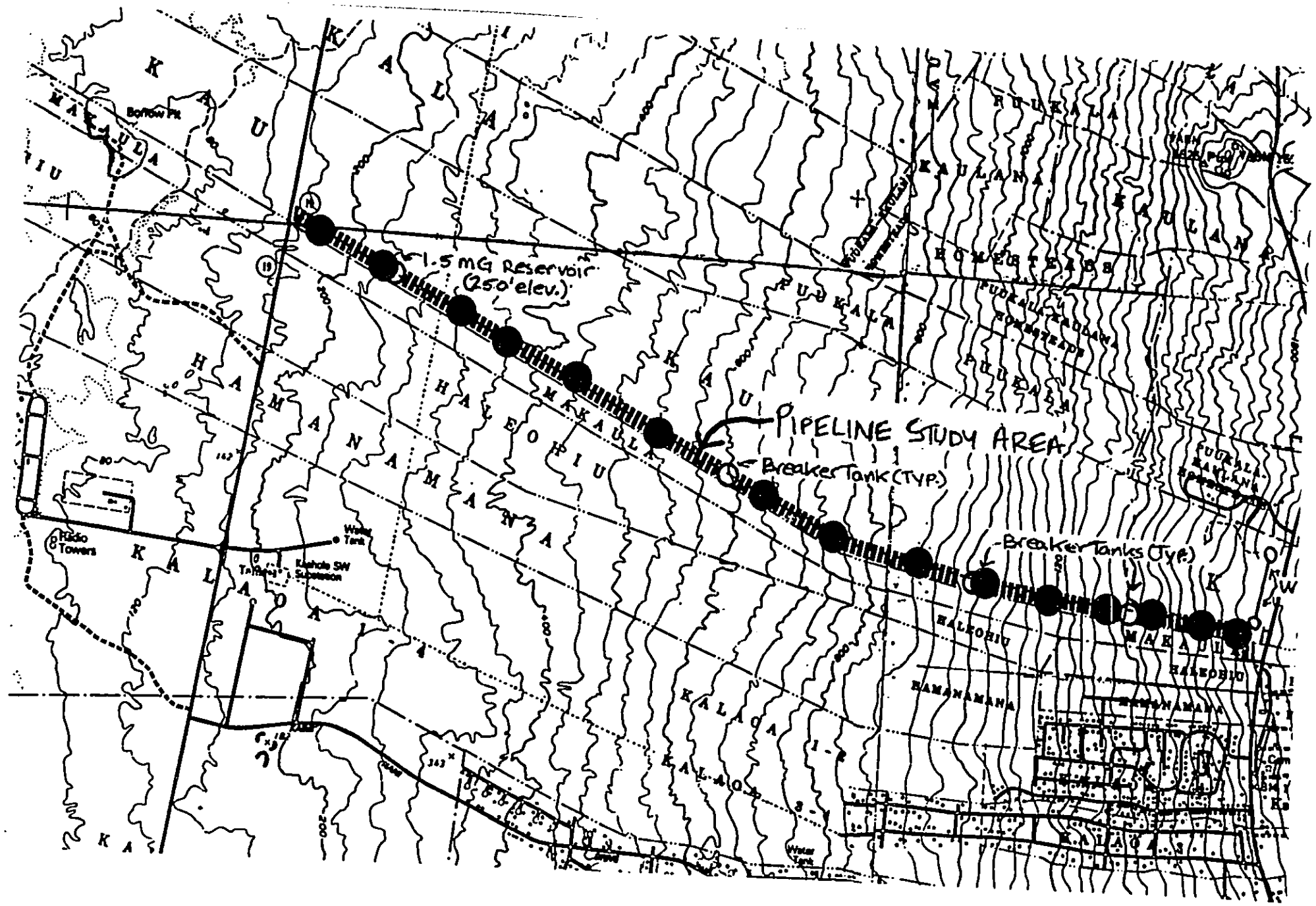

Fig. 1. Proposed waterline route with eight minute count stations indicated by solid circles.

TABLE 1

Exotic species of birds recorded at Kau Ahupua'a, North Kona, Hawaii

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
Ring-necked Pheasant	Phasianus colchicus	R = 2
Kalij Pheasant	Lophura leucomelana	R = 2
Black Francolin	Francolinus francolinus	C = 9
Gray Francolin	Francolinus pondicerianus	U = 2
Erckel's Francolin	Francolinus erckelli	R = 3
Spotted Dove	Streptopelia chinensis	U = 3
Zebra Dove	Geopelia striata	A = 12
Common Myna	Acridotheres tristis	U = 4
Northern Cardinal	Cardinalis cardinalis	C = 6
Yellow-billed Cardinal	Paroaria capitata	R = 3
Northern Mockingbird	Mimus polyglottos	R = 1
Saffron Finch	Sicalis flaveola	R = 5
Japanese White-eye	Zosterops japonicus	A = 16
Nutmeg Mannikin	Lonchura punctulata	C = 9
Warbling Silverbill	Lonchura malabarica	R = 18
House Finch	Carpodacus mexicanus	A = 14
Yellow-fronted Canary	Serinus mozambicus	A = 15

*(see page 12 for key to symbols)

KEY TO TABLE 1

Relative abundance = number of times observed during survey or frequency on eight minute counts.

A = abundant (ave. 10+) number which follows is average of data from all survey days)

C = common (ave. 5-10)

U = uncommon (ave. less than 5)

R = recorded (seen or heard at times other than on 8 min. counts. Number which follows is the total number of individuals seen or heard)

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PHRI

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Report 760-022290

March 5, 1990

Nansay Hawaii, Inc.
c/o Helber, Hastert & Kimura - Planners
Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Attention: Mr. Tom Fee

Subject: ***Archaeological Inventory Survey***
Phase I - Site Identification
Kau Waterline/Roadway Project Area
Land of Kau, North Kona District,
Island of Hawaii (TMK:3-7-2-05:Por.1)

Dear Mr. Fee:

At your request, Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently conducted Phase I (Site Identification) of an archaeological inventory survey of the Kau Waterline/Roadway project area, situated in the Land of Kau, North Kona District, Island of Hawaii (TMK:3-7-2-05:Por.1) (Figure 1, at end). The Phase I survey field work was conducted on February 8 and 9, 1990 by Supervisory Archaeologists Arne Carlson, B.A., and Berdena Burgett, B.A., assisted by Field Archaeologist Robert Noah. The work was conducted under the overall direction of Principal Investigator Dr. Paul H. Rosendahl. Approximately six man-days of labor were expended in carrying out the field work.

The basic purpose of an inventory survey is to identify—to discover and locate on available maps—all sites and features of potential archaeological significance present within a specified project area. An **inventory survey** comprises an initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources within a specified project area. This level of survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. It permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for any subsequent **mitigation** work as might be necessary or appropriate. Such work could include further data collection involving detailed recording of sites and features, and selected test excavations; and possibly subsequent data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The overall objective of the Phase I work was to identify (presence/absence determination) any sites of such obvious high significance as to seriously constrain or prevent future development. Phase II work would follow Phase I and would include the completion of appropriate data collection to current inventory-level survey standards.

The specific objectives of the present survey were fourfold: (a) to identify (find and locate) all sites and site complexes present within the parcel, (b) to evaluate the potential general significance of all identified archaeological remains, (c) to determine the possible impacts of proposed development upon the identified remains, and (d) to define the general scope of any subsequent further data collection and/or other mitigation work that might be necessary or appropriate.

The Kau Waterline/Roadway project area consists of a corridor measuring approximately 18,000 ft in length by 100 ft wide and includes a 5.7 ac reservoir site situated at c. 250 ft AMSL (above mean sea level). The project area rises in elevation from c. 160 ft AMSL on its seaward (west) end to c. 18,040 ft AMSL on its inland (east) end. It begins c. 1.8 miles (2.8 km) from the coast and continues c. 4.7 miles (7.6 km) inland. The project area is bounded on the north by undeveloped land within the Land of Kau, on the south by Makaula Subdivision and the Land of Makaula, on the east by Mamalahoa Highway (Hawaii Belt Road), and on the west by Queen Kaahumanu Highway. At the time of the survey, the south side of the project area, the boundary between the Lands of Kau and Makaula, had been previously staked by professional surveyors from R.M. Towill. The staking consisted of 3-ft wooden slats set c. 100-200 ft apart. In addition, the 250 ft AMSL point (location of the proposed reservoir site) was also staked and areas of dense vegetation were flagged with blue and orange surveyor's flagging tape. An old bulldozer-cut road, overgrown with vegetation, is present in the project area, extending between c. 700-1,800 ft AMSL.

The terrain in the project area is slightly undulating and slopes seaward (west). Above c. 1,000 ft AMSL, the soil in the area consists of Punaluu extremely rocky peat (6-20% slopes) representing the Punaluu series "...of well-drained, thin organic soils over pahoehoe lava bedrock...[r]ock outcrops occupy 40 to 50 percent of the surface" and Kaimu extremely stony peat (6-20% slopes) representing the Kaimu series "...of well-drained, thin organic soils over Aa lava" (Sato et al. 1973). The seaward portion of the project area, below c. 1,000 ft AMSL, consists of pahoehoe and aa lava flows. According to Sato et al. "...aa lava has practically no soil covering and is bare of vegetation, except for mosses, lichens, ferns, and a few small ohia trees...[t]his lava is rough and broken...[i]t is a mass of clinkery, hard glassy, sharp pieces piled in tumbled heaps" and pahoehoe lava "has a billowy, glassy surface that is relatively smooth...[i]n some areas, however, the surface is rough and broken, and there are hummocks and pressure domes" (1973:34).

Vegetation in the project area, above c. 700 ft AMSL, consists primarily of a moderately dense overstory of Christmas-berry (*Schinus terebinthifolius* Raddi) with scattered 'ohia (*Metrosideros collina* [Forst.] Gray), lama (*Diospyros* sp.), kukui (*Aleurites moluccana* [L.] Willd.), wiliwili (*Erythrina sandwicensis* [Degener; synonym, *E. monosperms* Gaud.]), alahe'e (*Canthium odoratum* [Forst.] Seem.), guava (*Psidium guajava* L.), kupukupu (*Nephrolepis* sp.), silver oak (*Bryophyllum pinnatum* [L.], ki (*Cordyline terminalis* [L.] Kunth), airplant (*Bryophyllum pinnatum* [L.] Kurz), and various grasses. Vegetation below c. 700 ft AMSL is generally very sparse and consists of grasses (predominately fountain grass, *Pennisetum setaceum* [Forsk.] Chiov.). Rainfall in the general vicinity of the project area ranges between 40-50 inches per year, and the mean annual temperature in the area is approximately 70-75 degrees F. (Armstrong 1983:63,64).

Previous archaeological work conducted within the present project area includes a reconnaissance survey of Queen Kaahumanu Highway corridor by Ching (1971) and subsequent salvage excavations in the same project area by Rosendahl (1973). During these two projects, no sites were formally identified within the small portion of the present project area included in those projects. Ching's site location map (1971:49), however, shows a trail (no site designation) which may cross the present project area.

Prior archaeological work conducted within the Land of Kau includes surface survey and excavations in the coastal area by Ching (1970) and Riley (1969). Previous archaeological work in the general vicinity of the present project area includes studies by Soehren (1978, 1980, 1982, and 1985), Cordy (1985 and 1987), Telea and Rosendahl (1987), Walker and Haun (1987 and 1988), and Walker and Rosendahl (1989).

A 100%-coverage surface survey was accomplished by way of one pedestrian transect oriented approximately east-west and parallel to the major axis of the project area. Transect intervals between sweeping crew members were generally 10.0-15.0 m. The survey was facilitated by color aerial photos (Nos. 8590-7 and 8649-5; 1"=400 ft scale) of the project area produced by R.M. Towill Corp. (dated February 13 and October 11, 1989). Ground visibility within the project area was excellent because in the upland (eastern) area the overstory of Christmas-berry restricted understory growth, and the seaward (western) area consisted of open lava flows.

During the survey, 25 sites containing 96+ component features were identified within or immediately adjacent to the project area. These are summarized in Table 1 (attached) in terms of temporary field site number, formal site/feature type, tentative functional interpretation, tentative CRM (Cultural Resource Management) value mode assessment, and

recommended future field work tasks. Approximate locations of the sites are shown on Figure 1 (attached). The principal types of sites and features identified were mounds of varying sizes related to agricultural activities. Several mounds may also have functioned as burial features. Twenty-three of the 25 identified sites (94+ of the 96+ features) are located within the inland portion of the project area, above 700 ft AMSL.

The project area appears to be situated within the dry barren intermediate zone and the upland habitation zone previously identified by Rosendahl (1973) and Cordy (1985). According to Rosendahl and Cordy, the intermediate zone consists predominately of recent volcanics almost devoid of soil or vegetation and is associated principally with temporary habitation and transportation between the coastal zone and inland zones. The upland habitation zone is associated with agricultural activities. Based on the distribution of features within the project area, the boundary between the intermediate and habitation zones in the project area, and its vicinity, is c. 700 ft AMSL.

Although inventory survey-level recording was not carried out as part of Phase I work, it is apparent that if it was, most of the sites and features would be evaluated as significant only in terms of information content (research value), and that after appropriate data collection, their physical preservation would not be required. Several sites and features (possible burials, a trail, and selected agricultural and habitation features) would also be evaluated as culturally significant and *significant as an excellent example of a site type* (interpretive value).

Since it is possible to avoid identified sites when bulldozing a road within the corridor, thus preserving the sites, site preservation with no further data collection is recommended for the sites. It is also recommended that the old bulldozed road located inland (east) of the c. 700 ft AMSL elevation contour be utilized (see Figure 1). This would insure that the concentration of sites near the road would not be affected.

It should be noted that the above evaluations and recommendations have been made solely on the basis of the present survey work (Phase I - Site Identification). There is always the possibility, however remote, that potentially significant, unidentified subsurface cultural remains or lava tubes will be encountered/uncovered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

This report constitutes the final report for the Phase I survey. If you have any questions concerning the survey or this report, please contact me at our Hilo office (808/969-1763).

Sincerely yours,

Paul H. Rosendahl, Ph.D.
President and Principal Archaeologist

ATW:atw

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Table 1.

SUMMARY OF IDENTIFIED SITES AND FEATURES

PHRI Temporary Site Number 760-#	Formal Site/Feature Type	Tentative Functional Interpretation	*CRM Value Mode Assess. R	I	C	#Field Work Tasks DR	SC	EX
1	Wall	Boundary	M	L	L	+	-	-
2	Terrace	Agriculture	M	L	L	+	-	-
3	Complex (7)	Agriculture/ poss. burial	H	L	L/H	+	-	+
A	Mound							
B	Mound							
C	Mound/platform							
D	Mound							
E	Mound							
F	C-Shape/platform							
G	Wall							
4	Mounds (+)	Agriculture	M	L	L	+	-	-
5	Mounds (+)	Agriculture	M	L	L	+	-	+
6	Linear mound	Agriculture	M	L	L	+	-	+
7	Complex (40)	Habitation-agriculture/poss. burial	M	L	L/H	+	-	+
A	Walled excav.							
B	Modified outcrop							
C	Mound							
D	Mound							

*Cultural Resource Management Value Mode Assessment:
Nature: R = scientific research
I = interpretive
C = cultural
Degree: H = high
M = moderate
L = low

#Field Work Tasks:
DR = detailed recording (scaled drawings, photographs, and written descriptions)
SC = surface collections
EX = limited excavations

+Number of component features within complex

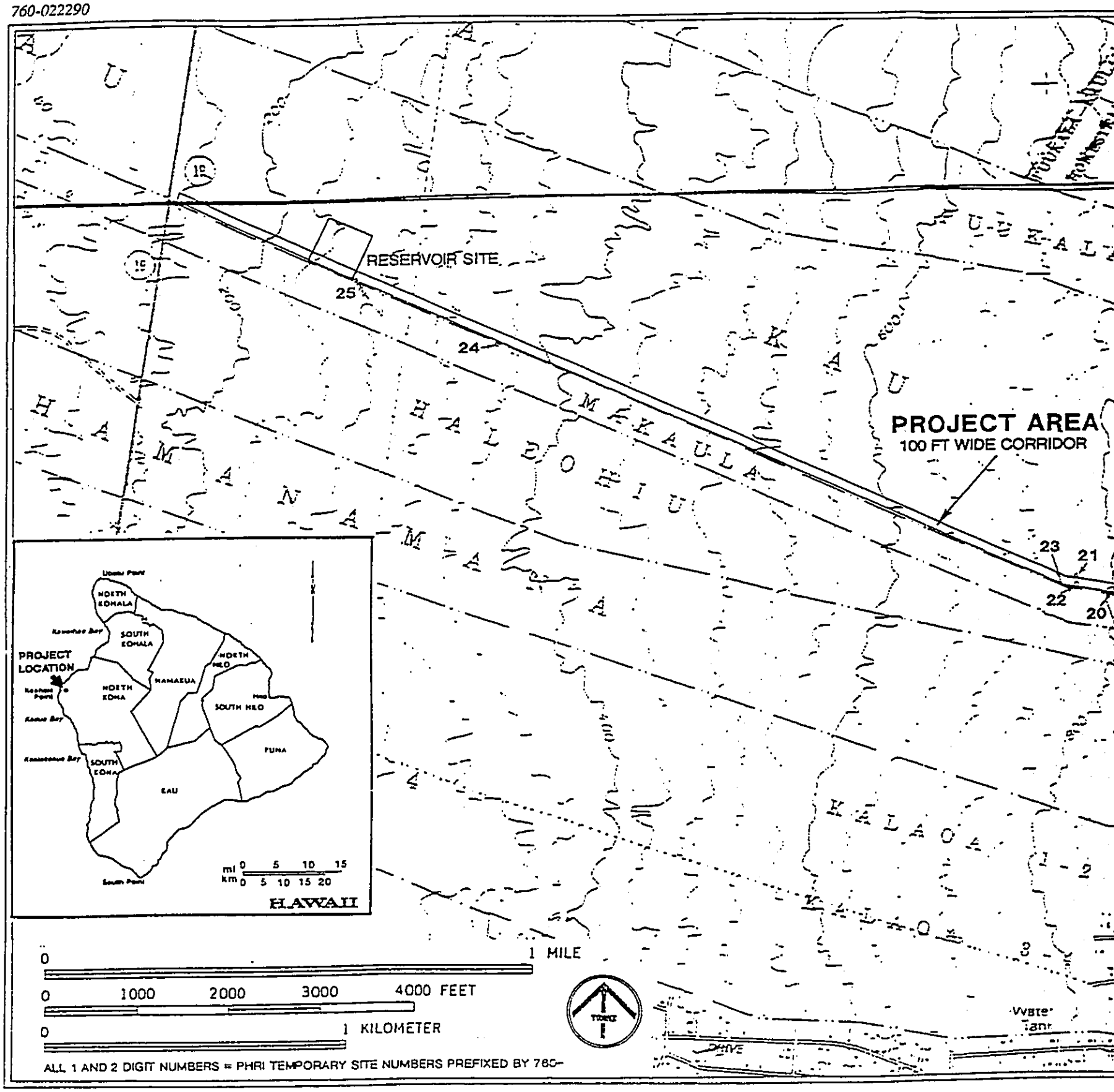
Table 1. (cont.)

PHRI Temporary Site Number 760-#	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
7 (cont.)								
E	Mound							
F	Mound							
G	Mound							
H	Mound							
I	Mound							
J	Mound							
K	Modified outcrop/wall							
L	Enclosure							
M	Mounds (26)							
N	Modified outcrop							
O	Modified outcrop							
8	Modified outcrop	Possible habitation	M	L	L	+	-	+
9	Wall	Boundary	M	L	L	+	-	+
10	Complex (2)	Boundary/agri.	M	L	L	+	-	+
A	Linear mounds (+)							
B	Linear mounds (+)							
11	Complex (3+)	Agriculture/ habitation	M	L	L	+	-	+
A	Terrace							
B	Mounds (+)							
C	Mound							
12	Terrace	Agriculture	L	L	L	+	-	-
13	Complex (3)	Agriculture	M	L	L	+	-	+
A-C	Terrace							
14	Wall	Boundary	M	L	L	+	-	+
15	Complex (2)	Agriculture	M	L	L	+	-	+
A	Mound							
B	Mound							

Table 1. (cont.)

PHRI Temporary Site Number 760-#	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
16	Complex (9)	Agriculture	M	L	L	+	-	+
A-I	Mound							
17	Complex (6+)	Agriculture	M	L	L	+	-	+
A-F	Mound							
18	Complex (2)	Habitation	M/H	L/M	L/M	+	-	+
A	Platform							
B	Wall							
19	Complex (5)	Agriculture	M/H	M/H	M/H	+	-	+
A-E	Mound							
20	Mounds (+)	Agriculture	M	L	L	+	-	+
21	Complex (2)	Habitation/ agriculture	M/H	L	L	+	-	+
A	C-Shape							
B	Mound							
22	Complex (2)	Habitation/ agriculture	M/H	L	L	+	-	+
A	Platform							
B	Mound							
23	Cairn	Possible marker	M	L	L	+	-	+
24	Cairn	Possible marker	M	L	L	+	-	+
25	Trail	Transportation	M	L/M	H	+	-	-

760-022290


RESERVOIR SITE
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PROJECT LOCATION
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SOUTH KOHALA
NORTH HILO
SOUTH HILO
HAMAKUA
NORTH KONA
SOUTH KONA
PUNA
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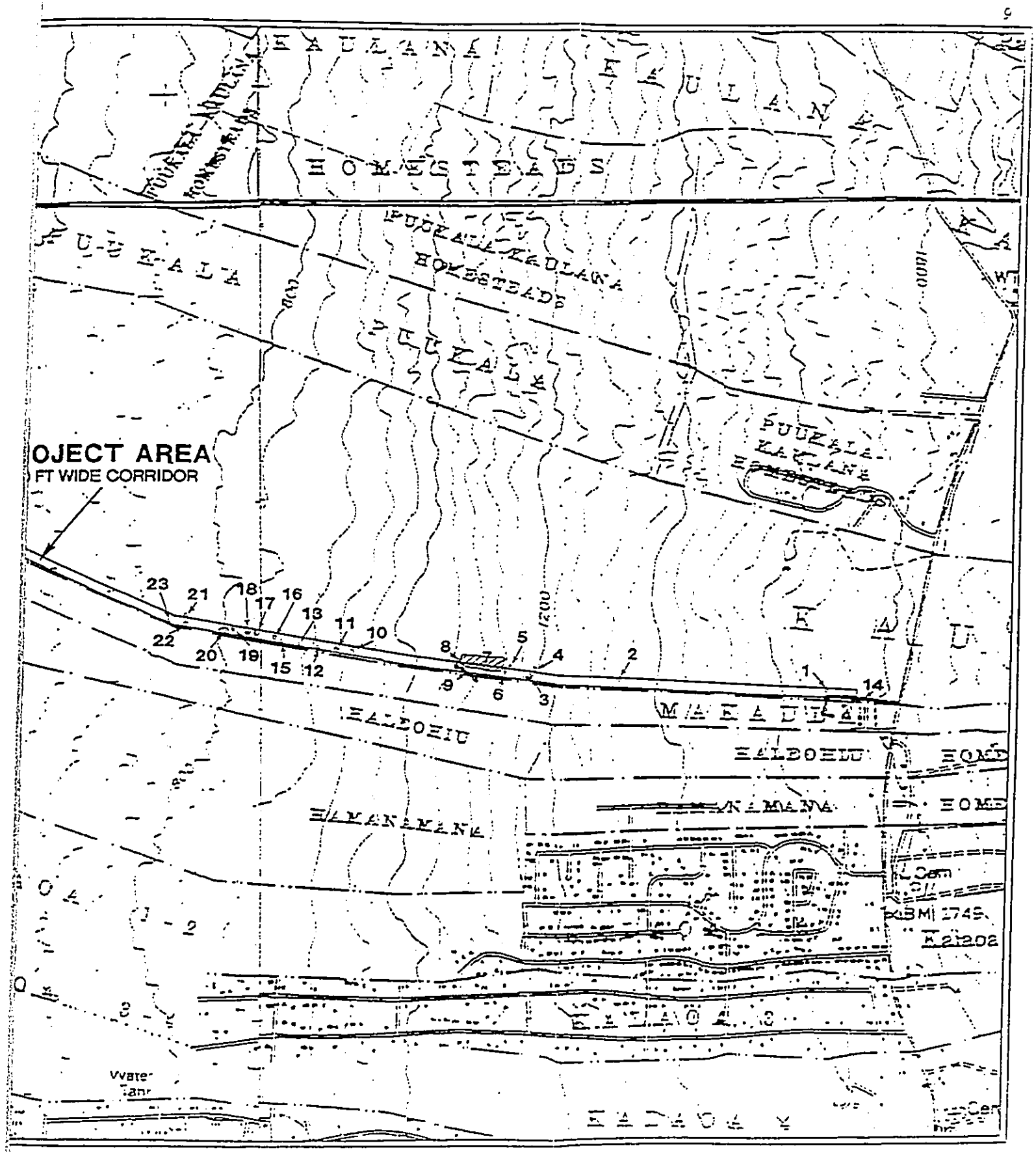
ALL 1 AND 2 DIGIT NUMBERS = PHRI TEMPORARY SITE NUMBERS PREFIXED BY 760-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8
5
4
2
1
14
9
6
3
Water Tank

APPENDIX C

'O'oma 2 Parcel

(1) Botanical Survey, Kohana-Iki Resort Project, Water Source Development. Char & Associates. November 1988.

(2) Terrestrial Vertebrate Animals of the Kohanaiki Development Site. Andrew J. Berger. November 1988

(3) Archaeological Inventory Survey, Kohana-Iki Resort Water Development Project Area. Paul H. Rosendahl, Ph.D., Inc. January 1989.

(4) Botanical Assessment, 'O'oma 2 Wellfield Site, North Kona, Island of Hawaii. Char & Associates. May 1990.

(5) Survey of the Avifauna and Feral Mammals at 'O'oma 2, North Kona, Hawaii. Philip L. Bruner. May 1990.

(6) Archaeological Inventory Survey, Phase I-Site Identification, Water System Development Project Area, Land of 'O'oma 2nd, North Kona District, Island of Hawaii. Paul H. Rosendahl, Ph.D., Inc. May 1990.

BOTANICAL SURVEY

KOHANA-IKI RESORT PROJECT

WATER SOURCE DEVELOPMENT

by

Winona P. Char

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

Prepared for: M&E PACIFIC, INC.

November 1988

BOTANICAL SURVEY
KOHANA-IKI RESORT PROJECT
WATER SOURCE DEVELOPMENT

INTRODUCTION

On 18 November 1988, a survey of the botanical resources along the proposed water transmission line corridor for the Kohana-Iki Resort Project was made. The corridor is approximately 200 ft. wide and 10,000 ft. in length. It extends from the Queen Ka'ahumanu Highway to the mauka boundary of the State parcel ('O'oma 2). Water storage reservoirs will be located at the 200 ft. elevation; at this location the corridor will be about 500 ft. wide.

The technical data from this report will be included an Environmental Assessment (EA) required for a Conservation District Use permit as the project is on State-owned land.

SURVEY METHODS

Prior to the field studies, a search was made of the pertinent literature to familiarize the principal investigator with the vegetation in the general area.

The water transmission line corridor was flagged and delineated before the biological field survey work. A walk-though survey, following along the corridor, was conducted. Notes were made on plant associations and distribution, substrate types, topography, etc. Plants which could not be positively identified in the field were collected for later determination in the herbarium or for comparison with the taxonomic literature.

DESCRIPTION OF THE VEGETATION

From the Queen Ka'ahumanu Highway to about the 400 ft. elevation, vegetation consists of clumps of fountain grass (Pennisetum setaceum) with scattered shrubs. Plant cover varies from 30 to as much as 50%, however, barren 'a'a and pahoehoe lava flows predominate. The more commonly encountered larger shrubs, 3 to 6 ft. high, include noni (Morinda citrifolia), pua-pilo (Capparis sandwichiana), kiawe (Prosopis pallida), and klu (Acacia farnesiana). Smaller shrubs or subshrubs frequently observed are 'uhaloa (Waltheria indica), 'ilima (Sida fallax), and indigo (Indigofera suffruticosa). Locally common are patches of pili grass (Heteropogon contortus). A few trees of the native false sandalwood or naio (Myoporum sandwicense) were observed nearby but not within the proposed corridor.

As one proceeds upslope, the woody components gradually increase and an open shrubland composed primarily of koa-haole (Leucaena leucocephala), 6 to 9 ft. tall, with scattered stands of kiawe trees, 12 to 15 ft. tall, is found. Other shrubs which are commonly observed here include lantana (Lantana camara), a'ali'i (Dodonaea viscosa), Christmas berry (Schinus terebinthifolius), and pluchea (Pluchea symphytifolia). A few scattered trees of 'ohi'a (Metrosideros polymorpha) can also be found, usually on the 'a'a flows. Again fountain grass is the most abundant ground cover.

The open shrubland gradually passes into a closed shrubland on the higher portions of the project site above 600 ft. elevation. Here Christmas berry forms a dense tangle with scattered trees of silk oak (Grevillea robusta). Koa-haole occurs here but in smaller numbers along with lantana, guava (Psidium guajava), pluchea, 'ilima, alahe'e (Canthium odoratum), and a'ali'i. Although fountain grass is still the most abundant grass, in some

areas molasses grass (Melinis minutiflora) is locally abundant.

DISCUSSION

No officially listed, proposed or candidate threatened and endangered plant species (U. S. Fish and Wildlife Service 1985) were found on the water transmission line corridor during the course of this survey. Studies made of the vegetation on the makai portion of Kohana-Iki and 'O'oma II (Char 1986; Char and Kjargaard 1986) have resulted in similiar findings.

A few species considered rare, such as the native kolomona (Senna gaudichaudii) and 'ohe (Reynoldsia sandwicensis), are known to occur on nearby lands (Char 1988; Linney and Char, in prep.).

The proposed project should not have a significant negative impact on the vegetation as the most abundant components are introduced species, i.e., fountain grass and Christmas berry. 'A'a flows, largely devoid of vegetation, also cover portions of the project site. Of a total of 41 species inventoried, 29 (71%) are introduced; 9 (22%) are indigenous, i.e., native to the Hawaiian Islands and elsewhere; 2 (5%) are endemic, i.e., native only to the islands; and 1 (2%) is originally of Polynesian introduction.

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APPENDIX
PLANT SPECIES LIST
KOHANA-IKI RESORT PROJECT
WATER SOURCE DEVELOPMENT

In the following species list, the plants are divided into three groups: Ferns, Monocots, and Dicots. Taxonomy and nomenclature of the Ferns follow Lamoureux (1984). The flowering plants, Monocots and Dicots, are in accordance with Wagner et al. (in press). Common English names used follow St. John (1973), in most cases; Hawaiian names used follow Porter (1972) or St. John (1973).

The checklist provides the following information:

1. Scientific name with author citation.
2. Common English or Hawaiian name, when known.
3. Biogeographic status of each species. The following symbols are used:
   E = endemic = native only to the Hawaiian Islands
   I = indigenous = native to the islands and also to one or more other geographic area(s)
   P = Polynesian introduction = plants brought to the islands prior to Western contact (1778); not native
   X = introduced or exotic = brought here intentionally or accidentally by humans after Western contact; not native.

Scientific name	Common name	Status
FERNS		
NEPHROLEPIDACEAE (Swordfern Family)		
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	swordfern, kupukupu	X
MONOCOTS		
CYPERACEAE (Sedge Family)		
Fimbristylis sp.		I
POACEAE (Grass Family)		
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	lovegrass	X
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili grass	I?
Melinis minutiflora P. Beauv.	molasses grass	X
Panicum maximum Jacq.	Guinea grass	X
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	X
DICOTS		
ANACARDIACEAE (Mango Family)		
Schinus terebinthifolius Raddi	Christmas berry	X
APOCYNACEAE (Dogbane Family)		
Catharanthus roseus (L.) G. Don	Madagascar periwinkle	X
ASTERACEAE (Sunflower Family)		
Emilia fosbergii Nicolson	red-pualele	X
Pluchea symphytifolia (Mill.) Gillis	pluchea	X
Tridax procumbens L.	coatbuttons	X
CAPPARACEAE (Caper Family)		
Capparis sandwichiana DC	pua-pilo	E
CONVOLVULACEAE (Morning glory Family)		
Ipomoea indica (J. Burm.) Merr.	koali-'awania	I

Scientific name	Common name	Status
CRASSULACEAE (Orpine Family)		
Kalanchoe pinnata (Lam.) Pers.	air plant	X
EUPHORBIACEAE (Spurge Family)		
Chamaesyce hirta (L.) Millsp.	hairy spurge	X
FABACEAE (Pea Family)		
Acacia farnesiana (L.) Willd.	klu	X
Chamaecrista nictitans (L.) Moench.	partridge pea, lauki	X
Desmodium triflorum (L.) DC	three-flowered beggarweed	X
Indigofera suffruticosa Mill.	indigo, iniko	X
Leucaena leucocephala (Lam.) de Wit	koa, ekoa	X
Pithecellobium dulce (Roxb.) Benth.	'opiuma	X
Prosopis pallida (Hump. & Bonpl. ex Willd.) Kunth	kiawe	X
MALVACEAE (Mallow Family)		
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X
Malvastrum coromandelianum (L.) Garcke	false mallow	X
Sida fallax Walp.	'ilima	I
MYRTACEAE (Myrtle Family)		
Metrosideros polymorpha Gaud.	'ohi'a, 'ohi'a-lehua	E
Psidium guajava L.	guava	X
NYCTAGINACEAE (Four-o'clock Family)		
Boerhavia repens L.	alena	I
PASSIFLORACEAE (Passion flower Family)		
Passiflora foetida L.	scarlet-fruited passion flower	X
PLUMBAGINACEAE (Leadwort Family)		
Plumbago zeylanica L.	'ilie'e	I
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	common purslane	X
Portulaca pilosa L.	'ihi	X

Scientific name	Common name	Status
PROTEACEAE (Protea Family)		
Grevillea robusta A. Cunn.	silk oak	X
RUBIACEAE (Coffee Family)		
Canthium odoratum (G. Forster) Seem.	alahe'e	I
Morinda citrifolia L.	noni	P
SAPINDACEAE (Soapberry Family)		
Dodonaea viscosa Jacq.	a'ali'i	I
STERCULIACEAE (Cacao Family)		
Waltheria indica L.	'uhaloa, hi'aloa	I?
VERBENACEAE (Verbena Family)		
Lantana camara L.	lantana, lakana	X
Stachytarpheta urticifolia (Salisb.) Sims	nettle-leaved vervain	X

Terrestrial Vertebrate Animals of the Kohanaiki Development Site

By Andrew J. Berger

This report was prepared on instructions received from Mr. Edward K. Harada, Manager of M & E Pacific, Inc. of Hilo, Hawaii, in letters dated July 22 and October 31, 1988. Mr. Harada met Ms. Winona Char and me at the Kona Airport on the morning of November 18. 1988. Our field work was completed that day.

The Habitat

The project site is the most depauperate of any area where I have worked in the Hawaiian Islands during the past 25 years. Most of the project site is covered either by 'a'a lava or by pahoehoe lava. The 'a'a is virtually devoid of any vegetation, as well as birds. The pahoehoe lava is heavily covered by a dense growth of fountain grass (Pennisetum setaceum), a nuisance plant introduced from Africa. The dead grass burns hot and spreads rapidly and is especially damaging where it serves as a ground cover under the endemic ohia lehua (Metrosideros collina). Other introduced plants, widely scattered, include klu (Acacia farnesiana), indigo (Indigofera suffruticosa), kiawe or mesquite (Prosopis pallida), koa-haole (Leucaena glauca), and christmasberry (Schinus terebinthifolius). There are no endemic ecosystems anywhere near the project site.

The Amphibians

There are no endemic amphibians in the Hawaiian Islands. All, therefore, have been introduced by man. None are endangered

and none are of significance for an environmental impact statement. Four species of frogs have been introduced to the Hawaiian Islands. Of these, three have been introduced to the Big Island.

A. Family Ranidae, True Frogs

1. Bullfrog (Rana catesbeiana).

2. Wrinkled frog (Rana rugosa).

B. Family Buffonidae, True Toads

3. Giant Neotropical Toad (Bufo marinus)

The bullfrog is native to North America, the wrinkled frog is native to Japan, and the neotropical toad is native to Mexico southward into South America (McKeown, 1978). All require water for their breeding activities (Hunsaker and Breese, 1967). The bullfrog is known to be a predator on the downy young of the endangered Hawaiian duck or Koloa (Anas wyvilliana), and probably is so for the downy young of the other endangered Hawaiian waterbirds. The neotropical toad is (because of the highly toxic skin glands on their back) a hazard to dogs and to children who get the milk white poison in their mouth or eyes.

The Reptiles

There are no endemic land reptiles in the Hawaiian Islands. All, therefore, have been introduced (either intentionally or unintentionally) by man, None is an endangered species and none is of any importance for an environmental impact assessment.

A. Family Typhlopidae, Blind Snakes

1. Blind snake (Typhlina bramina)

"This small, secretive snake was apparently introduced

from the Philippines in the dirt surrounding plants that were brought in for landscaping the campus of the Kamehameha Boys School in Honolulu. It was first found there in January of 1930"(Oliver and Shaw, 1933). These blind, worm-like snakes are rarely seen until they are flooded from underground burrows by heavy rains or unless one looks for them under branches and other debris on the ground. These small harmless snakes are of no significance for an environmental impact assessment and I did not look for them. They are found on all of the main islands in the chain (McKeown, 1978).

B. Family Iguanidae, Iguanid lizards

2. Green anole lizard (Anolis carolinensis porcatus)

C. FamilyGekkonidae, Geckos

3. Mourning gecko (Lepidodactylus lugubris)

4. Stump-toed gecko (Gehyra mutilata)

5. Tree gecko (Hemiphyllodactylus typus)

6. Indo-Pacific gecko (Hemidactylus garnoti)

7. House gecko (Hemidactylus frenatus)

D. Family Scincidae, Skinks

8. Metallic skink (Leiolopisma metallicum)

9. Snake-eyed skink (Cryptoblephanus boutoni)

10. Moth skink (Lipinia noctua)

These skinks and geckos of the Big Islands are irrelevant to an impact assessment, in part, because they adapt well to both urban and rural areas and because all are alien species in Hawaii.

The Birds

Three different groups of birds are found in the Hawaiian Islands: 1. endemic or unique, 2, indigenous or native, and 3. introduced or alien.

I. Endemic birds

These are birds that are unique to the Hawaiian Islands; they do not occur naturally in any other part of the world (Berger, 1981). At least 40 percent of these unique birds are already extinct and another 40 percent are now classified as endangered or threatened with extinction. Nearly all of these endangered Hawaiian birds are either forest birds or waterbirds. There is no native forest anywhere near the project site, nor is their any habitat for the endangered waterbirds on or adjacent to the site. Neither I nor Kjargaard (1986) saw any endemic birds either mauka of Queen Kaahumanu highway or makai of the highway (i.e., in the region of the proposed Kohanaiki Resort community). I mention the following two species only because I have seen them both north (along Mamalahoa Highway) of the project site as well as in South Kona.

A. Order Falconiformes

a. Family Accipitridae, Hawks

1. Hawaiian Hawk or 'Io (Buteo solitarius)

This endemic hawk is an adaptable species, feeding on spiders, insects, mammals (especially mice), and both endemic and introduced birds Berger (1981). Similarly, Scott and his co-workers wrote (1986) that the "'I'o occupies a broad range

of habitats from papaya and macadamia orchards through virtually all types of forest including ohia rain forest and subalpine mamane-naio woodland." Moreover, Griffin (1985, Abstract to Thesis) found "no differences . . . in success of 'io nests in habitats dominated by native (77%) versus exotic (65%) vegetation." Griffin also found the home range of this hawk to be 1,104 acres, and he wrote that "given the abundance, wide distribution, and high reproductive success of this species . . . , it seems appropriate to reevaluate its endangered status" (Griffin, 1984).

Regardless of its status (i.e., endangered or non-endangered), this hawk has a large home range where it forages for food, it has adapted to man's orchards and pastures, and there is no habitat for this hawk in the project area.

B. Order Strigiformes

a. Family Strigidae, Typical Owls

2. Hawaiian owl or Pueo (Asio flammeus sandwichensis)

The Pueo is a subspecies of the North American short-eared owl. It is a permanent resident on all of the main islands. The Pueo is not considered endangered on the island of Hawaii. The birds occur from sea level to at least 8,000 feet on Mauna Kea and Mauna Loa. This owl differs from most other owls in that it is diurnal in habits, typically being seen soaring either low or high over pastures and brushland looking

for prey, which consists largely of mice and rats. I did not see any Pueo during my field studies, nor did Kjargaard (1986) report this species makai of the highway.

II. Indigenous birds

These are species that are native to the Hawaiian Islands but whose total range also includes other islands in the Pacific Ocean and/or in North America. These native birds are the black-crowned night heron, 22 species of seabirds, and a number of migratory ducks and shorebirds that spend the winter or non-breeding season in the islands.

There is no habitat for any of these native birds in the project area. One species does need to be mentioned, however, because Kjargaard (1986) saw one bird "about one-half kilometer up the coast from the Mangrove patch in Kohana-iki (very close to the northern boundary of the parcel)." This bird is:

A. Order Ciconiiformes

a. Family Ardeidae, Herons and Egrets

1. Black-crowned Night Heron (Nycticorax n. hoactli)

This subspecies has a breeding range that includes Hawaii and the Western Hemisphere from Washington and Oregon southward to northern Chile and south-central Argentina. Because the Hawaiian birds are considered to be the same subspecies as the continental birds, they are not classified as endangered, even though their continued survival in Hawaii depends on the preservation of the same wetlands that are critical to the other Hawaiian waterbirds.

These herons feed on a wide variety of aquatic and terrestrial life: for example, fish, frogs, crayfish, mice, and insects. In Hawaii, they also eat the downy young of some seabirds and probably the downy young of the endangered Hawaiian waterbirds. They also relish prawns, and the State Land Board gave prawn producers a "120-day permit to destroy black-crowned night herons which have been causing economic havoc at Oahu's Kahuku prawn farm as well as other aquaculture farms statewide" (Honolulu Star-Bulletin, October 26, page A-8 and October 30, front page, 1985).

However, this heron is very uncommon on the Big Island. Personnel of the State Division of Forestry and Wildlife counted only nine herons on the island during their semiannual waterbird census on July 27, 1983, and only eight birds during January 1986, and only seven birds during the winter of 1987 (Bachman and Walker, 1986; Engilis, Walker, and Lum, 1988). At any rate, there is no habitat for this heron on the project site.

None of the seabirds nest or forage in the vicinity of the project site.

All but one of the many wintering shorebirds and ducks are restricted to ponds, mud flats, and mountain streams. I did not find any in the project area nor would I expect to see them there.

The most conspicuous of the migratory species is the lesser golden plover (Pluvialis dominica fulva), which occurs from sea level to elevations of nearly 10,000 feet on Maui and Hawaii during the winter months. This plover frequents lawns in residential areas, golf courses, weedy pastures, open areas

in the mountains. cane haul roads, grassy areas around air fields, and mud flats. On page 1 of this report, I mentioned the depauperate nature of the project site. I did not see a single plover on the project site. I would expect to find them only along the shore line at the proposed Kohanaiki Resort area.

III. Introduced birds

More than 170 species of exotic or alien bird species have been introduced to the Hawaiian Islands since 1796 (Berger. 1981). Approximately 50 species have established breeding populations in the islands. The depauperate nature of the project site is demonstrated clearly by the few species of birds actually found on it. Only three species of birds were actually seen on the project site itself. The birds discussed below are included because they occur makai of the Queen Kaahumanu highway either at the Kona airport or on the lands of the proposed Kohanaiki Resort Community. The reason for doing this is two-fold: first, my field studies on the project site itself were confined to November 18, 1988, and, secondly, some other bird species may fly over the project site from time to time. It should be emphasized, however, that most of the project site does not provide food and cover for any of these bird species.

A. Order Galliformes

a. Family Phasianidae, Pheasants, quails, francolins.

1. Indian Gray Francolin (Francolinus pondicerianus)

This francolin is a bird of dry grasslands, tropical thorn-scrub country, and subtropical dry forests at elevations

up to 1,500 feet. It often is found near Indian villages and cultivated land. In India, its native country, this bird is often kept as a fighting bird. About 1,700 gray francolins were imported by the State Division of Fish & Game between 1959 and 1962. Kjargaard (1986) found this francolin in arid grassland and in kiawe scrub at lower elevations.

B. Order Columbiformes

a. Family Columbidae, pigeons and doves

2. Rock dove or feral pigeon (Columba livia)

The pigeon probably was the first exotic bird that was introduced to the Hawaiian Islands; its importation has been traced back to 1796. Schwartz and Schwartz (1949) wrote that feral pigeons roost and nest the year around in sheltered portions of cliffs along the sea coast, in rocky gulches, and in collapsed lava tubes up to 10,000 feet on Mauna Kea. These authors also found heavy parasitism of feral pigeons by tapeworms, and they stated that the tapeworm infestation retards proper nutrition and "occludes the intestines, produces undesirable toxins, and hinders breeding." Navvab Gojrati (1970) reported infection by bird malaria, Haemaptoteus, and Leucocytozoon in birds at the Honolulu Zoo. Kishimoto and Baker (1969) reported finding the fungus Cryptococcus neoformans in 13 out of 17 samples of pigeon droppings collected on Oahu. The full significance of their finding was never determined in Hawaii, but, in man, this fungus causes a chronic cerebrospinal meningitis, and Hull (1963) remarked

that "in all but the cutaneous forms the prognosis is very grave." The rock dove was reported in kiawe scrub by Kjargaard.

3. Spotted or Lace-necked Dove (Streptopelia chinensis)

Also called the Chinese dove, this Asian species was released in the Hawaiian Islands at an early date; the exact date appears to be unknown, but the birds are said to have been very common on Oahu by 1879. Although this species occurs where the annual rainfall exceeds 100 inches, the highest densities are found in drier areas, especially where the alien kiawe or mesquite is the dominant plant. Schwartz and Schwartz (1949), for example, reported densities as great as 100 birds per square mile in dry areas on Molokai. Although it is classified as a game bird in Hawaii, only 14 birds were shot during the 1986-1987 game bird season on the island. Although a common species in the Kona region, I did not see any during my field studies, nor did Kjargaard find it at the lower elevations.

4. Barred Dove or Zebra Dove (Geopelia striata)

This dove is native to Australia and the Orient, where it is called the zebra dove. The species is said to have been introduced to Hawaii sometime after 1922 (Bryan, 1958). It now is an abundant species on all of the islands. This dove also prefers the drier areas. Schwartz and Schwartz (1949) reported densities as high as 400 to 800 birds per square mile in some areas on Oahu: for example, Barber's Point to Makaha. This dove also is classified as a game bird in Hawaii, although, because of its small size, only two birds were shot on Hawaii during the 1986-1987 season

(Bachman and Walker, 1987). One study of the food habits in Hawaii revealed that the diet consists of 97 percent seeds and other plant materials; the 3 percent animal matter included several species of beetles. weevils, and wireworm larvae. Kocan and Banko (1974) reported on zebra doves from the Big Island that were infected with trichomonas; this parasite has "catastrophic effects" on doves in North America. I was surprised not to find this dove on the project site, but Kjargaard found it along the coast in strand habitat, in the mangrove patch, and in kiawe scrub.

C. Order Strigiformes

a. Family Tytonidae, Barn Owls

5. Barn Owl (Tyto alba pratincola)

Barn owls differ from other owls in that they have a heart-shaped facial disc of feathers, hence the name of "monkey-faced" owl. Barn owls were first released on the island of Hawaii during 1958 (Tomich, 1962; Berger, 1981). Like the mongoose much earlier, the owls were released in the hope that they would help to control rats in the sugarcane fields. Few studies of the food habits of the barn owl have been made in Hawaii, but one study showed that on Hawaii island about 90 percent of the food consisted of house mice (Tomich, 1971). Byrd and Telfer (1980) reported that barn owls on Kauai and on Kaula island had killed more than 100 seabirds and their chicks. "The known spread of the Barn Owl in Hawaii to grazing land and to forested areas suggests . . . that this species has done no more in controlling rats in the sugarcane fields than did

the mongoose" (Berger, 1981:182). Barn Owls are nocturnal in habits and I did not see any during my daytime field studies. However, Kjargaard (1986) flushed one owl from its roosting site "in the Mangrove patch on the morning of the 10th."

D. Order Passeriformes

a. Family Timaliidae, Babblers and Laughing-thrushes

6. Melodious Laughing-thrush (Garrulax canorus)

This Asian species formerly was called the Chinese thrush (a petstore name), but this bird is not a thrush (family Turdidae) but rather a babbler. The Chinese name is Hwa-mei. This species was first introduced as a cage bird but birds were later brought in and released on most of the islands. This bird now occurs on Hawaii from near sea level to elevatinns at least as high as 8,000 feet (Berger, 1981). The species prefers areas with fairly dense thickets and higher rainfall. There is no habitat for this species in the project area. However, Kjargaard (1986) saw one bird "near the coastal jeep road south of the Mangrove patch in a patch of Kiawe trees." As Kjargaard points out, this is a most unusual habitat for this laughing-thrush.

b. Family Zosteropidae, White-eyes and Silver-eyes

7. Japanese White-eye (Zosterops japonicus)

This white-eye is native to the main islands of Japan, from Honshu to Kyushu and the islands lying between Japan and Korea. The very first Japanese white-eyes (also Mejiro) were released on Oahu by the Territorial Board of Agriculture

and Forestry in 1929 (Caum, 1933). At least 252 white-eyes were released on the island of Hawaii during June 1937 (Berger, 1975b).

The white-eye present an example par excellence of the success of introduced birds. This species now occurs on all of the main islands, is found from sea level to tree line on Maui and Hawaii, and inhabits very dry regions (e.g., Kawaihae) and those with 300 or more inches of rain per year. There is virtually no habitat in Hawaii that is not occupied by the Japanese white-eye. This is one of three species of birds found on the project site, where it was seen in the small clump of kiawe trees,

White-eyes eat insects, nectar, soft fruits, the pulp of berries, and flower buds, so that they can be a serious pest to farmers. The California State Department of Agriculture is greatly concerned about the accidental release of a related species (gray-backed white-eye, Z. palpebrosa) at San Diego. Two pairs escaped there in 1973 or 1974; 150 offspring had been captured in less than 10 years. "Estimates of the potential loss in soft-fruit crops, should white-eyes even begin to multiply rapidly and establish large populations, run as high as $2 million a year" (Audubon Magazine, September 1982).

c. Family Sturnidae, Starlings and Mynas

8. Common Indian Myna (Acridotheres tristis)

This myna is native to India, West Pakistan, Nepal, and adjacent regions. The myna was introduced from India "in 1865 by Dr. William Hillebrand to combat the plague of army worms that was ravaging the pasture lands of the islands. It has spread and multiplied to an amazing extent; reported to be

abundant in Honolulu in 1879; it now is extremely common throughout the territory" (Caum, 1933). The myna is common to abundant in lowland areas of all of the inhabitedislands, being most common in residential areas and in the vicinity of house and barns in rural areas. I have seen mynas sitting on the backs of cattle at South Point as well as at elevations of 7.500 feet on Mauna Kea. However. I saw none on the project site itself, but did see two birds fly across the Kaahumanu Highway.

d. Family Ploceidae, Weaverbirds and Their Allies

(1) Subfamily Estrildinae, Waxbills

9. Warbling Silverbill (Lonchura malabarica cantans)

I mention this species only because it is so widespread on the Kona coast of the Big Island, I did not see any birds on the project site or adjacent to it. There are no published records of the release of this species in Hawaii (Bryan, 1958; Berger, 1975a). It is assumed that cage birds were released on the Puuwaawaa ranch. probably during the 1960s. I first discovered this African silverbill near Kawaihae on March 22, 1972 (Berger, 1975a). Later observations have revealed that large populations have become established on the leeward slopes of the Kohala Mountain as well as in south Kona (Pyle, 1987).

Silverbills are seed eaters, and with the other seed-eating birds already established on the Big Island will make the harvesting of small grain crops virtually impossible (see house finch, to follow).

10. Nutmeg Mannikin or Ricebird (Lonchura punctulata)

Also known as the spotted munia, this species has a wide distribution in Sri Lanka, India, Nepal, Burma, and southward into Malaysia and the Indo-Chinese subregion. The species was introduced to Oahu by Dr. William Hillebrand in 1865 (Caum, 1933). Caum wrote that this species feeds on "seeds and grasses and does considerable damage to green rice." Although rice is no longer grown in Hawaii, this seed-eating bird continues to be a pest for certain agricultural crops (see explanation under house finch). Ricebirds are highly gregarious and flocks of 75 or more birds are not uncommon at certain times of the year. This is a prolific species and I have found active nests in every month of the year. They occur in pastures, golf courses, along dirt roads and canehaul roads, weedy fields, and in residential areas, wherever there are weed seeds. I did not see any ricebirds on the project site, but Kjargaard saw a small flock along the outer edges of the mangrove patch and nearby kiawe thickets.

(2) Subfamily Passerinae, Sparrow Weavers

11. House Sparrow (Passer domesticus)

Also incorrectly called the English sparrow, nine birds were first imported from New Zealand in 1871. Caum (1933) wrote that "whether or not there were further importations is not known, but the species was reported to be numerous in Honolulu in 1879." The house sparrow now is an abundant species on all of the

islands, typically being found in the vicinity of man and his buildings but they also forage in outlying areas. In North America, this house sparrow was first introduced in Brooklyn, New York, in 1852, were it became a serious pest; tens of thousands of dollars were spent in attempting to control the populations (Dearborn, 1912). This sparrow apparently never beacame a pest in Hawaii. The species is omnivorous in diet, eating weed seeds as well as insects and their larvae (see, Rana and Idris, 1986; Babu, 1988). I did not find this sparrow in the project area; it does occur at the Kona airport and in the kiawe thickets at lower elevations (Kjargaard, 1986).

e. Family Fringillidae, Cardinals, Buntings, and Sparrows

(1) Subfamily Emberizinae

12. Yellow-billed Cardinal (Paroaria capitata)

This cardinal is native to parts of Brazil, Paraguay, southeastern Bolivia, and northern Argentina, where it prefers a shrubby habitat in humid areas. The first reference to this species in Hawaii is that made by Brian A. Pedely, who saw a bird in Kailua-Kona on November 3, 1973 (Elepaio, 34:95). This species has since been seen at the City of Refuge, at Opaeula and Aimakapa ponds, and at Honokohau boat harbor (Berger, 1981). This is one of the two species that was found on the project site itself. A dozen birds in three small flocks were seen in the kiawe trees at the south side of the site.

(3) Subfamily Cardinalinae

13. Northern Cardinal (Cardinalis cardinalis)

Also called the Virginia cardinal, Kentucky cardinal, and Kentucky redbird, this species was released several times between 1929 and 1931 (Caum, 1933; Berger, 1975b, 1981). On Hawaii island it occurs from sea level to at least 7,500 feet on Mauna Kea and Mauna Loa. The species inhabits very dry areas and those with a high annual rainfall. I did not find this species in the project area but they were recorded by Kjargaard at lower elevations in the proposed kohanaiki resort area.

(4) Subfamily Carduelinae, Goldfinches and Allies

14. House Finch (Carpodacus mexicanus frontalis)

This seed-eating finch is native to North America. Birds were first brought to Hawaii "prior to 1870, probably from San Francisco" (Caum, 1933). It now is an abundant species on all of the islands, in residential areas, rural areas, and in the high ranch and open forest lands on Maui and Hawaii. It probably is the second most common song bird in the islands. Although the birds sometimes eat overripe papaya (hence, the local name of Papayabird), the house finch in predominantly a a seed-eater. House finches and ricebirds caused great damage to experimental crops of sorghum planted on Kauai and Hawaii during 1971-1972, "A report by the Senate Committe on Ecology, Environment, and Recreation says that ricebirds and linnets [equals house finch] caused a 30 to 50 percent loss in the sorghum fields at Kilauea on Kauai last year. . . . Seed-eating birds at Kohala ate about 50 tons of sorghum grain in a 30-acre

experimental field that was expected to produce 60 tons" (Honclulu Advertiser, March 14, 1972. page B-2). Hence, the growing of small grain crops on the island is not a promising potential for the much talked-about "diversified agriculture" in the State. Two other seed-eating birds (the silverbill and the Java sparrow) also have become established on the island of Hawaii since 1972.

Although the house finch is an abundant species in the entire Kona region, I did not see any on the project site itself, presumably because the 'a'a lava and the pahoehoe lava with its covering of fountain grass do not provide any suitable habitat for this finch.

The Mammals

I. Endemic Mammals

The only endemic land mammal in the Hawaiian Islands is the Hawaiian bat (Lasiurus cinereus semotus), a subspecies of the American hoary bat. This bat occur primarily on the islands of Kauai and Hawaii. It is most common on Hawaii, and has been seen from sea level to 13,200 feet elevation (Kramer, 1971; Tomich, 1986). Tomich wrote that "rarity of the hoary bat is a myth which stems from a lack of understanding by the casual observer of how a non-social and scattered population should appear." He added (1974): "The Hawaiian hoary bat is typically a solitary, tree-roosting animal. Occasional specimens are found singly in rock crevices or even in buildings.

Thus, the population is widely scattered." Since he wrote that, the bat also has been found to use lava tubes for roosting. The bats are nocturnal in habits and I did not see any during my daytime field studies. The bats feed on insects at night, and, if any are found in this general area, they would continue to do so after the constructinn is completed.

II. Introduced Mammals.

All of the introduced mammals have proven highly detrimental to man, his buildings, products, agriculture and/or to the endemic forests and their animal life. None of these alien mammals is an endangerdd species and none is of conern as far as detrimental effects on them of any construction or change in land use in the project area. It would, in fact, be a great boon to the islands if it were possible to exterminate all of them.

Some of these mammals were first released in the islands by Captains Cook and Vancouver. Feral cattle (Bos taurus), goats (Capra hircus), sheep (Ovis aries), and pigs (Sus scrofa) have been destroying the Hawaiian native forests since 1800, and they continue to do so today. Apparently only the feral goat inhabits this relatively barren region. Several piles of old goat droppings were found in the area.

With the possible exception of the house mouse (Mus musculus) all of the smaller alien mammals prey on birds, their eggs, and young. These small mammals include the roof rat (Rattus

rattus), Polynesian rat (Rattus exulans), Norway rat (Rattus norvegicus), small Indian mongoose (Herpestes auropunctatus), feral cat (Felis catus), and feral dog (Canis familiaris). The birds that serve as prey for these alien mammals include the endangered forest birds, the endangered Hawaiian waterbirds, as well as domestic poultry. The rats also cause great damage to sugar cane.

I did not attempt to trap the nocturnal rodents because their presence is irrelevant to an impact assessment because all are alien animals and all are pestiferous species. It seems certain that all of them occur in the general area (Kramer, 1971; Tomich. 1986). Dry cat scat was observed in two areas.

Summary and Conclusions

1. The vast majority of plants in the project area are introduced or alien plants, a number of which are pest species. More than 4,500 exotic plants have been introduced to the Hawaiian Islands (St. John, 1973). There is no semblance of any native ecosystem anywhere near the project site. The construction of the pipeline and reservoir will have no adverse effects on any native ecosystem.

2. Because there are no endemic amphibians or land reptiles in the Hawaiian Islands. all of those that are present are alien species. Some (e.g., the bullfrog) pose a threat to endangered Hawaiian waterbirds. All of these introduced animals are irrelevant to an impact assessment.

3. None of the 14 species of introduced birds discussed in this report is an endangered species and a number have proven to be serious pests to agriculture in Hawaii. The destruction to sorghum crops by the ricebird and the house finch already has been discussed. The two species of doves and the myna have been implicated in the spread of such noxious plants as Lantana camara. The Japanese white-eye causes considerable damage to ornamental flowers and to fruit crops (see Keffer, et al., 1976). The barn owl has been reported to kill birds on Kauai, and probably does so on all of the islands.

Moreover, the project area is so depauperate that only two species of birds were actually seen on the site, with a third species (the myna) being seen along the highway.

4. No indigenous bird species inhabit the project site.

5. Although it is possible that the two species of endemic birds (the hawk and the owl) may sometimes fly over the area, because of my previous discussion, it is my considered opinion that any change in the land use of the project site would have no significant impact on either species.

6. The only endemic land mammal in Hawaii is the Hawaiian bat, now classified as an endangered species. The nocturnal, insect-eating bat inhabits urban as well as outlying regions and they would continue to do so when the project is completed.

7. Only goat droppings and cat scat were found on the project site, and no animals were actually seen. Of the remaining alien mammals mentioned in this report, all are serious pests to man, his buildings, products. agriculture, and to the native flora and fauna. The three species of rats prey on the nests of both ground-nesting and tree-nesting brrds, and the mouse and the rats cause great damage to agriculture as well as to homes and businesses. The very common, diurnal mongoose is a serious predator on some of the endangered Hawaiian waterbirds as well as on poultry and other domestic birds. If it were possible to exterminate all of these alien mammals, it would be a great benefit to the Hawaiian Islands. Their possible presence at the project site, therefore, is irrelevant to an impact assessment.

8. Because of the nature of the project site (primarily 'a'a and pahoehoe lave covered with fountain grass) and because of the noticeable scarcity of any introduced birds and mammals on it, there can be no biological reason for not approving this project.

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Report 477-011589

ARCHAEOLOGICAL INVENTORY SURVEY
KOHANA-IKI RESORT WATER DEVELOPMENT PROJECT AREA

Land of Ooma 2, District of North Kona
Island of Hawaii
(TMK:3-7-3-09:5)

by

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SUMMARY

At the request of Mr. Edward Harada, manager of M&E Pacific, Inc., Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the Kohana-Iki Resort Water Development Project Area - Ooma 2 Water System, situated in the Land of Ooma 2, North Kona District, Island of Hawaii (TMK:3-7-3-09:5). The overall objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Assessment (EA) to be prepared in conjunction with a Conservation District Use permit and other development permit applications to be made to the appropriate state and county agencies. The Use permit is required in conjunction with the client's proposal to develop deep water wells, reservoirs, and water transmission facilities within a 200 ft-wide corridor along the boundary separating the Lands of Ooma II and Kohanaiki.

Field work was conducted on January 4 and 11, 1989. During field work, four sites were identified within the proposed corridor. The sites consist of both single and multiple features. Feature types in the project area include pits, wall, cave, rockshelter, terraces, and papamu. Functional types include ceremonial, quarrying, marker, and boundary or agriculture. Excepting one site, the sites appear to be prehistoric. Three of the four sites are assessed as significant solely for information content, and no further work is recommended for the sites. The remaining site, a complex which may have been used for ceremonial purposes, is assessed as significant for information content, cultural value, and interpretive value. On the basis of the field work and on discussions with Dr. Ross Cordy of DLNR-HSS, the site is recommended for "preservation as is."

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INTRODUCTION

BACKGROUND

At the request of Mr. Edward Harada, manager of M&E Pacific, Inc., Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the Kohana-Iki Resort Water Development Project Area - Ooma 2 Water System, situated in the Land of Ooma 2, North Kona District, Island of Hawaii (TMK:3-7-3-09:5). The overall objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Assessment (EA) to be prepared in conjunction with a Conservation District Use permit and other development permit applications to be made to the appropriate state and county agencies. The Use permit is required in conjunction with the client's proposal to develop deep water wells, reservoirs, and water transmission facilities within a 200 ft-wide corridor along the boundary separating the Lands of Ooma II and Kohanaiki.

Field work was conducted on January 4 and 11, 1989, by PHRI Supervisory Archaeologist Margaret L.K. Rosendahl and PHRI Field Archaeologist David Statler. Approximately 32 man-hours of labor were expended in conducting the field work. Upon completion of the field work, findings and preliminary conclusions--including tentative evaluations and recommendations--were discussed with Dr. Ross Cordy of the Department of Land and Natural Resources-Historic Sites Section (DLNR-HSS). The project findings and tentative evaluations and recommendations will be formally reviewed by the DLNR-HSS and the Hawaii County Planning Department (HCPD) upon submission of this final report.

SCOPE OF WORK

The basic purpose of the survey was to identify--to discover and locate on available maps--all sites and features of potential archaeological significance present within the specified project area. Formerly called a reconnaissance survey and more recently referred to as an inventory survey, the proposed survey comprises the initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources within a specified project area. This level of survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. It permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include intensive survey--data collection involving detailed recording of sites and features, and selected test excavations; and possibly subsequent mitigation--data recovery research excavations, construction monitoring,

interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The basic objectives of the survey were four-fold: (a) to identify (find and locate) all sites and site complexes present within the specified project area; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the general scope of any subsequent data collection and/or mitigation work that might be necessary or appropriate.

The inventory survey was carried out in accordance with the minimum requirements for reconnaissance-level survey recommended as standard by the Society for Hawaiian Archaeology (SHA). These standards are currently used by the HCPD and DLNR-HSS as guidelines for review and evaluation of archaeological reconnaissance survey reports submitted in conjunction with various development permit applications.

PROJECT AREA DESCRIPTION

The Land of Ooma 2, which was set aside as government land during the Great Mahele, is situated on the lower southwestern slope of Hualalai Volcano, in the region of Kekaha which includes those lands from Honokohau northward to Puuanahulu (Springer 1985:87). The principal environmental features of Kekaha are the dry, hot climate of the region and the extensive lava fields, many of which have little to no soil accumulation. Average annual rainfall in the vicinity is 10-20 inches, with a slightly lower average along the coastal zone (Armstrong 1983:57). Temperature in the vicinity is 70-76 degrees F (DLNR 1970:81).

The Kohana-Iki Resort Water Development project area consists of a corridor extending approximately 10,000 feet between Queen Kaahumanu Highway and an undeveloped parcel and rising in elevation (seaward-inland) from 80-760 feet above mean sea level (Figure 1). The corridor is situated immediately north of the boundary between the Lands of Kohanaiki and Ooma 2nd and is generally about 200 ft wide. At the 200-foot elevation, in an area where construction of water storage reservoirs is proposed, the width of the site is 500 feet.

The terrain of the project area is generally very uneven and consists of prehistoric pahoehoe and aa flows derived from Hualalai Volcano (Macdonald et al. 1983:353); the aa flows dominate the area. Vegetation in the project area is very thick in the inland portion of the corridor and thins out at lower elevations. Vegetation in the inland portion consists predominantly of Christmas-berry (Schinus terebinthifolius Raddi), koa-haole (Leucaena leucocephala [Lam.] de Wit), and a dense ground cover of fountain grass (Pennisetum setaceum [Forsk.] Chiov.); plus scattered lama (Diospyros sp.), a'ali'i (Dodonaea eriocarpa), alahe'e (Canthium odoratum [Forst.]), kiawe (Prosopis pallida [Humb. and Bonpl. ex Willd.] HBK.), Lantana (Lantana camara L.), silver oak (Grevillea robusta

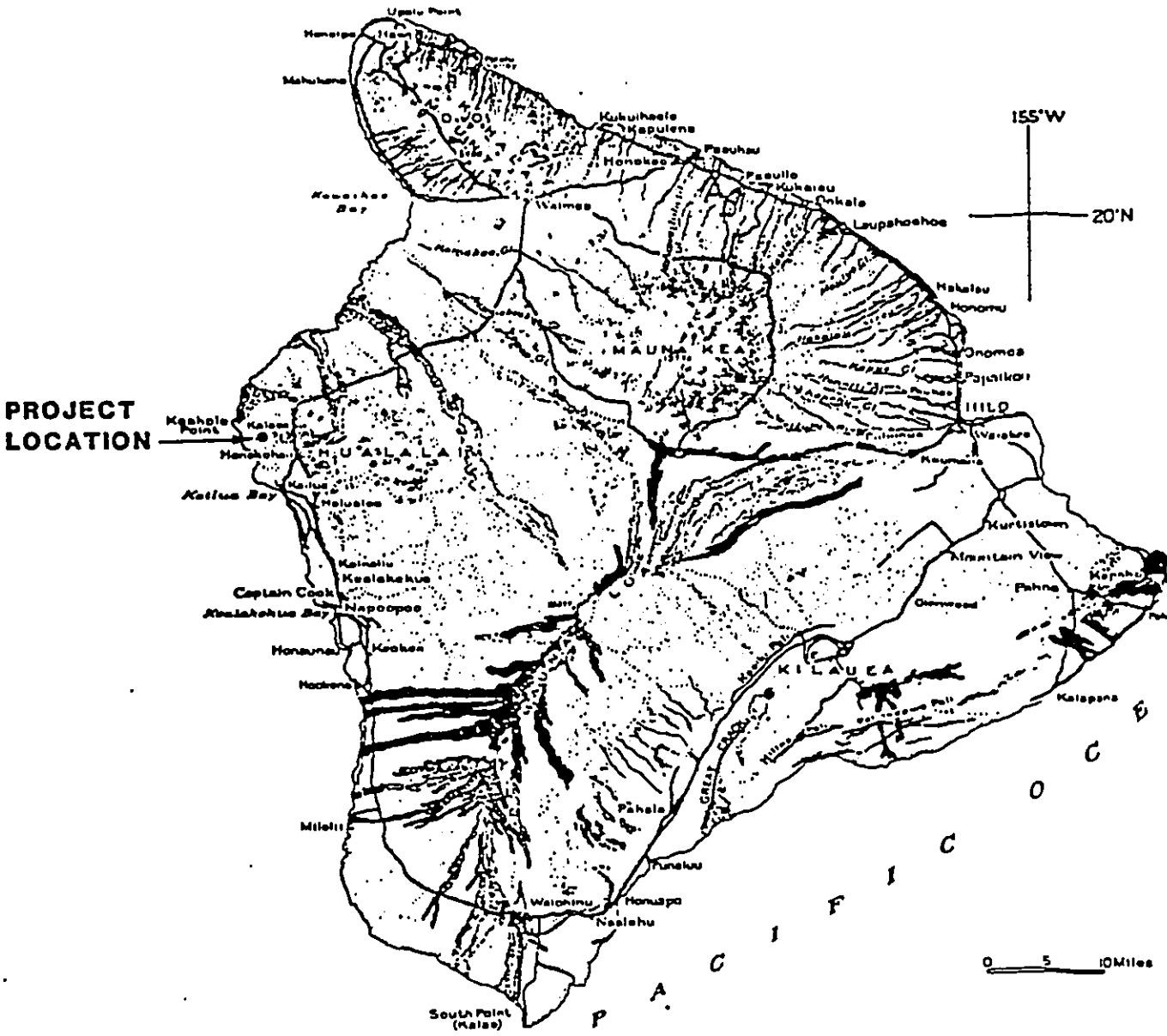

Figure 1. PROJECT LOCATION MAP

Archaeological Inventory Survey
Kohana-Iki Resort Water Development Project Area
Land of Ooma 2, District of North Kona
Island of Hawaii (TMK:3-7-3-09:5)

PHRI 88-477 January 1989

(Map taken from Macdonald and Abbott 1970:288.)

[A. cunn.]), and 'ilima (Sida fallax Walp.). Vegetation in lower elevations consists mostly of a cover of dense fountain grass, and scrub koa-haole, Christmas-berry, and a few isolated kiawe trees.

PREVIOUS ARCHAEOLOGICAL WORK

There have been numerous previous studies within the general vicinity of the present project area; most of these studies focused on the coastal section of Ooma 2. A detailed review of many of these previous studies is presented in Donham (1987:7-10). The following is an abbreviated version of the review in Donham (Donham 1987:7-10):

> The earliest recorded field work recorded for Ooma II was conducted for the Bernice P. Bishop Museum (BPBM) in 1930 by John E. Reinecke (1930), who located major coastal sites in the Districts of North Kona and South Kohala. Reinecke recorded twelve sites along the Ooma II coast (Sites 66-75), seven of which have been correlated with BPBM sites later recorded by Cordy (1986a:27). Reinecke's observations suggest that a number of shoreline structures have been totally washed away by storm waves. He observed "sand-covered platforms" along the beach at Site 66, which were interpreted as the site of "6-10 homes" (1930:15). He also observed that "(t)here are many faint traces of sites along this strip of coast" (1930:16).
>
> In 1971-72, the Hawaii Department of Land and Natural Resources began an inventory of known archaeological sites and revisited a number of sites located by Reinecke. State inventory numbers were assigned to seven coastal sites at this time by B.J. Martin, who completed Hawaii Register of Historic Places (HRHP) forms.
>
> The most intensive prior archaeological work conducted within the project area was done in late 1975 by Ross H. Cordy, who conducted a coastal survey and site testing program in selected areas of West Hawaii. Data collected at Ooma II were incorporated with data from seven other North Kona ahupua'a and were synthesized as part of Cordy's doctoral dissertation research (Cordy 1981).
>
> Between 1975 and 1985, a number of survey projects were conducted in the vicinity of the Keahole Airport and Agricultural Park Area, north of the project area. These surveys are summarized in an overview study of the Ooma and Kalaoa ahupua'a prepared by Cordy (1985).
>
> Additional field work was conducted at Ooma II in 1985 by William J. Barrera, Jr., who undertook a reconnaissance-level survey of the Ooma II Resort project area for Helber, Hastert, Van Horn & Kimura (Barrera 1985). Due to problems with

> Barrera's report and level of work, Helber, Hastert, Van Horn & Kimura requested a review and field check of the Barrera work by Dr. Cordy of the Historic Sites Section-DLNR. Cordy returned to Ooma II and examined the northern one-third of the inland survey area, as well as a small section of the northern coastal survey area (Cordy 1986b).

The most recent archaeological work in the vicinity of the project area was conducted by Donham (1987). Seventy-four sites with 279 component features were identified within Donham's 314-acre coastal parcel project area. Donham's age determination analysis indicated that the coastal parcel was occupied from AD 1430 to 1855 (narrower occupation span of AD 1550 to 1755 for the temporary sites) (Donham 1987:ii).

FIELD WORK PROCEDURES

Field investigations were conducted January 4 and 11, 1989, by PHRI Supervisory Archaeologist Margaret L.K. Rosendahl and PHRI Field Archaeologist David Statler. Thirty-two man-hours of labor were expended in conducting the field work. Prior to the field work, the property boundaries had been marked with range poles and flagged bamboo poles; these poles had been placed at irregular but intervisible intervals along both the southern and northern boundaries.

The corridor was inspected by means of pedestrian sweeps; distance between sweeping crew members was approximately 10 to 15 m. The first day of field work was spent covering the seaward half of the project area; the second day covered the inland half. On the second day, in order to gain access to the inland area, a helicopter was used. Kona Helicopters dropped the survey crew off at the inland extent of the corridor; the crew then proceeded to examined the inland area while walking toward Queen Kaahumanu Highway. In the inland area, ground surface visibility was generally poor due to thick fountain grass and many medium-sized trees.

Identified sites were assigned sequential PHRI temporary site numbers (beginning with T-1) and sites were plotted on a tax map of the project area. Later, sites were assigned the following permanent SIHP (State Inventory of Historic Places) site numbers: 5696 (T-1), 5697 (T-2), 5698 (T-3), 5699 (T-4). Descriptive data and feature dimensions for the sites were recorded on standard PHRI site survey record forms. Sites were then photographed using 35 mm black and white film (PHRI Roll No. 477-1. Subsequent to recording, the sites were marked with bright pink flagging tape, and were tagged with an aluminum tag denoting the temporary site number, the PHRI project number (88-477), the letters "PHRI," and the date.

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*State Inventory of Historic Places (SIHP) site designation system: all four-digit site numbers prefixed by 50-10-37- (50=State of Hawaii, 10= Island of Hawaii, 27=USGS 7.5' series quad map ["Keahole, Hawaii"]).

FINDINGS

Four sites were identified within the proposed corridor (Figure 2). The sites consist of both single and multiple features. Feature types in the project area include pits, wall, cave, rockshelter, terraces, and papamu. Functional types include ceremonial, quarrying, marker, and boundary or agriculture. See Table 1 for a summary of the sites and for CRM (Cultural Resource Management) value mode assessments for each site.

SITE 5696 - EXTRACTION PITS

Site 5696 consists of two extraction pits situated within an old pahoehoe flow (Figure 3). The southernmost pit measures 2.20 by 1.20 m by 0.25 m deep; the other pit, situated 2.0 m to the north, measures 1.60 by 0.75 by 0.25 m deep. The perimeters of both pits are lined with large pahoehoe slabs which have been extracted from the pits. Additional features are present north of Site 5696.

SITE 5697 - COMPLEX

Site 5697 is a complex situated inland of the proposed tank site, approximately 15 m from the project area's southern boundary. Features at the site include a cave, a rock shelter, two terraces, an enclosing alignment/wall, and a papamu (Figure 4). The structural surface features of the site--the terraces, wall, and rockshelter--are situated on the south face of a pahoehoe rise. The terraces are well-constructed, and they evidence very different construction styles. One terrace measures 3.3 m on a side by 0.55 m high (maximum). The perimeter of this terrace consists of pahoehoe boulders; the interior area of the terrace consists of a fill of pahoehoe pebbles and cobbles. The interior surface is very level; present on the surface are two coral cobbles. The second terrace is situated approximately 6.0 m northwest of the first terrace. The second terrace measures 3.8 by 4.4 m by 0.60 m high. The perimeter of the second terrace consists of pahoehoe slabs set upright. On one side of the terrace are two parallel alignments of upright slabs which extend from the perimeter toward the interior portion of the terrace. The space between the two alignments is paved with flat slabs. The terrace interior is fairly level and consists of a fill of small cobbles.

The enclosing wall at the site also includes upright pahoehoe slabs. This wall encloses an area immediately northeast of the terraces. Portions of the wall consist of loose rubble atop a foundation of flat slabs. The section of the wall which includes upright slabs measures 0.50-0.70 m high by 0.40-0.55 m wide.

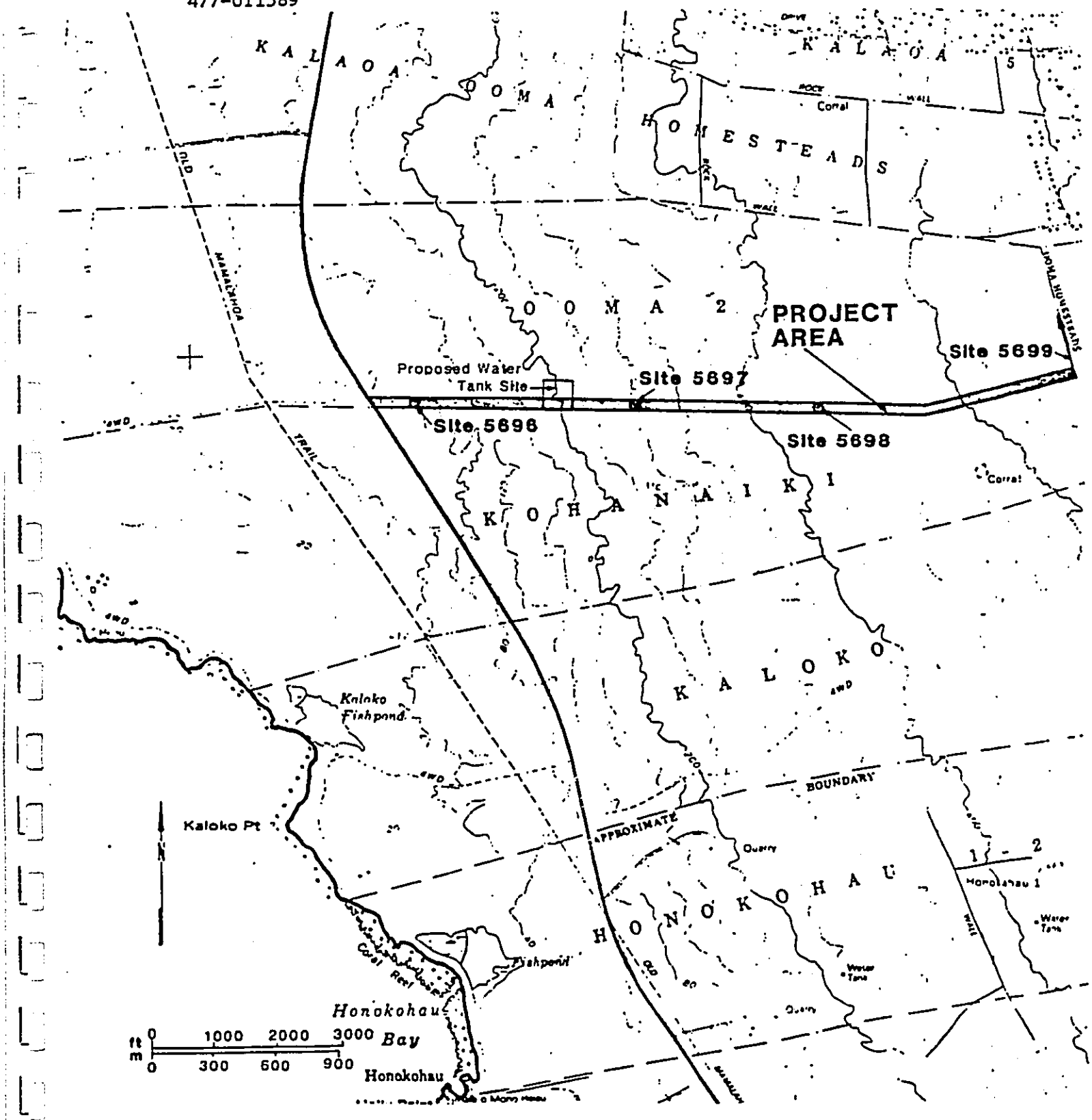

Figure 2. PROJECT AREA AND SITE LOCATION MAP

Table 1.

SUMMARY OF IDENTIFIED SITES AND FEATURES
KOHANA-IKI RESORT WATER DEVELOPMENT SURVEY

Site/Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	#CRM Value Mode Assess. R	I	C
5696	Pits	Quarrying	L	L	L
5697	Complex	Ceremonial/Habitation	H	H	H
5698	Mound	Marker	L	L	L
5699	Wall	Boundary/Agriculture	L	L	L

#Cultural Resource Management
Value Mode Assessment--Nature: R = scientific research,
I = interpretive, C = cultural;
--Degree: H = high, M = moderate, L = low.

The rockshelter (small overhang shelter) is situated immediately inland of the first terrace. The shelter is obscured by a Christmas-berry tree growing out of its entrance. The opening of the rockshelter measures roughly 2.0 m in diameter by 0.50 m high. The interior of the shelter measures 0.50 m high (maximum). Present within the interior are shallow tubes which extend in either direction. Present in the seaward portion of the overhang section of the rockshelter was a piece of gourd measuring 20 cm in diameter.

The cave is present immediately north of the surface features. The area immediately surrounding the cave opening consists of very smooth, shiny pahoehoe. Situated on this pahoehoe, immediately west of the cave opening, is a papamu measuring roughly 30 cm on a side. The papamu consists of six rows of seven holes. Situated immediately east of the cave opening is a small waterworn cobble with evidence of pecking. The opening to the cave has naturally rounded edges and measures 40 by 80 cm. Upon entering the cave, one drops vertically about 1.5 m onto a pile of loose pahoehoe boulders. Partially obscured by a rock pile is a small opening of a southerly extending tube. This opening was not entered. Another tube continues 2.0-3.0 m to the north. This tube opens onto a large chamber measuring 4.0-5.0 m high by 4.0-5.0 m wide (usable portion--chamber extends for undetermined distances to the north and south; a number of extensions to the south). The interior of the chamber is relatively smooth; some loose rock has accumulated along the western face of the chamber. Present on the chamber floor were marine shell midden (Conus, Cypraeidae), echinoid, wood fragments, wood charcoal, and at least two ash deposits.

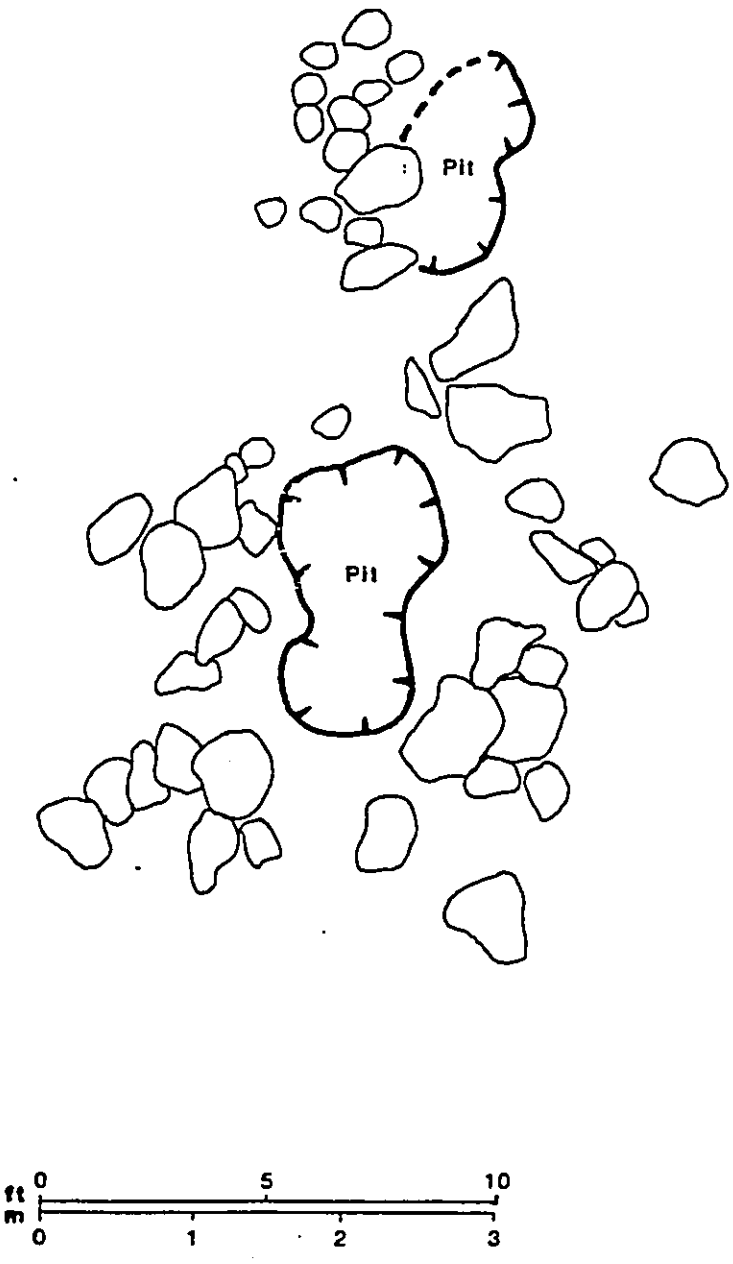

Figure 3: SITE 5696

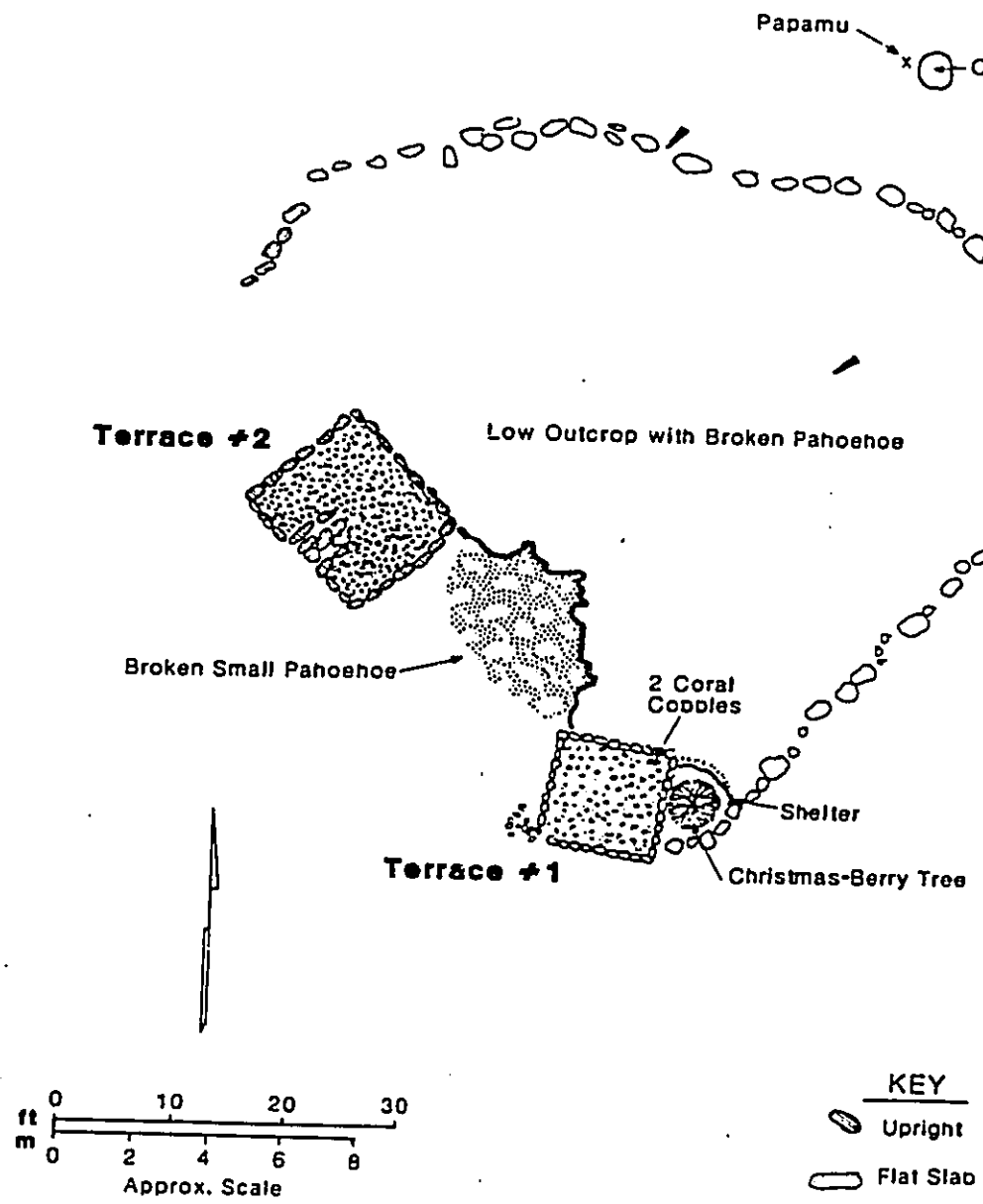

Figure 4. SKETCH MAP OF SITE 5697

SITE 5698 - MOUND

Site 5698 is a mound that incorporates an outcrop (Figure 5). The perimeter of the mound consists of stacked pahoehoe slabs; the mound's interior consists of cobbles and small boulders. Site 5698 measures roughly 1.5 m in diameter by 0.4 m high.

SITE 5699 - WALL

This wall forms the inland boundary of the survey corridor, and extends north for an undetermined length. The wall is core-filled; the exterior of the wall consists of blocky pahoehoe boulders stacked six to eight courses high, and the interior of the wall consists of small broken pahoehoe cobbles. The wall measures 1.25 m high. The top of the wall measures 0.6 m wide, while the basal part of the wall measures 1.0 m wide.

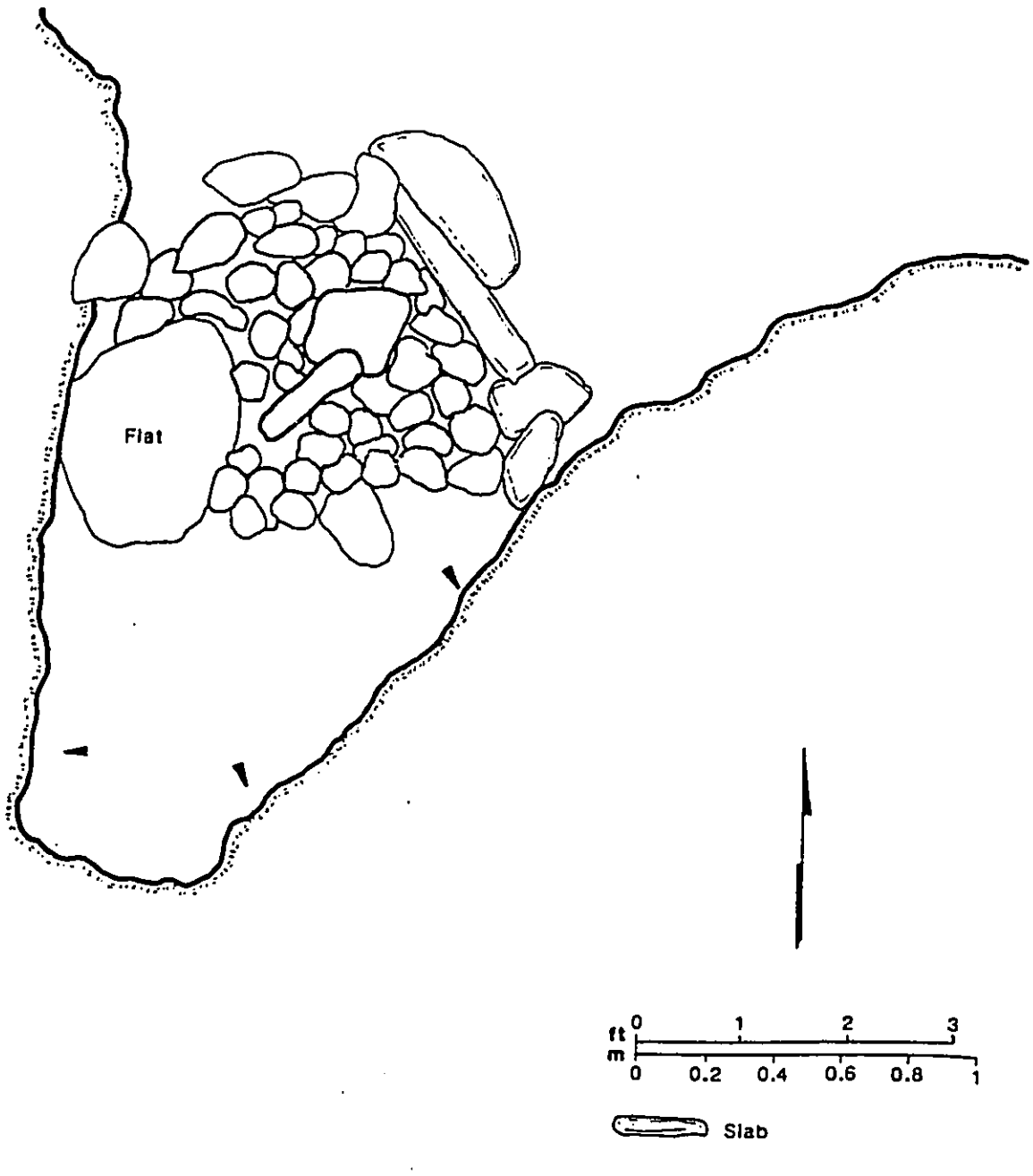

Figure 5. SITE 5698

CONCLUSION

DISCUSSION

Four sites were identified during the present survey. The sites consist of extraction pits (5696), a complex (5697), a mound (5698), and a wall (5699). Excepting 5699, the sites appear to be prehistoric. Site 5696 pits are similar to pits at other quarry areas previously documented in Ooma 2 (Donham 1987:137). The pits have battered rims where force was used to break away sections of pahoehoe. No basalt hammerstones were found in the immediate vicinity of the pits. Present approximately 150 m downslope of the pits was a large waterworn cobble.

Site 5697, as indicated by presence of coral, use of uprights, and location (on slight bluff), may have served a ceremonial purpose. The terraces at the site may contain burials. According to Dr. Paul Rosendahl, sites with similar configurations found north of the project area, in land units of upland Lapakahi, have been interpreted as ceremonial sites (pers. comm.). The cultural material present at the Site 5697 cave indicates the cave was used for habitation; to what extent it was inhabited is uncertain. A thorough examination of the cave is still needed in order to ascertain the extent of the cave and the extent of its cultural material.

Site 5698 is an isolated mound that may have served as a trail marker; however, no sign of a trail could be found. The trail could be obscured by the thick fountain grass in the project area. Site 5698 does not appear to be an agricultural mound because it is isolated in an area of almost no soil.

Site 5699 is a well-constructed wall defining the inland boundary of the survey corridor. This wall is undoubtedly historic and may have served as a boundary or agricultural wall.

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Site significance assessments are based on the National Register criteria for evaluation, outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Department of Land and Natural Resources-Historic Sites Section (DLNR-HSS) uses these criteria for evaluating site significance. Sites determined to be potentially significant for information content fall under Criterion D (Category A and X, Table 2), which defines significant resources as ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites potentially significant as representative examples of site types are evaluated under Criterion C (Category B), which defines significant resources as those which "embody

a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

Based on the above federal and state criteria, Sites 5696, 5698, and 5699 are assessed as significant solely for information content. These three sites have been measured, mapped, described, photographed, and plotted. Data collected from them is considered sufficient to warrant a recommendation of no further work. The remaining site (Site 5697), is assessed as significant for information content, cultural value, and interpretive value. This site has only been preliminarily inspected and recorded. The inventory survey findings concerning this site were reviewed with Dr. Ross Cordy of DLNR-HSS, and Dr. Cordy suggested marking the site and setting it aside at this time. As such, the site is recommended for "preservation as is." The site has been flagged along its perimeter with bright pink flagging tape; the site should not be entered by any construction personnel or be impacted in any way. To assure the site is preserved, construction period monitoring by a qualified archaeologist is recommended for the site.

In order to facilitate future client management decisions regarding site treatments, sites are further evaluated in terms of three value modes which are derived from the previously mentioned state and federal evaluation criteria. The archaeological sites are evaluated in terms of potential scientific research, interpretive, and/or cultural values. Research value refers to the potential of archaeological resources to produce information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values. Based on the above value modes, Sites 5696, 5698, and 5699 are assessed as being of minimal significance in terms of scientific, interpretive, and cultural values (See Table 1 for evaluations of individual sites), and Site 5697 is assessed as having high significance in terms of all three value modes.

The evaluations and recommendations presented within this final report have been based on a surface inventory survey of the project area. There is always the possibility that potentially significant, unidentified surface structural remains, subsurface cultural features, or deposits will be encountered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

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BOTANICAL ASSESSMENT
'O'OMA 2 WELLFIELD SITE
NORTH KONA, HAWAI'I

INTRODUCTION

The development of two brackish water well sites at about the 700-foot elevation are proposed for the 'O'oma 2 parcel (TMK 7-3-09:5). The well site will provide the proposed Kohanaiki resort with brackish water for irrigation use.

A reconnaissance survey to assess the botanical resources found on the wellfield site was conducted on 26 April 1990. The objectives of the survey were to (1) describe the major vegetation types, and (2) search for threatened and endangered plant species protected by federal and state laws.

Access was from the makai end of Kukuna Road. From there a rock wall follows along a portion of the site where the survey engineers have flagged a trail to the 700-foot elevation contour. The 700-foot contour has been flagged and staked. The field studies focused on a corridor 100 feet in width, with the flagged 700-foot contour running down the middle of the corridor.

DESCRIPTION OF THE VEGETATION

The scientific names used in the discussion follow Lamoureux (1984)

for the ferns and Wagner et al. (1990) for the flowering plants. Common English and/or Hawaiian names used follow St. John (1973).

Vegetation on the portion of the 'O'oma 2 parcel proposed for the wellfield consists of an open shrubland of Christmas berry (Schinus terebinthifolius) along with a number of other tree and shrub species which form about 40 to 50% cover. Very dense fountain grass (Pennisetum setaceum) fills in the matrix between the woody components. Trees of silk oak (Grevillea robusta) are more common on the northern portion of the corridor. Besides Christmas berry, silk oak, and fountain grass, other introduced or alien species found on the site include lantana (Lantana camara), koa-haole or ekoa (Leucaena leucocephala), guava (Psidium guajava), indigo (Indigofera suffruticosa), partridge pea (Chamaecrista nictitans), and air plant (Kalanchoë pinnata).

Among the native species alahe'e (Canthium odoratum), a large shrub with glossy green leaves and fragrant white flowers, and a'ali'i (Dodonaea viscosa), a medium-sized shrub with papery red fruits, are common to locally abundant. Other natives occurring with the corridor are the Hawaiian persimmon or lama (Diospyros sandwicensis), scattered clumps of mamane (Sophora chrysophylla), the orange-flowered 'ilima shrub (Sida fallax), the huehue vine (Cocculus trilobus), a native peperomia (Peperomia leptostachya), the yellow-flowered ko'oko'olau shrub (Bidens micrantha ssp. ctenophylla), the pale-green flowered kalamona shrub (Senna gaudichaudii), and moa (Psilotum nudum), a member of the whisk-fern family.

Three species thought to be of early Polynesian introduction, the noni (Morinda citrifolia), ti leaf (Cordyline fruticosa), and 'ahuhu (Tephrosia purpurea) are also found within the corridor.

DISCUSSION AND RECOMMENDATIONS

The 100-foot wide corridor along the 700-foot contour is vegetated primarily with Christmas berry and dense fountain grass. Native species are occasional to locally common in some places. None of the native species found within the corridor are officially listed endangered or threatened plants (U. S. Fish and Wildlife Service 1989).

One species, the ko'oko'olau (Bidens micrantha ssp. ctneophylla), was previously considered a Category 1, candidate endangered species (U. S. Fish and Wildlife Service 1985). Plants in this category are high priority species for listing as endangered or threatened. In the most recent review of plant taxa for listing (U.S. Fish and Wildlife Service 1990), the Bidens has been downgraded to a Category 2, candidate endangered species. Plants in this category show some evidence of vulnerability, but there are not enough data to support listing proposals at this time.

Within the corridor, a few scattered plants of Bidens are found between stakes 3 and 4 on the southern half of the corridor. It is recommended that, if possible, the well site be placed to avoid these plants. It should be noted though that other plants of Bidens can also be found outside of the corridor. Thus even if a few plants along the corridor were to be lost during construction, the population would still remain viable on certain other portions of the parcel. Other much larger populations of Bidens can be found on the leeward slopes of Hualalai.

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SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT OOMA 2 AHUPUA'A, NORTH KONA, HAWAII TMK 7-3-9:5

Prepared for

Helber Hastert and Kimura

By

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7 May 1990

INTRODUCTION

The purpose of this report is to summarize the findings of a one day (3 May 1990) bird and mammal field survey of a proposed well site located at Ooma 2 Ahupua'a in North Kona, Hawaii TMK 7-3-9:5 (see Fig. 1). Also included are references to pertinent literature as well as unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or may likely occur given the range of habitats available.

2- Provide some baseline data on the relative abundance of each species.

3- Determine the presence or likely occurrence of any native fauna particularly any that are considered "Endangered" or "Threatened".

4- Determine if the property contains any unusual or special habitats that if lost or altered by development might result in a significant impact on the fauna in this region of the island.

GENERAL SITE DESCRIPTION

The project site is located along the 700 foot contour at Ooma Ahupua'a, North Kona, Hawaii (see Fig.1). The property contains the usual mix of exotic plants typically found at this

elevation along the Kona Coast. The dominant trees in the area are: Christmas Berry (Schinus terebinthifolius) and Silk Oak (Grevillea robusta). The understory is predominantly Fountain Grass (Pennisetum ruppelii).

Weather during the field survey was clear with light NE winds of 5-10 mph.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. These observations were concentrated during the peak bird activity periods of early morning and late afternoon. Attention was also paid to the presence of tracks and scats as indicators of bird and mammal activity.

A marked (flagged) path following the 700 foot contour was followed from Kukuna Street to the point where the marking ceased. Transects perpendicular to this path were made in order to cover an area at least 200 feet on either side of the marked path. At various locations eight minute counts were made of all birds seen or heard (see Fig. 1 for approximate locations of count-stations). Between these census stations observations of birds seen or heard were also noted. These data provide the basis for the relative abundance estimates given in this report. Published and unpublished reports of birds known from similar habitat

elsewhere in West Hawaii were also consulted in order to acquire a more complete picture of the possible species that might occur in the area (Bruner 1988, 1989a, 1989b, 1989c, 1990; Berger 1988; Pratt et al. 1987; Hawaii Audubon Society 1989). Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names used herein follow those given in the most recent American Ornithologist's Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1989), A Field Guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987), Mammal Species of the World (Honacki et al. 1982) and Hawaiian Coastal Plants, Hawaiian Forest Plants (Merlin 1980).

RESULTS AND DISCUSSION

Resident Endemic (Native) Land and Water Birds:

No endemic species were recorded during the field survey. Given the location and size of the property as well as the type of habitat available no resident endemic species would be expected. No wetlands occur in the area. The Short-eared Owl or Pueo (Asio flammeus sandwichensis) and the I'o or Hawaiian Hawk (Buteo solitarius) may occasionally fly over the property.

Migratory Indigenous (Native) Birds:

No migratory birds were observed. Most such birds have departed to their arctic breeding grounds by the first week of May (Johnson et al. 1981, Bruner 1983, Johnson et al. 1989).

The only likely migrant that might be seen flying over the area but not resident on the site would be the Pacific Golden Plover (Pluvialis fulva). This species usually forages along shorelines and in short grass fields.

Resident Indigenous (Native) Birds:

No indigenous species were recorded nor would any be expected at this site.

Resident Indigenous (Native) Seabirds:

No seabirds were observed on the property. Several seabirds can be seen off shore. No seabirds would be expected to nest at this site due to the presence of predators.

Exotic (Introduced) Birds:

A total of 14 species of exotic birds were recorded during the field survey. Table One shows the relative abundance of each species. The most abundant species were Japanese White-eye (Zosterops japonicus), Zebra Dove (Geopelia striata) and Nutmeg Mannikin (Lonchura punctulata). Given the range of habitats found

on the property as well as data from surveys elsewhere in West Hawaii (Bruner 1988, 1989a, 1989b, 1989c; 1990; Berger 1988) and information provided in Pratt et al. (1987) and Hawaii Audubon Society (1989) the following exotic birds species might also be expected to occur on or near the property: Common Barn Owl (Tyto alba), Ring-necked Pheasant (Phasianus colchicus) and Gray Francolin (Francolinus pondicerianus).

Feral Mammals:

Small Indian Mongoose (Herpestes auropunctatus) were seen and heard during the survey. No feral cats were observed. Evidence of rats and mice was not discovered but these ubiquitous mammals undoubtedly occur in the area. No trapping was attempted in order to assess the relative abundance of mammals on this property.

Records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinerus semotus) are sketchy but the species has been reported from West Hawaii (Bruner 1984, Tomich 1986). None were observed on this field survey. This species roosts solitarily. Much remains to be learned about the natural history of this bat and its ecological requirements.

CONCLUSION

A brief field survey can at best provide only a limited perspective of the wildlife present in any given area. Not all species will necessarily be observed. The number of species and the relative abundance of each species may vary throughout the year or from year to year, due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the faunal picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987). Thus only long term studies can provide a comprehensive view of the bird and mammal populations in any particular area. However, when brief field studies are coupled with data gathered from other similar habitats the value of the conclusions drawn can be significantly increased.

The following are some general conclusions relating to bird and mammal activity on this property.

1- The present habitat provides a limited range of living spaces which are utilized by the typical array of exotic species of birds one would expect at this elevation and in this type of environment in Hawaii. However, some species normally found in this habitat were not recorded. This could have been due to the fact that the survey was too brief or

that their numbers are so low that they went undetected or a combination of these and other factors.

2- No endemic birds were found and it is unlikely that any would occur on this particular property given its location and type of habitat.

3- The proposed development of this property will alter the existing habitat. Species which require dense brush for cover, ie. Northern Cardinal (Cardinalis cardinalis) and Yellow-billed Cardinal (Paroaria capitata), will decline while more urban species such as House Sparrow (Passer domesticus) and Common Myna (Acridotheres tristis) should increase in abundance.

4- While it is true that this property provides habitat for a variety of exotic birds there is nothing unusual or special about this site. Abundant habitat of this sort occurs along the Kona Coast.

5- In order to obtain more definitive data on mammals, a trapping program would be required. No endangered species were observed.

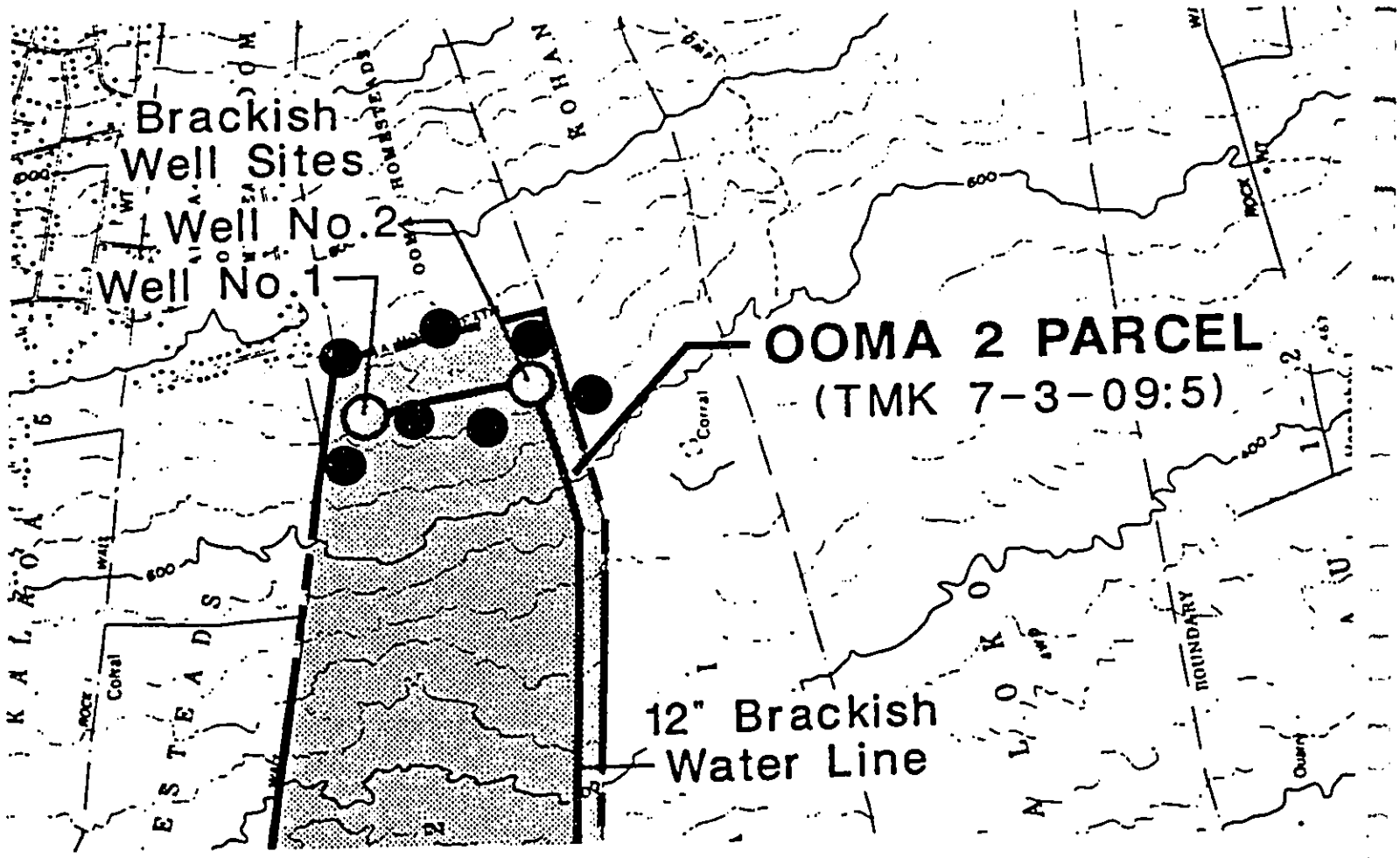

Fig. 1 Project site with location of eight minute count (census) stations shown as solid circles.

TABLE 1

Exotic species of birds recorded at Ooma 2 Ahupua'a, North Kona, Hawaii

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
Black Francolin	Francolinus francolinus	R = 4
Spotted Dove	Streptopelia chinensis	C = 6
Zebra Dove	Geopelia striata	A = 12
Common Myna	Acridotheres tristis	U = 4
Yellow-billed Cardinal	Paroaria capitata	U = 3
Northern Cardinal	Cardinalis cardinalis	C = 6
Northern Mockingbird	Mimus polyglottes	R = 2
Japanese White-eye	Zosterops japonicus	A = 14
Nutmeg Mannikin	Lonchura punctulata	A = 20
Warbling Silverbill	Lonchura malabarica	R = 10
Lavander Finch	Estrilda caerulescens	R = 6
Saffron Finch	Sicalis flaveola	R = 14
House Finch	Carpodacus mexicanus	C = 9
Yellow-fronted Canary	Serinus mozambicus	U = 5

* (see page 10for key to symbols)

KEY TO TABLE 1

Relative abundance = number of times observed during survey or average number on eight minute counts in appropriate habitat.

A = abundant (ave. 10+)

C = common (ave. 5-10)

U = uncommon (ave. less than 5)

R = recorded (seen or heard at times other than on 8 min. counts. number which follows is the total number seen or heard over the duration of the survey)

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Report 802-043090

Archaeological Inventory Survey
Phase I - Site Identification

Ooma-2 Water System Development Project Area

Land of Ooma 2nd, North Kona District
Island of Hawaii

PHRI

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Report 802-043090

Archaeological Inventory Survey
Phase I - Site Identification

Ooma-2 Water System Development Project Area

Land of Ooma 2nd, North Kona District
Island of Hawaii

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INTRODUCTION

BACKGROUND

At the request of Mr. Tom Fee, on behalf of Helbert, Hastert & Kimura - Planners, Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently conducted Phase I (Site Identification) of an archaeological inventory survey of the Ooma-2 Water System Development project area, situated in the Land of Ooma 2nd, North Kona District, Island of Hawaii. The Phase I survey field work was conducted on April 27, 1990 by Supervisory Archaeologist Arne Carlson, B.A., assisted by Field Archaeologists Robert Noah, Steve Tachera, and Ranae Ganske. The work was conducted under the overall direction of Principal Investigator Dr. Paul H. Rosendahl. Approximately four man-days of labor were expended in carrying out the field work.

SCOPE OF WORK

The basic purpose of an inventory survey is to identify—to discover and locate on available maps—all sites and features of potential archaeological significance present within a specified project area. An *inventory survey* constitutes an initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources within a specified project area. This level of survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. It permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for any subsequent *mitigation* work as might be necessary or appropriate. Such work could include further data collection involving detailed recording of sites and features, and selected test excavations; and possibly subsequent data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The overall objective of the present inventory survey is to provide a level of information appropriate to and sufficient for the preparation of an Environmental Impact Statement (EIS) and/or Hawaii County Special Management Area (SMA) Use Permit application. The specific objectives of the overall survey are fourfold: (a) to identify (find and locate) all sites and site complexes present within the parcel, (b) to evaluate the potential general significance of all identified archaeological remains, (c) to determine the possible impacts of proposed development upon the identified remains, and (d) to define the general scope of any subsequent further data collection and/or other mitigation work that might be necessary or appropriate.

The specific objective of the initial Phase I work was to identify (presence/absence determination) any sites of such obvious high significance as to seriously constrain or prevent proposed waterline/roadway development. The specific objective of any subsequent Phase II work that might be required would be the completion of appropriate data collection to current inventory-level survey standards.

Based on a review of available background literature and on our familiarity with both the general project area and the current requirements of pertinent State and County review authorities, and based on discussions with Mr. Fee, with Ms. Virginia Goldstein, staff planner/historic sites specialist in the Hawaii County Planning Department (HCPD), and with Dr. Ross Cordy, chief archaeologist with the Hawaii State Department of Land and Natural Resources-Historic Sites Section/State Historic Preservation Office (DLNR-HSS/SHPO), the following specific tasks were determined to constitute an adequate and appropriate scope of work for the initial (Phase I) site identification survey work:

1. Conduct limited archaeological and limited historical documentary background research involving review and evaluation of readily available archaeological and historical literature, historic documents and records, and cartographic sources relevant to the immediate project area;

2. Conduct 100% coverage, variable-intensity ground survey of the water system development/well field project area (area c. 2,600 ft long, 300 ft wide; c. 200 ft inland and 100 ft seaward of 700 ft elevation contour) to identify and plot the locations of all sites (both previously known and newly identified); and

3. Analyze background and field data, and prepare appropriate reports.

Phase II - Data Collection was to be undertaken only if potentially significant sites which could not be avoided (and thus preserved) were identified during Phase I field work.

The Phase I portion of the inventory survey was carried out in accordance with the standards for inventory-level survey recommended by DLNR-HSS/SHPO. The significance of all archaeological remains identified within the project area were assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60), and (b) the criteria for evaluation of traditional cultural values prepared by the national Advisory Council on Historic Preservation (ACHP). DLNR-HHS/SHPO uses these criteria to evaluate eligibility for both the Hawaii State and National Register of Historic Places. In order to facilitate future client management decisions regarding archaeological sites, archaeological remains were also assessed in terms of PHRI CRM (Cultural Resource Management) value modes, which are based on the above federal criteria.

PROJECT AREA DESCRIPTION

The Ooma-2 Water System Development project area consists of a corridor approximately 2,600 ft long by 300 ft wide (Figure 1). Two well sites and a connecting utility road are proposed within the corridor. The corridor's eastern boundary is 200 ft inland of the 700 ft AMSL (above mean sea level) contour, and the western boundary is 100 ft seaward of the 700 ft AMSL contour. The corridor is bounded on the north by the Land of Ooma 1st (Kalaoa-Ooma Homesteads), on the south by the Land of Kohana-Iki, and on the east and west by undeveloped land within Ooma 2nd. At the time of the survey, the 700 ft AMSL contour elevation had been previously staked by professional surveyors from R.M. Towill. The staking consisted of wooden slats and pink surveyor's flagging tape set c. 100-200 ft apart.

The terrain in the project area is slightly undulating and slopes seaward (west). The soil in the area consists of Punaluu extremely rocky peat (6-20% slopes) representing the Punaluu series "...of well-drained, thin organic soils over pahoehoe lava bedrock...[r]ock outcrops occupy 40 to 50 percent of the surface" (Sato et al. 1973:48).

Vegetation in the project area consists primarily of an overstory of Christmas-berry (*Schinus terebinthifolius* Raddi) with scattered kiawe (*Prosopis pallida* [Humb. and Bonpl. ex Willd.] HBK), and a ground cover of dense grasses, predominately fountain grass (*Pennisetum setaceum* [Forsk.] Chiov.). Rainfall in the general vicinity of the project area ranges between 35-40 inches per year, and the mean annual temperature in the area is approximately 70-75 degrees F. (Armstrong 1983:63,64).

PREVIOUS ARCHAEOLOGICAL WORK

Previous archaeological work conducted within the project area includes an inventory survey of a 200-ft wide corridor extending along the south boundary of Ooma 2nd, between Queen Kaahumanu Highway and the c. 760 ft AMSL contour. This survey was conducted by Rosendahl (1989) (Figure 1); no sites were identified within the small portion of the present project area included in that project.

Prior archaeological work conducted within the Land of Ooma 2nd has predominately been along the coast and includes surveys by Reinecke (n.d.), and Ching and Rosendahl (1968); an inventory of sites by staff archaeologists in the State Historic Preservation Office (SIHP 1971-72); data recovery excavations by Cordy (1981), a reconnaissance survey by Barrera (1985), and survey and testing by Donham (1987). The majority of these projects are summarized in the report by Cordy (1985); Cordy's report includes information on environmental zones, chronology, site patterning, and includes limited archival research and comments on regional development/interpretation and future considerations.

FIELD METHODS AND PROCEDURES

A 100%-coverage surface survey of the project area was accomplished by way of two pedestrian transects oriented approximately north-south and parallel to the major axis of the corridor. Transect intervals between sweeping crew members were generally 10.0-15.0 m. As sites were identified they were flagged with pink-and-blue flagging tape and were assigned PHRI sequential temporary numbers prefixed by "802-", beginning with 802-1. All sites were plotted on a USGS 7.5 series quad map ("Keahole Point, Hawaii") (1"=2,000', 40-ft contours). The survey was facilitated by a tax map (1"=1,000' scale). Ground visibility within the project area was poor due to thick fountain grass.

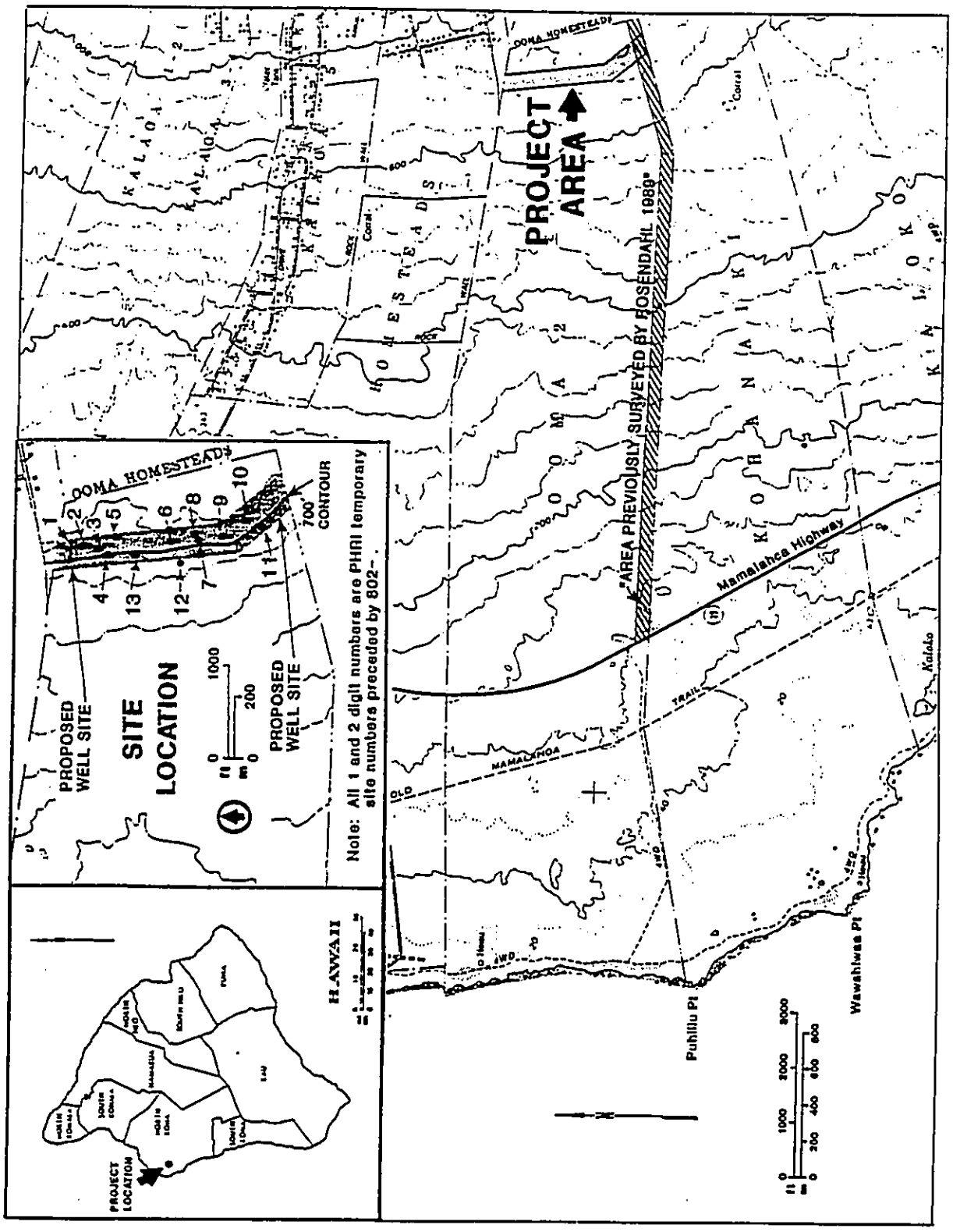

Figure 1. PROJECT AREA AND SITE LOCATION MAP

FINDINGS

During the survey, 13 sites containing 27+ component features were identified. The sites are summarized in Table 1 in terms of temporary field site number, formal site/ feature type, tentative functional interpretation, tentative CRM (Cultural Resource Management) value mode assessment, and recommended future field work tasks. Approximate locations of the sites are shown on Figure 1. The principal types of sites and features identified were mounds of varying sizes possibly related to agricultural activities. Several caves (one containing human burial remains), enclosures, cairns, a trail segment, a boulder alignment, and a terrace were also noted. In addition to agriculture, functional feature types encountered include boundary, habitation, transportation, burial, and marker.

CONCLUSION

Rosendahl (1973) and Cordy (1985) identified four zones in North Kona: (a) a narrow, arid coastal habitation zone associated principally with the exploitation of various marine resources, (b) a dry, barren middle zone characterized by exposed aa and pahoehoe lava rocklands largely devoid of soil or vegetation, and largely uninhabited, (c) an upland habitation zone associated with agricultural activities, and (d) an inland forest zone which was exploited but rarely inhabited. The present project area appears to be situated within the lower limits of the upland habitation zone; sites in the project area are typical of the zone.

Although inventory survey-level recording was not carried out as part of Phase I work, identified sites were tentatively evaluated according to federal guidelines (Table 2). Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). The DLNR-HSS/State Historic Preservation Office (SHPO) uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content fall under Criterion D, which defines significant resources as ones which "...have yielded, or may be likely to yield, information important in prehistory or history." Sites potentially significant as representative examples of site types are evaluated under Criterion C, which defines significant resources as those which "...embody the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction."

Sites with potential cultural significance are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (Draft Report, August 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth." The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value."

In order to facilitate future client management decisions regarding site treatments, sites are further evaluated in terms of PHRI CRM (Cultural Resource Management) value modes which are derived from the previously mentioned state and federal evaluation criteria. The archaeological sites are evaluated in terms of potential scientific research, interpretive, and/or cultural values. *Research value* refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. *Interpretive value* refers to the potential of archaeological resources for public education and recreation. *Cultural value* refers to the potential of archaeological resources to preserve and promote cultural and ethnic identity and values. Based on the above value modes, the sites in the present project are assessed as generally exhibiting a moderate amount of scientific research value, and low interpretive and cultural values (see Table 1 for value mode assessments for specific sites).

Based on the above federal/state guidelines, of the 13 sites identified during the current project, 11 are assessed as significant solely for scientific information content. If these 11 sites were to undergo Phase II (Data Collection) of the inventory-level survey, it would be anticipated that after Phase II, no further work would be recommended for the sites. Data collected from them would most likely be considered sufficient; their preservation would not be

Table 1.

SUMMARY OF IDENTIFIED SITES AND FEATURES

PHRI Temp. Site/Feature No. 802-	Formal Site/Feature Type	Tentative Functional Interpretation	*CRM Value Mode Assess. R	I	C	#Field Work Tasks DR	SC	EX
1	Linear mound	Boundary	M	L	L	+	-	-
2	Mound	Agriculture	M	L	L	+	-	-
3	Linear mound	Agriculture	M	L	L	+	-	-
4	Enclosure	Habitation	M	L	L	+	+	+
5	Complex (3+)	Transportation/ habitation	M	L	M/H	+	+	+
A	Cairn							
B	Trail segment							
C	Enclosure							
6	Complex (12)	Agriculture/ habitation	M	L	L	+	+	+
A-I	Mounds							
J	Enclosure							
K-L	Mounds							
7	Cave	Burial	M	L	H	+	+	+
8	Cairn	Marker	M	L	L	+	-	-
9	Cave	Temp. habitation	M	L	L	+	+	+
10	Cave	Habitation	M	L	L	+	+	+
11	Complex (2+)	Indeterminate/ marker	M	L	L	+	+	+
A	Boulder align.							
B	Cairn							
12	Caves (2)	Habitation	M	L	L	+	+	+
13	Terrace	Habitation	M	L	L	+	+	+

*Cultural Resource Management Value Mode Assessment
--Nature: R = scientific research; I = interpretive; C = cultural
--Degree: H = high; M = moderate; L = low

#Field Work Tasks: DR = detailed recording (scaled drawings, photographs, and written descriptions); SC = surface collections; EX = limited excavations

+Number of component features within complex

Table 2.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Site No. 802-	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
1	+	-	-	-	+	-	-	-
2	+	-	-	-	+	-	-	-
3	+	-	-	-	+	-	-	-
4	+	-	-	-	+	-	-	-
6	+	-	-	-	+	-	-	-
8	+	-	-	-	+	-	-	-
9	+	-	-	-	+	-	-	-
10	+	-	-	-	+	-	-	-
11	+	-	-	-	+	-	-	-
12	+	-	-	-	+	-	-	-
13	+	-	-	-	+	-	-	-
Subtotal:	**11**	**0**	**0**	**0**	**11**	**0**	**0**	**0**
5	+	-	-	+	+	-	-	-
Subtotal:	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**0**
7	+	-	-	+	+	-	-	+
Subtotal:	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**1**
Total:	**13**	**0**	**0**	**2**	**13**	**0**	**0**	**1**

General Significance Categories:

A = Important for information content, further data collection necessary (PHRI=research value);
X = Important for information content, no further data collection necessary (PHRI=research value, DLNR-HSS=not significant);
B = Excellent example of site type at local, region, island, state, or national level (PHRI=interpretive value); and
C = Culturally significant (PHRI=cultural value).

Recommended General Treatments:

FDC = Further data collection necessary (intensive survey and testing, and possibly subsequent data recovery/mitigation excavations);
NFW = No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential;
PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work); and
PAI = Preservation "as is," with minimal further work (and possible inclusion into landscaping), or appropriate data recovery/disinterments.

considered essential, although some sites could perhaps be considered for inclusion into development landscaping. In the unlikely event that after Phase II additional data recovery at sites was warranted, a data recovery plan would have to be prepared and implemented for sites not recommended for preservation or interpretation.

The remaining two sites (Sites 5 and 7) are assessed as culturally significant and significant for information content. If these two sites were to undergo Phase II (Data Collection) of the inventory-level survey, it would be anticipated that after Phase II, no further work would be necessary for Site 5, and Site 7 would be recommended for preservation "as is". Feature B of Site 5 is a short secondary trail segment. This segment is not an *excellent* example of a site type; after Phase II data collection is completed it is anticipated the site would not be recommended for preservation. If Site 7 (burial cave) could not be preserved "as is", it would be required that the procedures of Section 43 of Chapter 6E (Historic Preservation, Haw. Rev. Stat., as amended) be followed. The DLNR-HSS/SHPO would be notified and would contact the Office of Hawaiian Affairs (OHA). A mitigation plan for burials, with osteological analyses, would be worked out with DLNR-HSS/SHPO. At least, a search for direct lineal descendants—consisting of publishing in a newspaper of general circulation a public notice to notify possible direct lineal descendants—would have to be conducted. If direct lineal descendants are found, the osteological analyses would be subject to their wishes. Lastly, a plan for final disposition of the remains would be developed in accordance with Section 43 of Chapter 6E. It would be recommended that any remains found be reinterred within the project area. A disinterment permit would probably be required from the State Department of Health.

As indicated, the above recommendations would be made subsequent to Phase II of the inventory-level survey. However, rather than implementation of Phase II, it is recommended that the 13 identified sites be avoided when building the road and well pads. The sites would then effectively be preserved "as is" and no further data collection work would be necessary in the corridor.

Prior to any development work in the corridor, it is recommended that identified sites first be accurately plotted by professional surveyors, with the aid of an archaeologist, on an appropriate scale topographic map of the project area. This would greatly aid development planning by allowing developers to plot the route of the road and the location of the well pads in relation to the sites accurately. In order to ensure that all sites are preserved "as is," it is further recommended that archaeological monitoring of all initial grubbing and grading in the corridor be conducted by a qualified archaeologist.

If after all sites are accurately plotted it is decided that it is not feasible to avoid identified sites, then it is recommended that Phase II (Data Collection) be implemented in the project area.

This report constitutes the final report for the Phase I survey. It should be noted that the evaluations and recommendations in this report have been made solely on the basis of the present Phase I (Site Identification) survey work. There is always the possibility, however remote, that potentially significant, unidentified subsurface cultural remains or lava tubes will be encountered/uncovered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

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APPENDIX

LIMITED HISTORICAL DOCUMENTARY RESEARCH OOMA-2 WATER SYSTEM DEVELOPMENT PROJECT AREA

by Helen Wong Smith, B.A.

The ahupua'a of Ooma 2 is within the area of North Kona known as Kekaha. Kekaha is a barren, dry area consisting mainly of old lava flows with numerous fishponds on the coast. Although the meaning of Ooma is given as "concave" (Pukui, Elbert, Mookini 1974:171) a somewhat more descriptive meaning is provided by noted Kekaha historian, Hannah Springer, who translates Ooma as "where food does not grow" (pers. comm. 13 September 1989). The main resources exploited in Kekaha were ocean products and products from the dryland forest, such as the hardwood 'uhi'uhi (*Mezoneuron kauaiense* [Mann] Hbd.) used for the runners of holua sleds (ibid).

One early reference to Ooma is by John Papa Ii, a member of Kamehameha II's court. Ii writes that upon Kamehameha I's return to Kailua-Kona in 1812, fishing canoes from Ooma "drew close to the ship to trade for pa`ipa`i (hard poi) carried on board, and shortly a great quantity of aku lay silvery-hued on the deck (Ii 1959:109). Ii also mentions the "gentle Eka sea breeze of the land" as they sailed passed Kekaha, including Ooma (ibid:110). These traders were most likely coastal dwellers, as modern archaeologists conclude that the bulk of the permanent population in North Kona was on the coast, with cultivated fields located in the upland forest and trails connecting these two areas (Cordy 1985:37). In fact, Cordy places the inception of permanent settlement in Ooma 2 as 1400-1450 AD (ibid:38).

Ooma's claim to fame is most likely that from the years 1841-1819 Kauikeaouli (Kamehameha III) was raised there by his guardian Kaikioewa. This suggests that Kaikioewa had principal interest in Ooma. During the Mahele in 1848, the lands of Ooma were designated Government Lands (Board of Commissioners). Since they were not ahupua'a that were commutated by other chiefs, it is most likely that they were the personal holdings of Kauikeaouli which he passed onto the government (Cordy 1985:35). With its classification as Government Land, parcels were sold as grants, primarily for homestead purposes. A letter from H.N. Greenwell to Wilder (Minister of Interior from 1878-1880) informs him that Greenwell's konohiki Kekoanui collected $30 from Kama, a leasee of lands at Kalaoa and Ooma. John Avery Maguire who started Huehue Ranch, c. 1902 leased some 302 acres in the vicinity. This suggests some ranching activities took place in the ahupua'a (Jean Greenwell pers. comm. 8 May 1990).

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APPENDIX D

Consulted Parties Correspondence

Helber Hastert & Kimura
Planners

March 9, 1990

FACSIMILE OF LETTER TO AGENCIES

Dear

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Districts of Kau and 'O'oma 2,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

We are now in the process of preparing an Environmental Assessment (EA) of proposed offsite infrastructure improvements for the Kohanaiki Resort. The EA will accompany a Conservation District Use Permit application to be submitted to the State Department of Land and Natural Resources (DLNR). Enclosed with this letter is pertinent information concerning the general nature of the proposed improvements including maps of the project area, a brief description of the proposed action, an overview of the scope of the forthcoming EA, and a list of agencies which will be consulted. The EA is being prepared under the provisions of Chapter 343 Hawaii Revised Statutes, and Department of Health's Environmental Impact Statement Rules (Chapter 200, Hawaii Administrative Rules), because portions of the proposed action are within the State Conservation District and/or involve State-owned lands.

We would appreciate your review of this material and any suggestions/comments you may have regarding specific issues and concerns which should be addressed in the EA. We hope to submit the EA and the Conservation District Use Permit Application to DLNR by the end of March. Accordingly, we will need any comments you may have by March 23. We will contact your office by telephone early in the week of March 19 to discuss this matter further. Thank you for your assistance in this matter.

Sincerely,

HELBER HASTERT & KIMURA, Planners

Thomas A. Fee, AICP
Senior Associate

Enclosures

cc: Mr. Tom Yamamoto, Nansay Hawaii, Inc.

Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Telephone 808 545 2055
Facsimile 808 545 2050

I. OVERVIEW

Helber Hastert & Kimura, Planners (HH&K) is preparing an Environmental Assessment (EA) for Nansay Hawaii, Inc. ("applicant"), in support of a Conservation District Use Application (CDUA) to the State Department of Land and Natural Resources (DLNR) for the development of two utility corridors proposed for construction on lands within the Kau and 'O'oma 2 Districts, between the Queen Kaahumanu and Mamalahoa Highways in North Kona, Hawaii (the "proposed action") (see Figure 1). The proposed utility corridors will accommodate potable and brackish irrigation water wells, transmission lines, water reservoirs, breaker tanks, overhead power and telemetry lines, an electric/telephone substation and paved service roads. The lower reaches of both the Kau and 'O'oma 2 parcels lie within the State Conservation District, and the entire 'O'oma 2 parcel is State-owned. Accordingly, the EA will address the probable impacts associated with the development of infrastructure within Conservation lands at Kau, and address probable impacts associated with development of infrastructure on State-owned and Conservation zoned lands at 'O'oma 2.

The proposed off-site infrastructure will serve a planned resort at Kohanaiki located on the coast between Honokohau Small Boat Harbor and the Keahole Airport, about 2 miles south of the airport and 5 miles north of Kailua. The proposed 450-acre Kohanaiki Resort was designated Urban by the State Land Use Commission in January 1987 and subsequently received General Plan and zoning approvals from the Hawaii County Council to allow the development of three hotel sites, a golf course, a large commercial village complex and various multi- and single-family residential sites. A full environmental impact statement of the Kohanaiki Resort was accepted by the Hawaii County Planning Department in September 1986.

The Kau parcel (999.028 acres, identified as TMK 7-2-05:1) is owned in fee by the applicant, Nansay Hawaii, Inc. The parcel is rectangular in shape, with the long axis extending from the Mamalahoa Highway to the Queen Kaahumanu Highway, a distance of some 18,000 lineal feet. The lower third of the parcel lies within the State Conservation District (Figure 2). The 'O'oma 2 parcel (903.789 acres, identified as TMK 7-3-09:5) is owned by the State of Hawaii. The parcel is also rectangular in shape with its long axis extending some 11,000 lineal feet mauka of its frontage along Queen Kaahumanu Highway. The lower half of the parcel lies within the State Conservation District.

II. SUMMARY OF PROPOSED ACTION

Project Title:	Off-Site Infrastructure Improvements for Kohanaiki Resort, North Kona, Hawaii
Applicant/ Developer:	Nansay Hawaii, Inc. P.O. Box 111222, Suite 727 Kamuela, Hawaii 96743

Preparer of Environmental Assessment:	Helber, Hastert & Kimura, Planners 733 Bishop Street, Suite 2590 Honolulu, Hawaii 96813	
Proposed Action:	Construction of two utility corridors and an electrical/telephone substation. Parts of these systems are located within the State Conservation District and/or on State-owned lands.	
Request/ Approving Agency:	Application to the State Department of Land and Natural Resources for a Conservation District Use Permit	
Parcel Data:	Kau Parcel	'O'oma 2 Parcel
Owner:	Nansay Hawaii, Inc.	State of Hawaii
Location:	North Kona, Hawaii	North Kona, Hawaii
Tax Map Key:	7-2-05: 1	7-3-09: 5
Size:	999.028 Acres	903.789 Acres
Existing Land Use Regulations:		
State Land Use:	Cons./Ag.	Cons./Ag.
General Plan:	Cons./Extensive Ag.	Cons./Extensive Ag.
Zoning:	Open/Ag-3	Open/Unplanned
Existing Land Uses:	Vacant	Vacant

III. DESCRIPTION OF PROPOSED ACTION

Kau Parcel Improvements

The utility corridor on the Kau parcel is intended to deliver potable water to the Kohanaiki Resort and will traverse the length of the parcel, from wells located at the 1,800-foot elevation adjacent to the Mamalahoa Highway, down to the Queen Kaahumanu Highway frontage (about the 170-foot elevation), a distance of about 18,000 lineal feet. The lower third, or approximately 5,300 lineal feet of the corridor is within the State Conservation District (General Subzone). The proposed utility corridor follows the southern boundary of the parcel. The utility corridor will be approximately 30 feet in width, consisting of a 12-foot paved roadway, 4-foot unpaved shoulders and an approximate ten-foot allowance for changes in topography. The physical improvements to be located within the utility corridor include a 12-inch below-grade water transmission line, several breaker tanks located along the transmission line, a 2.0 million gallon reservoir at the 250-foot elevation, the 12-foot wide paved service road and overhead power and telemetry lines to service the utility corridor. The breaker tanks will be spaced approximately at each 400-foot change in elevation and are designed to reduce the

pressure that builds up within the water lines due to the flow of the water and forces of gravity. Preliminary plans call for the breaker tanks to be approximately 13 feet high and 13 feet in diameter and for the 2.0 MG reservoir to be about 20 feet high and 130 feet in diameter.

The State Commission on Water Resource Management granted approval to drill and test two 1,800-foot elevation wells on the Kau parcel (located within the State Agricultural District) in September 1989. The wells are planned to provide about 1.6 mgd for the Kohanaiki Resort and 0.16 mgd for the County water supply system. Pump installation permits will be sought from the Commission upon completion of well testing.

The off-site Kau system will be linked to the Kohanaiki Resort via a 16,000-foot long, 16-inch transmission line proposed to be buried within the Queen Kaahumanu Highway right-of-way. Approvals for any proposed work within State Highway rights-of-way, including this segment of the waterline, will have to be secured from the State Department of Transportation. The applicant intends to dedicate the entire Kau water system to the County of Hawaii.

'O'oma 2 Parcel Improvements

Two brackish wells are proposed for development on State-owned land at about the 700-foot elevation within the 'O'oma 2 parcel. The well sites are located within the State Agricultural District. The two wells are intended to supply the irrigation requirements for the planned golf course and landscaping at the Kohanaiki Resort. Applications for well drilling permits for the two wells will be submitted to the State Commission on Water Resource Management in the near future.

The 'O'oma 2 utility corridor will extend from the 700-foot elevation wells to the Queen Kaahumanu Highway frontage (approximately 80-foot elevation), a distance of approximately 11,000 lineal feet. The lower 4,500 feet of this corridor is within the State Conservation District (General Subzone). Brackish water will be delivered from the two wells via a 12-inch, 8,000-foot underground transmission line to a 1.0 million gallon reservoir located at the 200-foot elevation. The reservoir will be connected to the resort via approximately 3,000 feet of underground transmission line. The utility corridor will also include a 12-foot wide paved service road and overhead power and telemetry lines lines to service the corridor.

The electrical/telephone substation will be located immediately mauka of and adjacent to the Queen Kaahumanu Highway right-of-way, at the south-west corner of the 'O'oma 2 parcel. The substation site will be approximately 300-feet square, occupying a site of about 90,000 square feet. In addition to providing telephone service to the resort, primary power voltage will be transformed from the 69 KV transmission lines running along the Queen Kaahumanu Highway shoulder, to a distribution rating of 12 KV to service the resort. A reinforced concrete pad will support the substation transformer and associated switch gear. In addition, the substation will be fully enclosed with high voltage warning signs and grounding system. Care will be exercised in siting, landscaping and designing the facility to minimize visual impacts to motorists traveling along the Queen Kaahumanu Highway.

III. ENVIRONMENTAL ASSESSMENT

The proposed action involves the use of lands within the State Conservation District and/or the use of State-owned lands. Accordingly, the preparation of an Environmental Assessment (EA) of the proposed action is required pursuant to Chapter 343-5, HRS. The EA will be prepared in accordance with State Department of Health's Environmental Impact Statement Rules, Chapter 200-10, Hawaii Administrative Rules. The EA will provide a general description of the action's technical and environmental characteristics, a summary description of the affected environment, the identification of major impacts and alternatives considered, proposed mitigation measures and a determination of the significance of the potential environmental effects of the proposed action.

IV. AGENCIES TO BE CONSULTED IN PREPARATION OF THE EA

The following agencies will be consulted during the preparation of the EA.

State Agencies

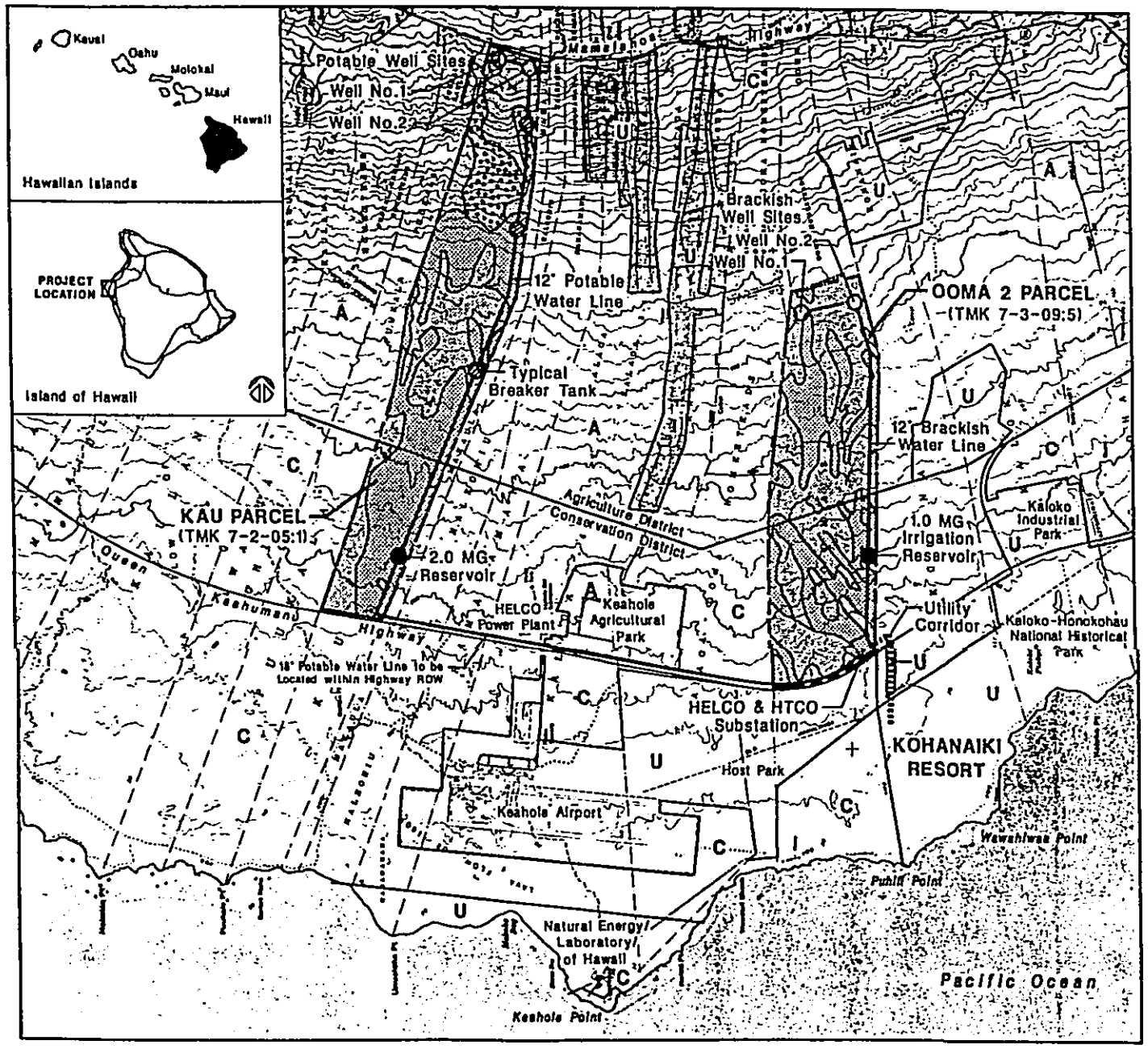
Department of Land and Natural Resources (DLNR)
Department of Health (DOH)
Department of Transportation (DOT)

County Agencies

Planning Department
Department of Public Works (DPW)
Department of Water Supply (DWS)

Utilities

Hawaiian Electric Light Company (HELCO)
Hawaiian Telephone Company (HTCO)



Nansay Hawaii, Inc.

Figure: 2

SOILS AND STATE LAND USE

LEGEND

Soils

- Pahoehoe
- A'a
- Punaluu Extremely Rocky Peat
- Kaimu Extremely Stony Peat

(U.S. Soil Conservation Service, 1973)

State Land Use

- A Agriculture
- C Conservation
- U Urban

Offsite Infrastructure Assessment: Resort at Kohanaiki

North Kona, Hawaii

0 3000 Feet

March 1990

HELBER, HASTERT & KIMURA PLANNERS
GOVERNOR CENTER • 9TH TOWER • 733 BISHOP STREET • SUITE 2590
HONOLULU, HAWAII 96813 • TELEPHONE (808) 545-2055

JOHN WAIHEE
GOVERNOR OF HAWAII

MAY 18

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES

KEITH W. AHUE
MANABU TAGOMORI
RUSSELL N. FUKUMOTO

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

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

REF:OCEA-CT

MAY 16 1990

File: 90-570
Doc.: 8046E

Mr. Thomas A. Fee, Senior Associate
Helber Hastert & Kimura, Planners
Grosevenor Center, PRI Tower
733 Bishop Street
Suite 2590
Honolulu, HI 96813

Dear Mr. Fee:

Subject: Offsite Infrastructure Environmental Assessment for
Kohanaiki Resort
Districts of Kau and O'oma 2, North Kona, Hawaii
TMKs: 7-2-5: 1 and 7-3-9: 5

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the materials you submitted and have the following comments.

Any Environmental Assessment (EA) would have to include an archaeological inventory survey report covering the proposed project areas which would alter land surfaces. Previously altered land surfaces (altered by bulldozing, recent lava flows, etc.) need not necessarily be surveyed, but a justification for why sites are unexpected in this area must be included.

The archaeological inventory survey report should include initial significance evaluations of any historic sites found, using the criteria of the Hawaii Register of Historic Places. Mitigation recommendations should also be included for any sites that appear to be significant.

Additionally, a high probability exists for finding at least one (1) and possibly as many as three (3) or four (4) rare or endangered plant species within the subject parcels. As such, we would expect to see included in the EA results of a complete

botanical survey of the proposed alignment. We would also expect to see discussion regarding efforts/measures to be taken to mitigate fire potential throughout the proposed projects' life (planning, construction and utilization).

Furthermore, the EA should include statements to the effect that nene geese attracted to golf courses will be accommodated and herbicides and rodenticides will be cleared to prevent wildlife mortalities. Restaurants should also be screened to prevent wildlife nuisance complaints that eventually result in control measures being taken for public safety.

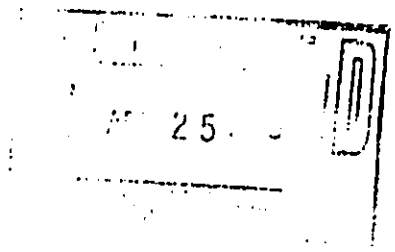
Finally, as indicated in the subject material, a portion of the proposed project is located in the Conservation District. As such, you have plans to submit a Conservation District Use Application (CDUA) to our Department for the portion of proposed work within the Conservation District. For your information, the following is a brief history of the CDUA application approved for TMK: 7-3-9: 05. There are no CDUA's listed for TMK: 7-2-5: 01.

> The Board of Land and Natural Resources approved CDUA #HA-255 for an 8-foot Wide Non-Exclusive easement for access purposes only at Ooma 2nd, North kona, Hawaii.

If you have any questions, please call me or Cathy Tilton at our Office of Conservation and Environmental Affairs at 548-7837.

Very truly yours,

WILLIAM W. PATY



April 16, 1990

MEMORANDUM

TO: Roger C. Evans, OCEA

FROM: Don Hibbard, Director, Historic Preservation Program

SUBJECT: CDUA Proposal -- Offsite Infrastructure for Kohanaiki Resort (Nansay Hawaii) File No.: 90-570
Kau & Ooma 2, North Kona, Hawaii
TMK: 7-2-5: 1; 7-3-9: 5

HISTORIC PRESERVATION PROGRAM CONCERNS:

Any EA would have to include an archaeological inventory survey report covering the proposed project areas which would alter land surfaces. Previously altered land surfaces (altered by bulldozing, recent lava flows, etc.) need not necessarily be surveyed, but a justification for why sites are unexpected in this area must be included. The archaeological inventory survey report should include initial significance evaluations of any historic sites found, using the criteria of the Hawaii Register of Historic Places. Mitigation recommendations should also be included for any sites that appear to be significant.

DON HIBBARD

Helber Hastert & Kimura
Planners

June 5, 1990

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

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Dear Mr. Paty:

Thank you for your letter of May 16, 1990 and the intra-office memorandum dated April 16, 1990 providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

We would like to take this opportunity to respond to your specific comments:

(1) Archaeological Inventory Surveys. All areas being considered for development have been subjected to an inventory-level survey by Paul H. Rosendahl, Inc. The EA will include complete survey reports, including initial significance criteria of the Hawaii Register of Historic Places.

(2) Biological and Terrestrial Fauna Surveys. All areas being considered for development have been subjected to the referenced surveys conducted by Char & Associates, Dr. Andrew Berger, and Mr. Phillip Bruner. The EA will include complete survey results of these investigations.

(3) Mitigation of Fire Potential. The EA will include a discussion of efforts/measures to be taken to mitigate fire potential throughout the proposed project's life.

(4) Nene Geese Attracted To Golf Course. The proposed action involves the construction of offsite water system improvements and an electric power/telephone substation to service the Kohanaiki Resort. It should be noted that no golf courses are being proposed under the proposed action. We realize the indirect association of the proposed action with the development of the resort (which will have a golf course) and, accordingly, will recommend measures to mitigate potential impacts to Nene Geese and wildlife mortalities as suggested.

(5) CDUA #HA-255 (Non-exclusive easement across TMK 7-3-9: 5). We have reviewed the referenced CDUA file and have discussed this matter with Ms. Tilton at OCEA. We understand that the referenced easement is actually across of a portion of what was formerly designated as Parcel 5 makai of the Queen Kaahumanu Highway (lands within the proposed action are all mauka of the Highway). The parcel has subsequently undergone a consolidation and

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733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Telephone 808 545 2055
Facsimile 808 545 2050

resubdivision as part the 'O'oma 2nd land exchange with HOST Park, and is now classified for taxation purposes as 7-3-9: 22.

We plan to submit the completed EA and accompanying Conservation District Use Application to your Department shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

JOHN WAIHEE
GOVERNOR OF HAWAII

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

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

May 18, 1990

In reply, please refer to:
EPHSD
040

Mr. Thomas A. Fee, AICP
Helber, Hastert & Kimura, Planners
Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Fee:

SUBJECT: Off-site Infrastructure Environmental Assessment (EA) for
Kohanaiki Resort
Districts of Kau and 'O'ama 2
North Kona, Hawaii
TMK: 7-2-05: 1 and 7-3-09: 5

Thank you for the opportunity to review and comment on the subject document. We have reviewed the materials submitted and have determined that the majority of our previous concerns regarding this project are still valid. Our comments are as follows:

1. The Description of Proposed Action indicates that two wells will be drilled on the Kau parcel at the 1,800 foot elevation. If each well will serve 25 or more individuals at least 60 days per year or have a minimum of 15 service connections, the use of each well as a source of drinking water will require compliance with the Department's Administrative Rules, Title 11, Chapter 20, "Potable Water Systems."

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

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

4. All of the project's Kau and the upper portion of the 'O'ama parcels are situated above the Department's Underground Injection Control (UIC) line. Land areas located above the UIC line are generally considered to contain underground sources of drinking water. These areas should therefore be protected against all sources

of groundwater contamination. It is essential that any proposed well (including the brackish water wells) in the project area be designed and constructed to prevent the possibility of groundwater contamination. For example, each well should have a concrete pad and full grouting to prevent seepage or floodwaters from migrating down the well shaft.

5. A public golf course is planned for the project itself. There are many golf course related activities which might contribute to groundwater contamination. Some of the activities of concern include:

   a. Application of biocides and fertilizers;
   b. Storage of fuel for vehicles;
   c. Maintenance of vehicles and equipment (cleaning, refueling, lubrication, etc.)

   If any of these activities are planned, mitigative measures to insure that groundwater contamination will not occur must be addressed.

6. The Department of Health's Eight (8) Conditions Applicable To This New Golf Course Development (attached) should apply to this project. A monitoring system should be installed throughout the golf course, especially in areas downgradient of effluent irrigation and, if any, areas above perennial streams. The type of monitoring system to be used should be tailored to fit site conditions. the monitoring system may consist of monitoring wells, lysimeters, vadose zone monitoring instruments or a combination of the different methods. The design and siting of the monitoring system should be reviewed by the Department of Health.

7. The Description of Proposed Action indicates that two brackish water wells will be drilled on 'O'ama 2 parcel at the 700 foot elevation. These wells are intended to supply the irrigation requirements for the golf course and landscaping at the resort. The potable and non-potable water systems must be carefully designed ad operated to prevent cross-connections and backflow conditions. The two systems must be clearly labeled and physically separated by air gaps or reduced pressure principle backflow preventers to avoid contaminating the potable water supply.

If you should have any questions, please contact the Safe Drinking Water Branch at 543-8258.

Sincerely,

BRUCE S. ANDERSON, PH.D.
Deputy Director for
Environmental Health

Attachment

cc: Hawaii, District Health Office

STATE OF HAWAII
DEPARTMENT OF HEALTH

April, 1990 (Version 3)

EIGHT (8) CONDITIONS APPLICABLE TO THIS NEW GOLF COURSE DEVELOPMENT

1. The owner/developer and all subsequent owners shall establish a groundwater monitoring plan and system which shall be presented to the State Department of Health for its approval. The groundwater monitoring plan and system shall minimally describe the following components:

   a. A monitoring system tailored to fit site conditions and circumstances. The system shall include, and not be limited to, the use of monitoring wells, lysimeters and vadose zone monitoring technologies. If monitoring wells are used, the monitoring wells shall generally extend 10 to 15 feet below the water table.

   b. A routine groundwater monitoring schedule of at least once every six (6) months and more frequently, as required by the State Department of Health, in the event that the monitoring data indicates a need for more frequent monitoring.

   c. A list of compounds which shall be tested for as agreed to by the State Department of Health. This list may include, but not be limited to the following: total dissolved solids; chlorides; PH; nitrogen; phosphorus; or any other compounds associated with fertilizers, biocides or effluent irrigation.

2. Baseline groundwater/vadose zone water data shall be established as described in this paragraph. Once the monitoring system and list of compounds to be monitored for have been determined and approved by the State Department of Health, the owner/developer shall contract with an independent third-party professional (approved by the State Department of Health) to establish the baseline groundwater/vadose zone water quality and report the findings to the State Department of Health. Testing of the analyses of the groundwater shall be done by a certified laboratory.

3. If the data from the monitoring system indicate the presence of the measured compound and/or the increased level of such compound, the State Department of Health can require the owner/developer or subsequent owner to take immediate mitigating action to stop the cause of the contamination. Subsequently, the developer/owner or subsequent owner shall mitigate any adverse effects caused by the contamination.

4. Owner/developer shall provide sewage disposal by means of connection to the public sewer system; or by means of a wastewater treatment works providing treatment to a secondary level with chlorination. Effluent from this wastewater treatment works may be used for golf course irrigation, subject to Condition #3. The entire system shall be approved by the State Department of Health in conformance with Administrative Rules Title 11, Chapter 62, Wastewater Treatment Systems, effective December 10, 1988.

5. If a wastewater treatment works with effluent reuse becomes the choice of wastewater disposal, then the owner/developer and all subsequent owners shall develop and adhere to a Wastewater Reuse Plan which shall address as a minimum, the following items:

   a. Management Responsibility. The managers of the irrigation system using reclaiming wastewater shall be aware of the possible hazards and shall evaluate their system for public health, safety, and efficiency. They must recognize that contact with the reclaimed wastewater from treated domestic sewage poses potential exposure to pathogenic organisms which commonly cause infections diseases (bacteria, viruses, protozoa, and halminths or worms).

   b. General Recommendations

      1) Irrigated areas should be no closer than 500 feet from potable water wells and reservoirs.

      2) Irrigated areas should be no closer than 200 feet from any private residence.

      3) Application rates should be controlled to minimize ponding. Excess irrigation tailwater in the reclaimed wastewater irrigation area shall be contained and properly disposed. An assessment should be made of the acceptable time and rate of application based on factors such as type of vegetation, soil, topography, climate and seasonal variations.

      4) Effluent holding/mixing ponds shall be designed to prevent the infiltration of the wastewater into the subsurface. The holding/mixing ponds shall be made impervious.

      5) Irrigation shall be scheduled such that the public is not in the vicinity and the soil is sufficiently dry to accept the irrigation water.

      6) Permanent fencing or barriers shall be erected around polishing or holding ponds to prevent public entry or stray feral and tame animals from gaining access to the ponds.

7) Adequate irrigation records shall be maintained. Records should include dates when the fields are irrigated, rate of application, total application and climatic conditions. Records should also include any operational problems, diversions to emergency storage or safe disposal and corrective or preventive action taken.

8) The holding/mixing ponds shall be periodically monitored for the purpose of detecting leakage into the subsurface. If leakage is detected, corrective action shall be immediately taken.

c. Adequate Notice. Appropriate means of notification shall be provided to inform the employees and public that reclaimed wastewater is being used for irrigation on the site.

1) Posting of conspicuous signs with sufficient letter size for clear visibility with proper wording should be distributed around the use areas.

2) Signs shall be securely fastened. Periodic surveillance shall be conducted to assure permanent posting at all times. Immediate replacements shall be made when necessitated by deterioration, vandalism or misuse.

d. Adequate Employee Education. Employees or users should be cautioned and warned of the potential health hazards associated with the ingestion of reclaimed wastewater being used at the site.

1) Employees should be warned that the ingestion of reclaimed wastewater is unsafe.

2) Employees should be protected from direct contact of the reclaimed wastewater. If necessary, protective clothing should be provided.

3) Employees should be informed of the following:

- The irrigation water is unsafe for drinking or washing.
- Avoid contact of the water or soil with any open cuts or wounds.
- Avoid touching the mouth, nose, ear or eyes with soiled hands, clothes or any other contaminated objects.
- Be aware that inanimate objects such as clothes or tools can transport pathogenic organisms.
- Always wear shoes or boots to protect feet from the pathogenic organisms in the soil or irrigation water.

6. Releases from underground storage tanks (USTs) used to store petroleum products for fueling golf carts, maintenance vehicles, and emergency power generators pose potential risks to groundwater.

   Should the owner/developer/operator plan to install USTs that contain petroleum or other regulated substances, the owner/developer/operator must comply with the federal UST technical and financial responsibility requirements set forth in Title 40 of the Code of Federal Regulations Part 280. These federal rules require, among other things, owners and operators of USTs to meet specific requirements in the detection, release response and corrective action. Also, the owner/developer/operator must comply with all State UST rules and regulations pursuant to Chapter 342-L 'Underground Storage Tanks' of the Hawaii Revised Statutes.

   In consideration of the above-mentioned remarks, the Department of Health recommends that the owner/developer/operator implement facility plan alternatives that exclude the installation and operation of UST systems (e.g., the preferential use of electric golf carts, use of above-ground storage of fuel oil for emergency power generators, etc.), or, if USTs are utilized, that secondary containment be considered.

7. Buildings designated to house the fertilizer and biocides shall be bermed to a height sufficient to contain a catastrophic leak of all fluid containers. It is also recommended that the floor of this room be made waterproof so that all leaks can be contained within the structure for cleanup.

8. A golf course maintenance plan and program will be established based on "Best Management Practices (BMP)" in regards to utilization of fertilizers and biocides as well as the irrigation schedule. BMP's will be revised as an ongoing measure. The golf course maintenance plan will be reviewed by the State Department of Health prior to implementation.

If there are any questions regarding the eight (8) conditions mentioned here, please contact Mr. James K. Ikeda at 543-8304. We ask you cooperation in the protection of Hawaii's valuable groundwater resource.

Helber Hastert & Kimura
Planners

June 5, 1990

Bruce S. Anderson, Ph.D.
Department of Health
State of Hawaii
P.O. Box 3378
Honolulu, Hawaii 96801

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Dear Mr. Anderson:

Thank you for your letter of May 18, 1990 providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

It should be noted that the proposed action (the development of offsite infrastructure for the Kohanaiki resort) does not include the development of a golf course. The proposed resort will, however, include an 18-hole championship golf course which is now being considered for SMA approvals by Hawaii County. We realize that the two projects (offsite infrastructure and resort development) are indirectly linked as the proposed offsite infrastructure will at least partially serve the proposed resort golf course. Accordingly, we recognize the Department's concerns relative to golf course development, as well as the Eight (8) Conditions Applicable To This New Golf Course Development transmitted with your comments.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Telephone 808 545 2055
Facsimile 808 545 2050

JOHN WAIHEE
GOVERNOR

EDWARD Y. HIRATA
DIRECTOR

DEPUTY DIRECTORS
DAN T. KOCHI (PRIMARY)
RONALD N. HIRANO
JEANNE K. SCHULTZ
CALVIN M. TSUDA

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

IN REPLY REFER TO:
HWY-PS
2.1127

April 4, 1990

Mr. Thomas A. Fee, Senior Associate
Helber Hastert & Kimura, Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Fee:

Offsite Infrastructure Environmental Assessment
for Kohanaiki Resort, District of Kau and 'O'oma 2,
North Kona, Hawaii, TMK: 7-2-05:1; 7-3-09:5

Thank you for your letter of March 9, 1990 requesting our comments on the proposed project's Offsite Infrastructure Environmental Assessment.

1. All utilities within the Queen Kaahumanu Highway rights-of-way shall be underground and placed outside the edge of pavement at a location approved by the Highways Division. The ultimate design of Queen Kaahumanu Highway will be a four-lane divided freeway facility with frontage roads.

2. Visual impacts that may be caused by the installation of breaker tanks, reservoirs, overhead power and telemetry lines should be mitigated.

3. Access to the freeway will be allowed only at interchange locations. In this area, we have determined the location of two of these interchanges, one at the Kealakehe Parkway and the other at the Keahole Airport. Therefore, access for this project should be coordinated with other developments in the immediate area.

4. Any work within the State highway right-of-way will require a permit from the Highways Division, Construction and Maintenance Branch. Submit all plans for work within the State right-of-way to the Highways Division for review and approval.

Very truly yours,

Edward Y. Hirata
Director of Transportation

Helber Hastert & Kimura
Planners

June 5, 1990

Mr. Edward Y. Hirata, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Dear Mr. Hirata:

Thank you for your letter of April 4, 1990 (Ref. HWY-PS 2.1127) providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Telephone 808 545 2055
Facsimile 808 545 2050

CORRECTION

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

Helber Hastert & Kimura
Planners

June 5, 1990

Mr. Edward Y. Hirata, Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Dear Mr. Hirata:

Thank you for your letter of April 4, 1990 (Ref. HWY-PS 2.1127) providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Telephone 808 545 2055
Facsimile 808 545 2050

Bernard K. Akana
Mayor
Duane Kanuha
Director
William L. Moore
Deputy Director

Planning Department

25 Aupuni Street, Rm. 109 • Hilo, Hawaii 96720 • (808) 961-8288

March 27, 1990

Mr. Thomas A. Fee, AICP
Senior Associate
Helber Hastert & Kimura
733 Bishop Street, Suite 2590
Honolulu, HI 96813

Dear Mr. Fee:

Kohanaiki Resort - Offsite Infrastructure
Draft Environmental Assessment (EA)
Kau and Ooma 2, North Kona, Hawaii
TMK: 7-2-05:1 & 7-3-09:5

We have reviewed your letter of March 9, 1990, requesting our review of material which will be used as part of the EA for this project. Thank you for the opportunity to comment.

The Land Use Pattern Allocation Guide Map of our General Plan was recently amended. With the exception of a corridor of Open designation running parallel to the Queen Kaahumanu Highway, the balance of both parcels is planned as Urban Expansion.

Enclosed for your information are revisions to the Keahole to Kailua Development Plan which were recently presented to our Planning Commission. Please note on Page 5, the discussion of the "Open" zone on both sides of Queen Kaahumanu Highway. This "Open" should be considered especially as it relates to the placement of the proposed HELCO & HTCO Substation shown on your maps.

We look forward to reviewing the Environmental Assessment you're preparing. Meanwhile, should you have any questions, please feel free to contact us.

Sincerely,

DUANE KANUHA
Planning Director

RKN:lm

Enclosure

Helber Hastert & Kimura
Planners

June 5, 1990

Mr. Duane Kanuha, Director
Planning Department
County of Hawaii
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Attention: Mr. Rodney Nakano

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Gentlemen:

Thank you for your letter of March 27, 1990 providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Telephone 808 545 2055
Facsimile 808 545 2050

Bernard K. Akana
Mayor
Hugh Y. Ono
Chief Engineer
Bruce C. McClure
Deputy Chief Engineer

Department of Public Works

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

March 20, 1990

MR THOMAS A FEE AICP
HELBER HASTERT AND KIMURA
733 BISHOP STREET SUITE 2590
HONOLULU HI 96813

SUBJECT: KOHANAIKI RESORT
Offsite Infrastructure Environmental Assessment
North Kona, HI
TMK: 7-2-5:1 and 7-3-9:5

We have reviewed the subject document and we have the following comments to offer:

1. The Queen Kaahumanu Highway will inevitably be widened. The waterline should be placed so as not to require adjustments due to the widening.

2. A grading permit is required for the subject work.

for ROBERT K. YANABU, Division Chief
Engineering Division

DHM:so

Helber Hastert & Kimura
Planners

June 5, 1990

Mr. Robert K. Yanabu, Division Chief
Engineering Division
Department of Public Works
County of Hawaii
25 Aupuni Street, Room 202
Hilo, Hawaii 96720

Attention: Mr. David Murakami

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Gentlemen:

Thank you for your letter of March 20, 1990 providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

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DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII
25 AUPUNI STREET • HILO, HAWAII 96720
TELEPHONE (808) 969-1421 • FAX (808) 969-6996

May 3, 1990

MAY - 5

Mr. Thomas Fee, AICP
Senior Associate
Helber Hastert & Kimura
Grosvenor Center, PRI Tower
733 Bishop Street, Suite 2590
Honolulu, HI 96813

OFFSITE INFRASTRUCTURE ENVIRONMENTAL ASSESSMENT AND
SPECIAL MANAGEMENT AREA USE PERMIT APPLICATION
KOHANAIKI RESORT
KAU AND O'OMA 2, NORTH KONA
TAX MAP KEY 7-3-9:3 AND 16

We have reviewed the offsite water system concept and have the following comments:

1. Since the proposed water system will be dedicated to the Department of Water Supply, the water system must be interconnected with our existing water systems. The 2.0-mg concrete reservoir should be located at an overflow elevation of 325± feet mean sea level.

2. Pressure Breaker Reservoirs are too small (12,900 gallons). Ideally reservoirs should be 288 feet apart in elevation.

3. Pressure Breaker Reservoir lots should be subdivided and should be large enough to accommodate future pump stations.

4. It should be mentioned that the irrigation system will be a separate water system and will be privately maintained.

5. A chlorination point is not specified. Normally, water is chlorinated at the well site reservoir. This reservoir should be a sizable one (0.1-mg or greater).

6. All reservoirs shall be constructed with reinforced concrete. All pipelines shall be ductile iron.

7. The number of wells cannot be determined until such a time that a pump test is made. The number of wells depends on the yield of each. Total capacity of the wells is 1.76 million gallons average day. There may be more than just two wells. Please keep in mind the Total Pump Capacity Standards in the "Water System Standards."

8. The offsite water system is in the land divisions of Ka'u and O'oma 2, not districts as stated.

Should there be any questions, please do not hesitate to contact us.

H. William Sewake
Manager

CS

cc - Planning Department
Mr. Tom Yamamoto, Nansay Hawaii, Inc.

Helber Hastert & Kimura
Planners

June 5, 1990

Mr. H. William Sewake, Manager
Department of Water Supply
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Dear Mr. Sewake:

Thank you for your letter of March 20, 1990 providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

Based on your letter and follow-up discussions with Mr. Shimabukuro of your staff by Mr. Bill Bow of M&E Pacific, we note the following:

- o Kau Pressure Breaker Reservoirs. Increased capacity from 12,900 gallons to 20,000 gallons. Spacing to be decreased from 400-foot elevation intervals to 300-foot elevation intervals.

- o Chlorination Point. 0.1 MG chlorination reservoir has been added at 1,800-foot elevation adjacent to the proposed Kau well field.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

cc: Ms. Christine Barada, Nansay Hawaii, Inc.

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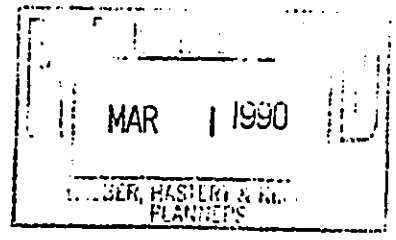
Hawaii Electric Light Company, Inc. • PO Box 1027 • Hilo, HI 96721-1027

CUST
H-W/G

March 29, 1990



Helber, Haster & Kimura
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Attention: Mr. Thomas A. Fee

Gentlemen:

Subject: Offsite Infrastructure Environmental Assessment
Proposed Kohanaiki Resort
North Kona, Hawaii TMK 7-2-05:1 and 7-3-09:5

I apologize for the late response to the EA, however, appreciate the opportunity to review and comment on it. The project is in the Kailua-Keahole Development plan proposed by the County of Hawaii Planning Department. Our comments were provided to Duane Kanuha, copy attached, which is relative to the overall project.

A. District of Kau

There is a 69KV transmission line and 12KV distribution line available along Mamalahoa Highway. However, the existing 12KV distribution line is inadequate to accommodate the proposed 700 HP pump(s).

A dedicated 69/12KV substation is required to serve the proposed 700 HP pump because of excessive voltage starting dip on HELCO's 12KV system. A 150' X 150' minimum substation lot near the well sites must be deeded over to HELCO in fee to HELCO. The developer must also contribute to the cost of a 69KV transmission line tap, substation and 12KV overhead distribution line to the well site.

B. District of 'O'oma 2

There is a 69KV transmission line available along Queen Kaahumanu Highway. However, the existing 69KV transmission line is inadequate to accommodate the Kohanaiki Resort load.

The following is a summary of the customer's requirements discussed in a meeting held with the developer's consultant and our staff on January 19 this year:

1. Participate with other developers in the construction of a new 69KV transmission line and provide a corridor with utility easements from Keahole to Kailua.

2. Pay for a 10 MVA 69/12 substation transformer minimum required to serve the project estimated 10 MW load.

3. Dedicate a 250' X 250' minimum substation lot to HELCO in fee in the map shown in figure 2. A larger lot is needed because of the County of Hawaii's landscape and setback requirements along Queen Kaahumanu Highway.

4. Provide an access road to the substation lot from the Queen Kaahumanu Highway constructed in accordance to the State Highway Standards.

5. Contribute to the cost of the new transmission line, substation and 12KV underground distribution system.

We encourage that energy conservation features suitable to reduce the peak demand be considered in the resort development. For example, fluorescent lighting should be used in buildings and sodium lighting for parking lots and roadways. Our Administration Department is prepared to assist you in providing rate analysis and other recommendations regarding heating and cooling needs of the resort. Contact Tom Goya, Director of Customer and Consumer Service Administration Departments at 969-0131.

If there are any questions on this, please call me at 969-0323.

Very truly yours,

Melvin S. Yamaki
Electrical Engineer
Planning Division

MSY:ts

Enclosures

cc: C. Nagata
H. Kamigaki
T. Goya

Hawaii Electric Light Company, Inc. • P.O. Box 1027 • Hilo, HI 96721-1027

GENPP
H-W/G

November 16, 1989

Planning Department
County of Hawaii
25 Aupuni Street, Room 109
Hilo, Hawaii 96720

Attention: Mr. Duane Kanuha, Planning Director

Gentlemen:

Subject: Keahole to Kailua Development Plan

Thank you for allowing us the opportunity to comment on the Keahole to Kailua Development Plan.

Based on the plan, we estimated an addition of approximately 100 MW of load. This will have a major impact on our system. Additional generation and transmission lines will be required.

Existing Conditions:

1. HELCO has three (3) 69KV transmission lines serving Kona. One 69KV line is along the Hawaii Belt Highway from Waimea to Kailua and the other along Queen Kaahumanu Highway from Keahole to Kailua. The third line is along Mamalahoa Highway from South Point direction toward Kailua.

2. The three (3) 69KV transmission lines serve distribution substations which step the voltage down from 69KV to 12.47KV. The 12.47 KV overhead distribution line on Hawaii Belt Highway originates from a substation in Kona Industrial Subdivision on Kaiwi Street. There are six (6) substations on Queen Kaahumanu and Kuakini Highways.

Proposed Conditions:

1. Ninety per cent or 12,622 acres of the 14,000 acres of undeveloped land in the area are owned by several large landowners. The estimated load for the existing land use is 20 MW now and will be at least 100 MW when fully developed.

2. Preliminary analysis, show that two (2) or more additional 69KV lines will be required in the Kona area to support this added load. The routing and termination points of these lines will be dependent upon the location of major load centers and easement availability. Developers are required to contribute to the cost of additional facilities and must provide the necessary lots for the substations, and easements for the transmission and distribution lines. One or more 69KV transmission line corridors will be required between Keahole and Kailua. Perhaps the

proposed Kailua bypass road could be used for one or two of these lines. The easement should be a minimum of 75' wide per line if located in private property.

In order for us to make a thorough study of the system improvements required, we would appreciate receiving a twenty (20) year load projection, time schedule, size and location of the loads.

Very truly yours,

Clyde H. Nagata, Manager
Engineering Department

CHN:MSY:ts

cc: J. Oda
H. Kamigaki
D. Kiyosaki

Helber Hastert & Kimura
Planners

June 5, 1990

Mr. Melvin S. Yamaki, Electrical Engineer
Planning Division
Hawaii Electric Light Company, Inc.
P.O. Box 1027
Hilo, Hawaii 96721-1027

Offsite Infrastructure Environmental Assessment for Kohanaiki Resort
Land Divisions of Kau and 'O'oma 2nd,
North Kona, Hawaii. TMKs 7-2-05:1 & 7-3-09:5

Dear Mr. Yamaki:

Thank you for your letter of March 29, 1990 providing comments on the forthcoming environmental assessment (EA). We have incorporated your comments into the EA and intend to include your comments, together with this response, into an appendix of the EA.

We plan to submit the completed EA and accompanying Conservation District Use Application to the State Department of Land and Natural Resources shortly. Please don't hesitate to call me or Ms. Barada at Nansay Hawaii, Inc. (885-5300) if we can be of any assistance. Thanks again for your attention to this matter.

Sincerely,

Thomas A. Fee, AICP
Vice President

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