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# KAUPULEHU RESORT

Kaupulehu, North Kona, Hawaii

## Final Environmental Impact Statement

June 1986



 **Kaupulehu**  
DEVELOPMENTS

Office of Environmental Quality Control  
235 S. Beretania #702  
Honolulu HI 96813  
586-4185

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Kaupulehu, North Kona, Hawaii

## Final Environmental Impact Statement

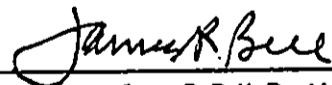
June 1986

Prepared for:  
Kaupulehu Developments

Prepared by:  
Belt, Collins & Associates

For Submission to:  
Land Use Commission, State of Hawaii

Submitted by:



James R. Bell, President  
Belt, Collins & Associates  
Honolulu, Hawaii



 **Kaupulehu**  
DEVELOPMENTS

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- B. Anchialine Pond Survey, Kaupulehu, North Kona, Hawaii: Final Report. OI Consultants, Inc.
- C. Baseline Assessment of the Offshore Marine Environment in the Vicinity of Kaupulehu, North Kona, Hawaii. Steven Dollar, Marine Research Consultant.
- D. Botanical Survey for Kaupulehu Developments, Kaupulehu, North Kona, Hawaii. Winona P. Char, & Associates.
- E. An Avifaunal and Feral Mammal Survey of Property Proposed for a Resort-Residential Development at Kaupulehu, Hawaii. Phillip L. Bruner, M.S.
- F. An Archaeological Reconnaissance of the Makai Parcel of Kaupulehu Ahupuaa, North Kona, Hawaii Island. Laura A. Carter, Department of Anthropology, Bernice P. Bishop Museum.
- G. Preliminary Report Upon Completion of Field Work: Archaeological Survey and Test Excavations, Kaupulehu Makai Resort Project Area, Land of Kaupulehu, N. Kona, Island of Hawaii. Alan T. Walker, B.A., and Paul H. Rosendahl, Ph.D.
- H. Kaupulehu Resort Development: Public Revenue-Cost and Economic Impact Analysis. Environment Capital Managers, Inc.
- I. Air Quality Impact Analysis, Kaupulehu Resort. J.W. Morrow, Environmental Management Consultant.
- J. Noise Study for Resort Development, Kaupulehu, North Kona, Hawaii. Y. Ebisu & Associates.

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# Chapter I

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# Chapter I

## CHAPTER I

### INTRODUCTION AND SUMMARY

#### 1. PURPOSE OF THIS DOCUMENT

This environmental impact statement (EIS) has been prepared in conjunction with a State Land Use District boundary amendment petition submitted by Kaupulehu Developments to the State Land Use Commission. It has been prepared and processed in compliance with the requirements of Chapter 343, Hawaii Revised Statutes, and the regulations adopted pursuant thereto.

#### 2. PROPOSED GOVERNMENTAL ACTION

Kaupulehu Developments is requesting that the State Land Use Commission amend the State Land Use District boundaries as shown in Figure II-7. This involves changes in the designation of 698 acres: 575 acres from the Conservation to the Urban District and 123 acres from Urban back to Conservation. The affected acreage is designated by tax map as Third Division, 7-2-03: Portion of 1.

#### 3. PROJECT DESCRIPTION

Kaupulehu Developments leases about 11,000 acres of land in the ahupuaa of Kaupulehu from the B.P. Bishop Estate. It proposes to develop portions of the leased land makai of Queen Kaahumanu Highway as a self-contained resort/residential community to be known as Kaupulehu Resort. Facilities will be developed at a site south of the existing Kona Village Resort over a period of about ten years. They will include a luxury hotel and beach club, beach resort condominiums, golf resort condominiums, and two golf courses. Vehicular access to the resort will be via the main entry road from Queen Kaahumanu Highway. A separate new roadway to the existing, independently-operated Kona Village Resort will branch off from this entry road. The operators of Kona Village Resort propose to relocate an existing check point to the new roadway.

Public access from Queen Kaahumanu Highway to the shoreline will be provided, which will facilitate pedestrian access at the shoreline.

Approximate acreages to be devoted to each major land use category and the range of units planned at Kaupulehu Resort are as follows:



**KAUPULEHU RESORT  
LAND USE BY ACREAGE AND UNITS**

<u>Land Use</u>	<u>Approximate Acreage</u>	<u>Planning Range Number of Units</u>
Hotel	60	600-900
Beach Club	5	
Beach Condominiums	60	50-150
Golf Condominiums	60	300-450
Golf Courses (2)		
Open Space, Buffer, Roadways, and Services Areas	<u>438</u>	
	<u>623</u>	

The current request for reclassification would also allow Kona Village Resort to expand its operations by providing additional Urban District shorefront property adjacent to its north boundary. An agreement between Kaupulehu Developments and Kona Village Resort will make additional acreage available to Kona Village Resort for expansion purposes. About 9.5 acres of reclassified Urban land would be combined with existing Urban classified land both north and south of Kona Village Resort to develop additional facilities at Kona Village Resort. Expansion will include five shoreline acres south of Kona Village Resort for 29 new units, fifteen shoreline acres north of Kona Village Resort for 25 new units, and two acres for parking and tennis facilities. See the following table for proposed land uses at Kona Village Resort.

**KONA VILLAGE RESORT LAND USE**

<u>Acres</u>	<u>U s e</u>
60*	Existing Kona Village Resort (TMK 7-2-3:2)
1*	Tennis court
1*	Parking Lot Expansion
5*	29 New Units South of Existing Resort
<u>15**</u>	25 New Units North of Existing Resort
82	

\* In existing Urban district.

\*\* About 9.5 acres to be part of Kaupulehu Developments' petition for District Boundary change from Conservation to Urban, with the other 5.5 acres within the existing Urban District.

The combined Kona Village Resort and proposed Kaupulehu Resort facilities constitute one intermediate resort under County General Plan designation. As such, the facilities are limited to 1,500 units total. Kona Village Resort currently has 100 units and plans to build 54 additional units. At the same time, 4 existing units will be converted to other uses, giving Kona Village Resort a total of 150 units. Should Kona Village Partnership exercise its right to develop up to 140 additional units at Kona Village Resort in the future, Kaupulehu Developments will restrict development at Kaupulehu Resort to 1,210 units so that the total number of units at both resorts are consistent with current County intermediate resort designation.

The current request for reclassification would allow a buffer to be provided around Kona Village Resort by putting land not used by Kona Village Resort into Conservation.

For clarification purposes in the remainder of this environmental impact statement, where appropriate, the Kaupulehu Resort development and Kona Village expansion will be jointly referred to as the "proposed project."

A marina and condominium complex north of Kona Village Resort is targeted for long-range development on 65 acres of land in the existing Urban District. A golf course to serve this complex is also planned for future development. Although the marina and condominium acreage is already classified Urban, based on an analysis of current conditions, Kaupulehu Developments intends to first develop its lands south of Kona Village, which are more suitable for resort/residential development both from an environmental and economic viewpoint. The proposed reclassification from Conservation to Urban would allow Kaupulehu Developments to proceed with development of the more suitable south site first. There is no current development plan for the north site which is targeted for development well beyond the 10-year development schedule of the south site, and perhaps beyond twenty years' time. Prior to the development of the marina site, an environmental impact statement will be prepared if necessary to comply with then-existing legal requirements.

#### **4. NEED FOR THE PROJECT**

Ming Chew Associates, a Hawaii-based firm specializing in visitor industry projections, prepared a market analysis for the proposed Kaupulehu Resort. In the firm's opinion, Kaupulehu Resort will be more similar to the luxury resorts on the Kohala Coast than to resorts in Kona, by virtue of the project site's topographic and climatic conditions, the resort's proposed ambience and the potential market. The resort would have the advantage of being the first resort encountered by visitors to Kohala who arrive through Keahole Airport.

Ming Chew Associates projects a rebounding level of tourism in the Kohala Coast Resort Region, which for the purposes of its analysis, includes the Kaupulehu Resort. Applying a percentage capture rate to the Kaupulehu Resort, Ming Chew Associates projected the demand for resort hotel and resort/residential condominium units and golf play as follows:

**PROJECTED MARKETABILITY\* OF KAUPULEHU RESORT  
1990-2000**

	Projected Marketability		
	1990	1995	2000
Hotel Rooms	200-600	400-800	500-900
Low-Rise Multi-Family Units			
Higher-Quality	50	100-150	150-300
Mid-Quality	100	200-300	300-600
Lower-Quality	50	100-150	150-300
	<u>200</u>	<u>400-600</u>	<u>600-1,200</u>
<b>Total (Rooms/Units)</b>	<b>400-800</b>	<b>800-1,400</b>	<b>1,100-2,100</b>
<b>Golf Rounds, Annual</b>	<b>31,000- 81,000</b>	<b>52,000- 119,000</b>	<b>81,000- 150,000</b>

\*Cumulative demand in excess of February 1985 inventory.

According to the operator of Kona Village Resort, increasing demand for facilities at the resort is projected. The occupancy rate at Kona Village Resort has gone up substantially since the resort operator made improvements to facilities in 1984. In 1985, the average monthly occupancy rate was almost 70 percent, and to date in 1986 the average rate has been almost 85 percent. Kona Village Resort operators expect demand to continue rising and thus project the need for additional facilities to accommodate the demand.

**5. SUMMARY OF IMPACTS**

Because the environment of the project area is relatively flat, dry, and sparsely vegetated (much of the site is relatively recent lava flow), the impacts on the physical environment are not as great as they might otherwise be.

The following summary of impacts is based on published information concerning the study area, on special studies that have been conducted for the proposed project, and on projections of the kinds of activities that would be associated with the proposed project. Its purpose is to identify the kinds of impacts which may occur and to indicate areas of concern where further study may be necessary to fully assess specific impacts.

## 5.1 PHYSIOGRAPHY, GEOLOGY, SOILS, AND AGRICULTURAL POTENTIAL

The general nature of the area will be changed as a result of the proposed project. The proposed site is now dry, rugged lava terrain with sparse vegetation. The relief of the makai Kaupulehu land, a result of successive layering of lava flows, will not be significantly affected by site development. The site is relatively flat and is characterized by aa and pahoehoe lavas with little soil cover. Little mass grading would be required on the development site. With the development of the project, there will be a substantial increase in water and vegetation. Soil to support the proposed golf courses and resort landscaping is insufficient and importation would be required. Soil, where it exists, is shallow and has little, if any, agricultural potential.

## 5.2 HYDROLOGY

The slopes of Hualalai consist of geologically recent, unweathered lava flows. Drainage courses are poorly developed, and no perennial streams exist. Most rainfall percolates into the ground to the underlying groundwater body and moves seaward to be discharged at the coast.

There are no major surface drainage channels on the project site. The golf courses and other landscaping in the hotel and resort/residential development will require irrigation. The increase in surface water runoff will be slight due to the highly porous nature of the crushed lava which is likely to be used as fill in creating the golf courses.

Groundwater underlying the project site is brackish basal water unsuitable (unless desalted) for potable water supply. Potable water will be drawn from a Kaupulehu Developments well site at the 1,400-foot elevation mauka of Queen Kaahumanu Highway. Irrigation water may be drawn from brackish water wells in the makai area.

## 5.3 NATURAL HAZARDS

The shoreline area of the proposed Kaupulehu Resort development is subject to potential flooding by storm waves and tsunamis. For the most part, development will occur beyond, or mauka of, the zone identified by the Flood Insurance Rate Map as within the 100-year flood range, thereby decreasing the likelihood of potential inundation by the ocean.

Volcanic hazards are primarily the result of seismicity due to the Hualalai Volcano rift zone. The last recorded lava flows from Hualalai were in 1800-1801. Earthquakes of 6.4 Richter Scale magnitude are recorded in this area about every 64 year, and should be taken into consideration during the engineering design phase of the development project.

## 5.4 COASTAL RESOURCES

Eight ponds were identified by OI Consultants at the project site, three of which are considered to be typically anchialine in nature. Three other ponds may be more properly considered wetlands and are almost completely covered by dense vegetative growth. In the context of the 450 to 500 known anchialine ponds in the West Hawaii area, the ponds at the proposed Kaupulehu site represent a small portion of the total resource.

The ponds are all situated within about 1500 feet of the shoreline. There are no plans to fill any of the ponds and Kaupulehu Developments intends to integrate them into the overall resort design where possible.

The ponds may be temporarily affected by site clearing and consequent erosional processes, but the degree to which they are affected should be minimal with no impact on their viability as ecosystems. The natural flushing process of the ponds should reduce any potential threat from pollution or nutrients.

Slight surface runoff is anticipated to occur during the grading and construction phases of the project. The impact of this runoff on coastal waters is expected to be insignificant. The proposed development would increase the intensity of use of the coastline and waters.

## 5.5 MARINE RESOURCES

The impacts of site development would primarily be the result of increased sedimentation, increased nutrient loading, changes in storm runoff patterns and subsequent shoreline modification, and shoreline use. The assessment of the marine environment offshore conducted by Steven Dollar (June 1985) determined that these factors would have minimal adverse affect on the marine environment.

At this time it is unknown how drainage patterns may change as a result of development. Currently there appear to be no areas within the Kaupulehu boundaries where marine systems have been affected, in spite of long-term use of the Kona Village Resort site.

Increased access to the project site will occur as a result of resort development. This will include an increase in the number of both hotel visitors and residents using the shoreline area. It is expected that much of the use by residents of the shoreline will be for fishing, which is likely to have some effect on the fish population.

## 5.6 TERRESTRIAL FLORA

Vegetation on the makai Kaupulehu lands is sparse due to the lack of soil cover and water. During a botanical survey of the project lands and vicinity by Winona Char (1985), four vegetation types were identified: the predominant scrub vegetation on lava and small coastal areas of kiawe thicket, strand vegetation, and wetlands. Of the 70 species of plants identified, more than half are introduced species. Among the native species, 15 are indigenous and 11 endemic to the Hawaiian islands.

No endangered or rare species were observed. One candidate endangered species, the tree 'ohai (*Sesbania arborea*) was found near the Kona Village Resort water tanks, near a proposed archaeological preserve. The tree is outside the petition area.

Although the development of Kaupulehu Resort will result in the loss of a number of native plants, the same species are found in habitats similar to the project site elsewhere in the Kona area. With resort landscaping and irrigation, plants adapted to a dry climate will be replaced by those better adapted to wetter conditions. The tree 'ohai is in an area that is not planned for development and will therefore remain undisturbed.

## 5.7 FAUNA

According to a study conducted by Philip Bruner (1985) for the proposed project site, the animals evidenced on the property are predominantly introduced species. One native bird and several migratory birds were seen on the site. Kaupulehu is one of the last remaining habitats of the feral donkey, and evidence of the donkey was detected. Upon project implementation the donkeys will migrate to adjacent undeveloped areas. No individuals of an endangered or threatened species were observed.

The increase in human activity in the area will lead to changes in the bird and animal populations. Species adapted to urban and semi-urban environments and to open grasslands will prosper, while those preferring a dry, solitary habitat would experience a decline.

## 5.8 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Several archaeological surveys in the Kaupulehu area have been conducted throughout the years. The most recent archaeological survey and testing (Paul Rosendahl, 1986) have documented the presence of both prehistoric and historic-period archaeological sites. Of these sites, 35 are believed to require no further work, 9 are recommended for further work, and nine (including 6 foot trails) are recommended for preservation.

Kaupulehu Resort intends to follow the recommendations for the preservation of specific sites and trails, and will modify site plans to accommodate them within the overall resort plan.

## 5.9 SOCIOECONOMIC CONSIDERATIONS

New jobs will be created as a result of the construction and operation of the resort. Environment Capital Managers, Inc. (1986) estimates the creation of 1,847 full-time equivalent direct jobs at full operation of Kaupulehu Resort. Additional long-term employment will also result from the operation of 50 new units at Kona Village Resort. Some of the new positions are expected to be filled by newcomers to the region, which would lead to an increase in population as these workers and their families relocate to the Kona-Kohala region. This would result in new demand for housing.

Personal income and state and local tax revenues, including real property tax revenue, will increase. At the same time, government expenditures for additional services for the new residents and visitors to the area will also increase. Environment Capital Managers, Inc. estimates a favorable revenue-cost ratio of 4.0 to 1.0, or an additional \$4.00 in public revenue benefits that would accrue to the State or County for every dollar of public cost caused by the proposed development at Kaupulehu Resort.

Without the proposed development, neither the planned public access within the project site or further research on archaeological sites are likely to occur. Both would be of public benefit.

## 5.10 TRANSPORTATION FACILITIES

The transportation facilities in the area which will be affected by the proposed project include air and land transportation. Harbor facilities and boat ramps are not expected to become more congested as a result of project development. Keahole Airport, the second largest airport on the island, would have the capacity to handle increased traffic resulting from added visitors to the Kohala Coast Resort Region. The State Department of Transportation has plans to improve the airport's facilities in about five years' time if it is deemed necessary.

The traffic generated by the Kaupulehu Resort and the additional units at Kona Village Resort is not expected to have significant impact on highway capacity or movement. It is expected that a high level of service will be maintained at the intersection of Queen Kaahumanu Highway and the resort entrance road if necessary improvements are made.

## 5.11 AIR QUALITY

An air quality study by James Morrow (1986) concludes that the greatest impact on air quality at the project site will be the result of indirect sources of air pollution, namely vehicular traffic. Due to the low density character of proposed development and the substantial roadway setbacks planned, air quality is not expected to be significantly degraded, even when considering the generation of other resort-related air pollution in the region. Existing air quality is good and no serious problems are envisioned.

## 5.12 NOISE

Vehicular traffic is expected to be the only significant long-term source of noise associated with the proposed project. An analysis conducted by Y. Ebisu & Associates (1986) concluded that planned buffer zones and setbacks along Queen Kaahumanu Highway and internal roadways will minimize impacts from traffic and that noise levels will remain within acceptable Federal agency guidelines for noise levels.

The most significant adverse noise impacts are expected to be only temporary and occur during the construction period. During intermittent construction periods, the air quality at Kona Village Resort and Kaupulehu Resort will be degraded.

## 5.13 INFRASTRUCTURE

### Water

Kaupulehu Developments has a well site located about four miles inland from Kona Village Resort at approximately 1,400-foot elevation. A freshwater well was successfully drilled at the site in July 1981 and approved by the Department of Health in October 1981. This well will serve as part of the water source for the makai development. A second well has been recently drilled to expand the potable water supply. A reservoir will be required for water storage.

It is anticipated that the Kaupulehu water system will be independent from the county system and that no public monies will be required for water supply facilities.

The new Kona Village Resort units will obtain water from the same supply of desalinated water used by the existing resort. Improvements to the existing water system are anticipated.

#### Sewage Disposal

The proposed development will use a sewage treatment plant which meets government standards. Treated sewage effluent may be used for golf courses and other landscape irrigation or disposed of in deep wells. Potential adverse effects from this use will be monitored. Kona Village Resort will expand its own existing treatment facilities.

#### Solid Waste Disposal

Private refuse collectors will provide collection service and solid waste will be disposed of at county landfills. It is not expected that the proposed project will add significantly to the amount of solid waste delivered to landfills.

#### Electricity

Kaupulehu Developments will need to assist in the financing of a new substation mauka of Queen Kaahumanu Highway to be constructed by HELCO on its 69 KV line along the Kailua corridor. Service will be extended to the proposed development from the substation. Kona Village Resort will continue to use its own generating plant.

#### Access

The proposed entry to the makai property from Queen Kaahumanu Highway is identified in Figure II-4. It is located toward the southwest property line because it may be desirable to relocate the existing entry from its present location on land owned by Huehue Ranch to lands held by Kaupulehu Developments. The possible relocation of the entry has been discussed with the State Highways Division, and an intersection to meet State design standards will be provided.

A separate road off the main entry to Kona Village Resort is proposed to encourage the maintenance of the unique identities of both resorts. The main entry road will serve Kaupulehu Resort's hotel, condominiums, and recreational facilities.

A significant aspect of the Kaupulehu Resort development is the provision of public access from Queen Kaahumanu Highway to the shoreline, with parking. This will facilitate the public's access to and enjoyment of coastal resources, including the cultural resources within Kaupulehu.

### **5.14 PUBLIC SERVICES AND FACILITIES**

Increased on-site visitor and resident population as a result of the project will necessitate an increase in public services and facilities such as police protection, fire protection, health care provision, schools, and recreational facilities. Various government agencies have confirmed that an adequate level of service can be maintained and that the proposed project will not have an adverse effect on the provision of services.



## 5.15 VISUAL CHARACTER

The visual character of the project site will be substantially altered from a sparsely vegetated lava environment to a heavily landscaped environment typical of quality resorts. Hence, the overall visual character of the site will be enhanced. Due to the low-rise, low-density character of planned development and the use of buffers, views across the project site from the shoreline and Queen Kaahumanu Highway will not be adversely affected.

## 6. SUMMARY OF PROPOSED MITIGATION MEASURES

Mitigation measures to reduce potential significant environmental effects to insignificant levels will be taken in both the short-term during construction and the long-term during operation of the resorts. The most important of these measures are summarized below:

- o Anchialine ponds and wetlands identified on the project site will be preserved and incorporated into the overall project design.
- o Archaeological sites and foot trails recommended for preservation will be preserved and those recommended for further work will either undergo this work or be preserved. In addition, certain areas of the project containing clusters of representative archaeological resources have been designated archaeological preserves in the Kaupulehu Resort concept plan. The concept plan will be modified as appropriate to accommodate significant archaeological sites and trails.
- o The appropriate governmental rules and regulations will be followed to ensure the proper management of natural resources on the project site. It is also the developer's policy to preserve and enhance natural resources as much as possible and to use them as integral beneficial elements in the overall project plan.
- o The offshore waters will be monitored for any potential adverse impacts due to construction and operation of the resort.
- o Large landscaped buffers will be established to reduce adverse effects from traffic, noise, and air pollution.
- o The project will generate demand for public services and utilities. Any public cost required to provide these additional services and facilities will be more than offset by additional government revenue generated by the project.

## 7. SUMMARY OF ALTERNATIVES

Three general alternatives to the proposed resort development have been considered. The "no action" alternative (no boundary amendment request) would entail two alternatives, either no development on Kaupulehu makai lands or near-future resort development at the north marina/condominium site and land surrounding Kona Village Resort. The third alternative is to develop the petition lands as a lower density resort similar to Kona Village Resort. All three fail to meet the objective of establishing a high quality, low to medium density, economically viable and competitive resort facility at Kaupulehu Resort.

## 8. SUMMARY OF UNRESOLVED ISSUES

None of the unresolved issues are controversial at this time and it is felt that all issues can be resolved without undue difficulty. A list of these issues, with brief explanations, follows.

- 1) The availability of employee housing has not been determined. It is anticipated that the private housing market is capable of satisfying most of projected demand. However, some assisted housing may be necessary and Kaupulehu Developments will continue to explore various housing alternatives with County and State agencies and concerned private entities.
- 2) The proposed Kaupulehu Resort will have some impacts on Kona Village Resort. Although the proposed Kaupulehu development will not infringe directly on Kona Village Resort, it will be located close enough to the existing resort to potentially affect the sense of isolation desired by Kona Village Resort guests. Potential adverse impacts are expected to be either short-term (construction-related), mitigatable, or both. Kaupulehu Developments will work with Kona Village Resort in developing a buffer and plans to have lower density development in areas closer to Kona Village Resort.
- 3) Offsite population growth as a result of resort development is anticipated, but undetermined. The proportion of workers at the project who will move to the region will depend on the ability of the existing labor force to fill new jobs created at future resorts and in other new businesses.
- 4) Transportation improvements will eventually be needed as traffic volumes increase and existing roadways become congested. The need to improve Queen Kaahumanu Highway is a function of projected regional growth and not solely a result of the proposed Kaupulehu Developments resort plans.
- 5) Kaupulehu Developments is committed to follow recommendations to preserve archaeological sites and trails at the project site and to undertake further archaeological work as appropriate. It is possible that other archaeological remains will be uncovered during construction, and, if so, immediate precautions will be taken to inform appropriate agencies and evaluate the discoveries. The extent of any additional resources is currently unknown.

## 9. SUMMARY OF COMPATABILITY OF LAND USE POLICIES AND PLANS

The project lands are predominantly within the State Conservation District. If land use designations are changed through the proposed reclassification, the project will be basically consistent with State and County land use plans and policies. The Hawaii County General Plan's Land Use Pattern Allocation Guide Map (LUPAG) designates the property as "intermediate resort."

**10. NECESSARY APPROVALS AND PERMITS**

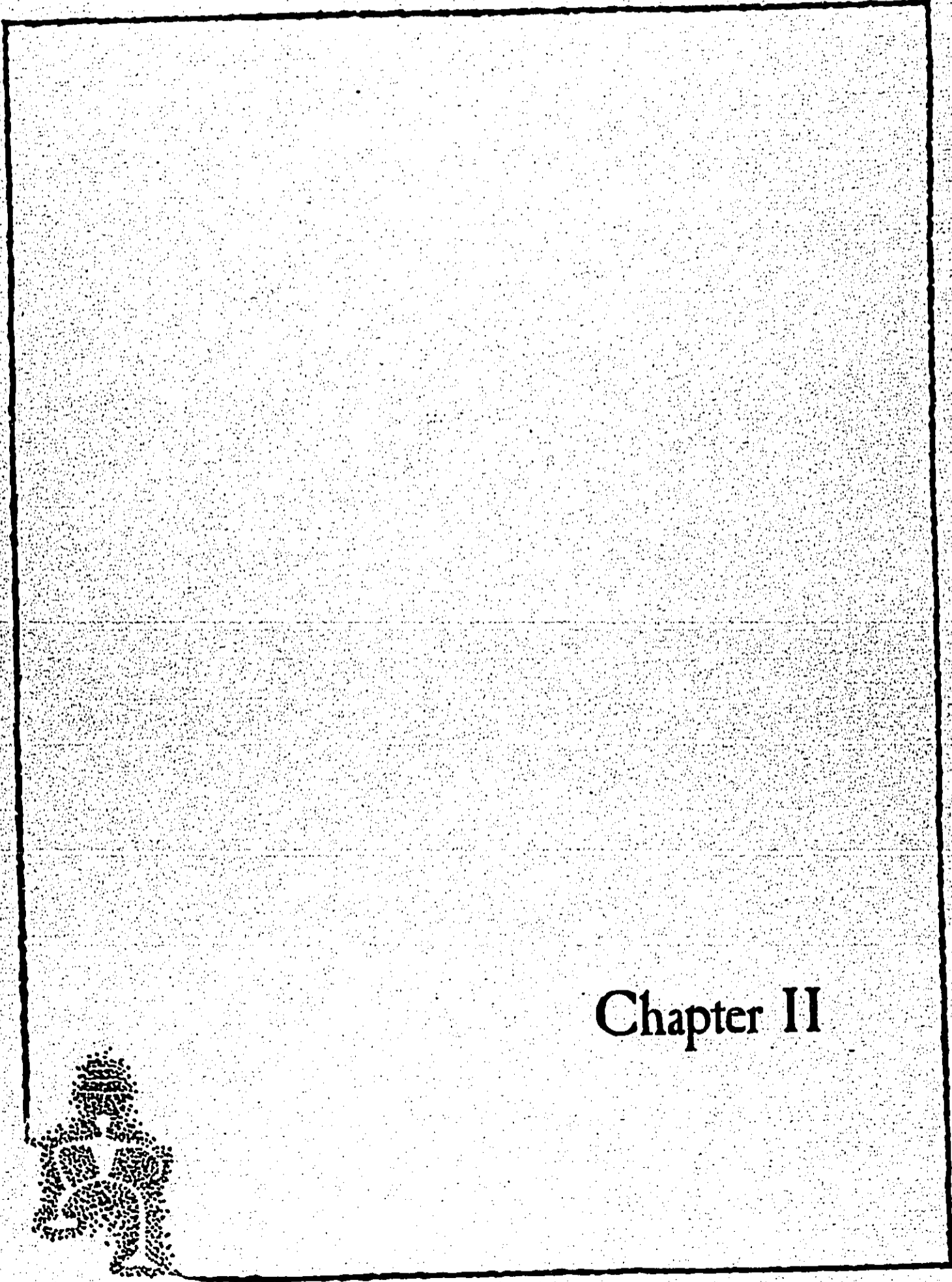
The State Land Use District Boundary amendment is the first of many approvals required by state and county agencies. The following list is of approvals which must be obtained for the project to proceed.

<u>APPROVALS NEEDED</u>	<u>APPROVING AGENCY OR BODY</u>
<b><u>HAWAII/COUNTY:</u></b>	
Special Management Area Use Permit	Planning Dept./Planning Commission
Rezoning	County Council
Plan Approval	Planning Department
Subdivision Approval	Planning Department
Building Permit	Department of Public Works
Grubbing, Grading, Excavation, and Stockpiling Permit	Department of Public Works
Outdoor Lighting Permit	Department of Public Works
Conformance with County Flood Control Ordinance	Departments of Planning & Public Works
Sign Permit	Department of Public Works
Water System Expansion Approval	Department of Water Supply
<b><u>STATE:</u></b>	
State Land Use Boundary Amendment	State Land Use Commission
Historic Sites Review	Dept. of Land & Natural Resources
Drinking Water System Approval	Department of Health
Wastewater Treatment Facility Approval	Department of Health

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## Chapter II

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Chapter II



Vehicular access to the major resort areas in South Kohala and North Kona coasts is mainly via the Queen Kaahumanu Highway which opened in 1975 and connects Kailua-Kona with Kawaihae, the only deep water harbor in West Hawaii. The Honokohau Small Boat Harbor is about 12 miles to the south of the site, within the North Kona District. The Kaupulehu site is located about 6 miles north of Keahole Airport, the major airport in the region. Approximately 40 miles by automobile northeast of the site is the Waimea-Kohala Airport. Service by Princeville Airways to Waikoloa is also available using an airstrip near the Waikoloa Beach Resort, about 15 miles north of the proposed Kaupulehu site.

# CORRECTION

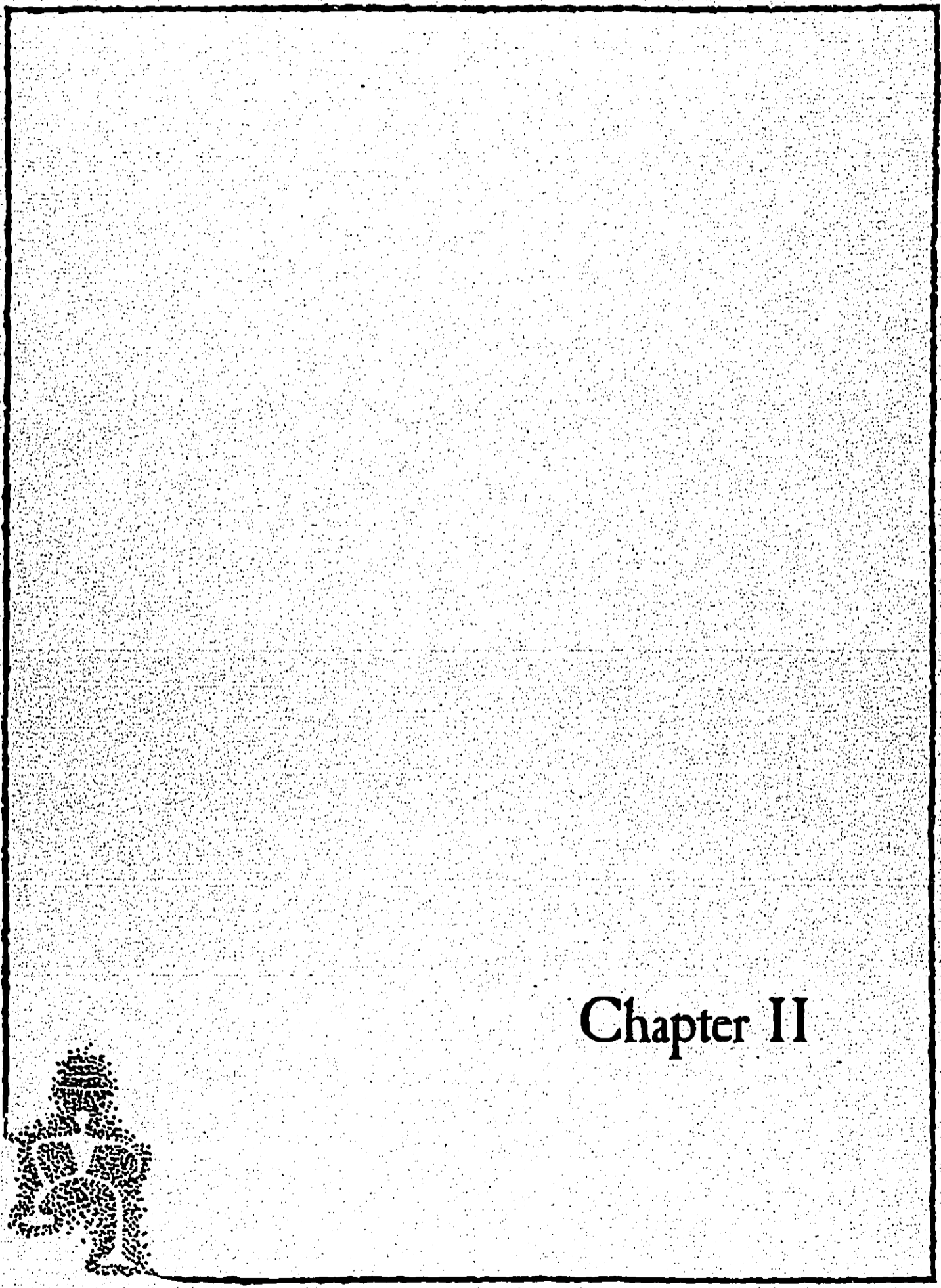
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## Chapter II



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## Chapter II



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Vehicular access to the major resort areas in South Kohala and North Kona coasts is mainly via the Queen Kaahumanu Highway which opened in 1975 and connects Kailua-Kona with Kawaihae, the only deep water harbor in West Hawaii. The Honokohau Small Boat Harbor is about 12 miles to the south of the site, within the North Kona District. The Kaupulehu site is located about 6 miles north of Keahole Airport, the major airport in the region. Approximately 40 miles by automobile northeast of the site is the Waimea-Kohala Airport. Service by Princeville Airways to Waikoloa is also available using an airstrip near the Waikoloa Beach Resort, about 15 miles north of the proposed Kaupulehu site.

## **2. BACKGROUND OF KAUPULEHU RESORT DEVELOPMENT**

The land of Kaupulehu Developments comprises about 11,000 acres within the ahupuaa of Kaupulehu. The property extends about six miles inland from the shoreline to Mamalahoa Highway at the 2,000-foot elevation. It is owned in fee by the Bernice Pauahi Bishop Estate and is presently leased to Kaupulehu Developments.

The makai third of the property, from the shoreline to Queen Kaahumanu Highway, is identified as Tax Map Key 7-2-3:01, Third Division and consists of 2,829 acres. Portions of these lands are planned for resort development. (Not included in the applicant's property, although located in the makai portion of Kaupulehu ahupuaa, are about 60 acres identified by TMK 7-2-3: 2, the site of the existing Kona Village Resort.) (See Figure II-2 for tax map designation.)

The lands mauka of Queen Kaahumanu Highway (TMK 7-2-03:3) consist of 8,164 acres, of which 5,000 acres of Agriculture designated lands are partially slated for future agricultural subdivision. This mauka property includes the well site. Potable water for the resort development will be drawn from wells at this site. Figure II-3 shows the existing conditions in the Kaupulehu lands.

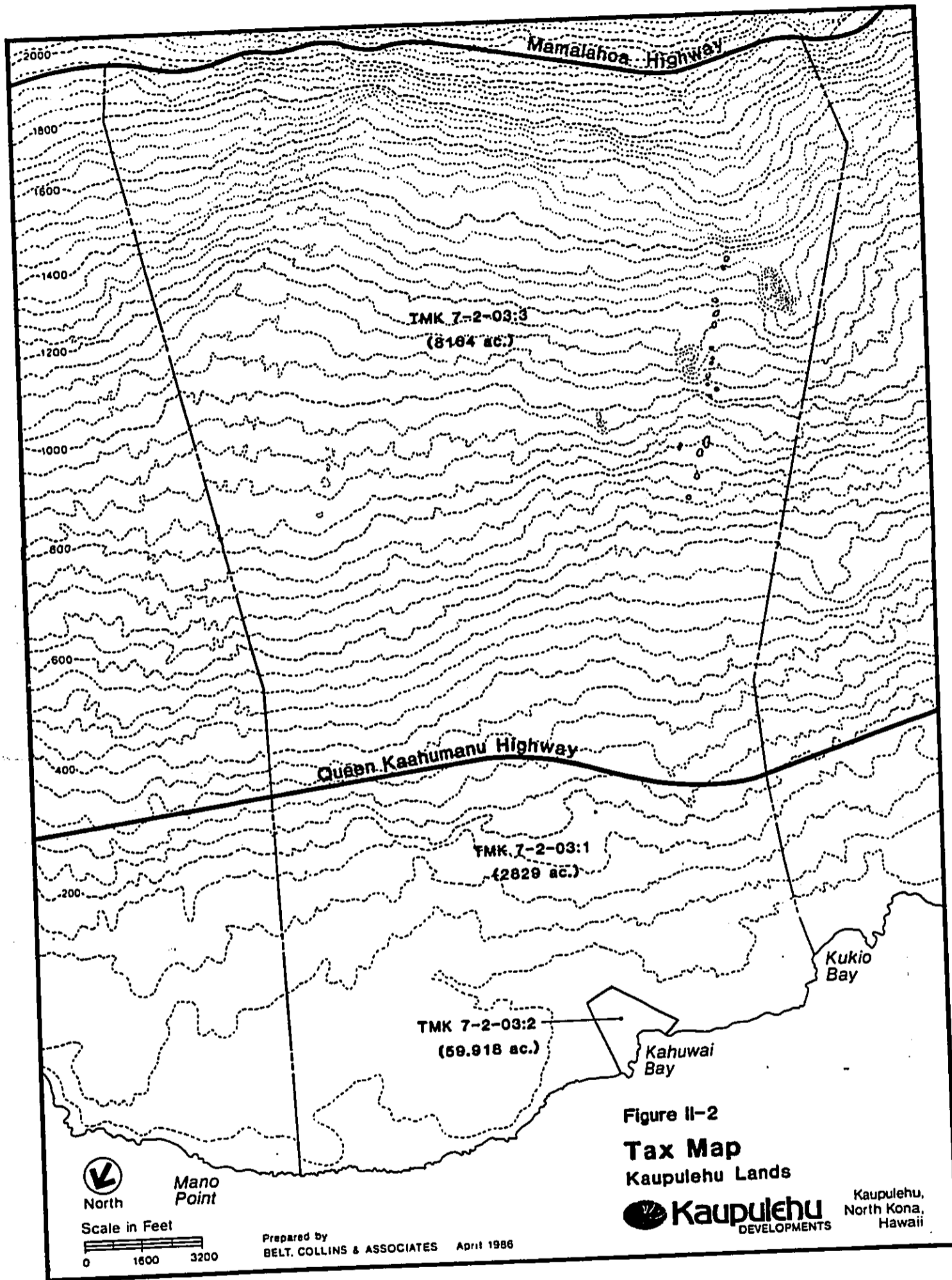
The development history of the area dates to 1959 when Johnno Jackson leased land adjacent to Kahuwai Bay from the Bishop Estate to construct the Kona Village Resort. In July 1962, the Land Use Commission granted a Special Permit to Mr. Jackson on 62 acres of land to construct and operate Kona Village Resort (Land Use Commission File #SP (T) 62-2). Forty-seven units were built by 1966. In 1967, Mr. Jackson sold Kona Village Resort to Signal Properties (dba Island Copra and Trading Company, Ltd.), which expanded the Kona Village Resort to 71 units.

In 1974, Hualalai Development, the long-term leaseholder, and Island Copra and Trading Company, Ltd., the sub-lessee, asked the State Land Use Commission during its five-year boundary review to reclassify 318 acres from the Conservation District to the Urban District. This request included the original 62 acres developed by Mr. Jackson under a Special Permit. In May 1975 the Land Use Commission approved the reclassification (Docket No. 74-34).

In October 1976, the County of Hawaii granted Hualalai Development Corporation a Special Management Area (SMA) Use Permit for 29 additional hotel units and in December 1976 the Hawaii County Council passed Ordinance 242 rezoning 15 acres from Open to Resort-Hotel (V-3). This brought the allowed number of units (100) and the zoned acreage (15) up to the maximum under the Hawaii County General Plan Retreat Resort designation.

During the 1978 General Plan Revision Program, the County of Hawaii upgraded Kaupulehu from Retreat Resort to Intermediate Resort. This designation allows 1,500 units on 45 resort-zoned acres.

Originally, the entire makai and mauka portions of the Kaupulehu Ahupuaa were leased from the Bishop Estate by Hualalai Development Corporation under a lease agreement established in 1961. The Kona Village Resort was subleased from Hualalai Development by Signal Properties, which operated Kona Village under the name of Island Copra and Trading Company.



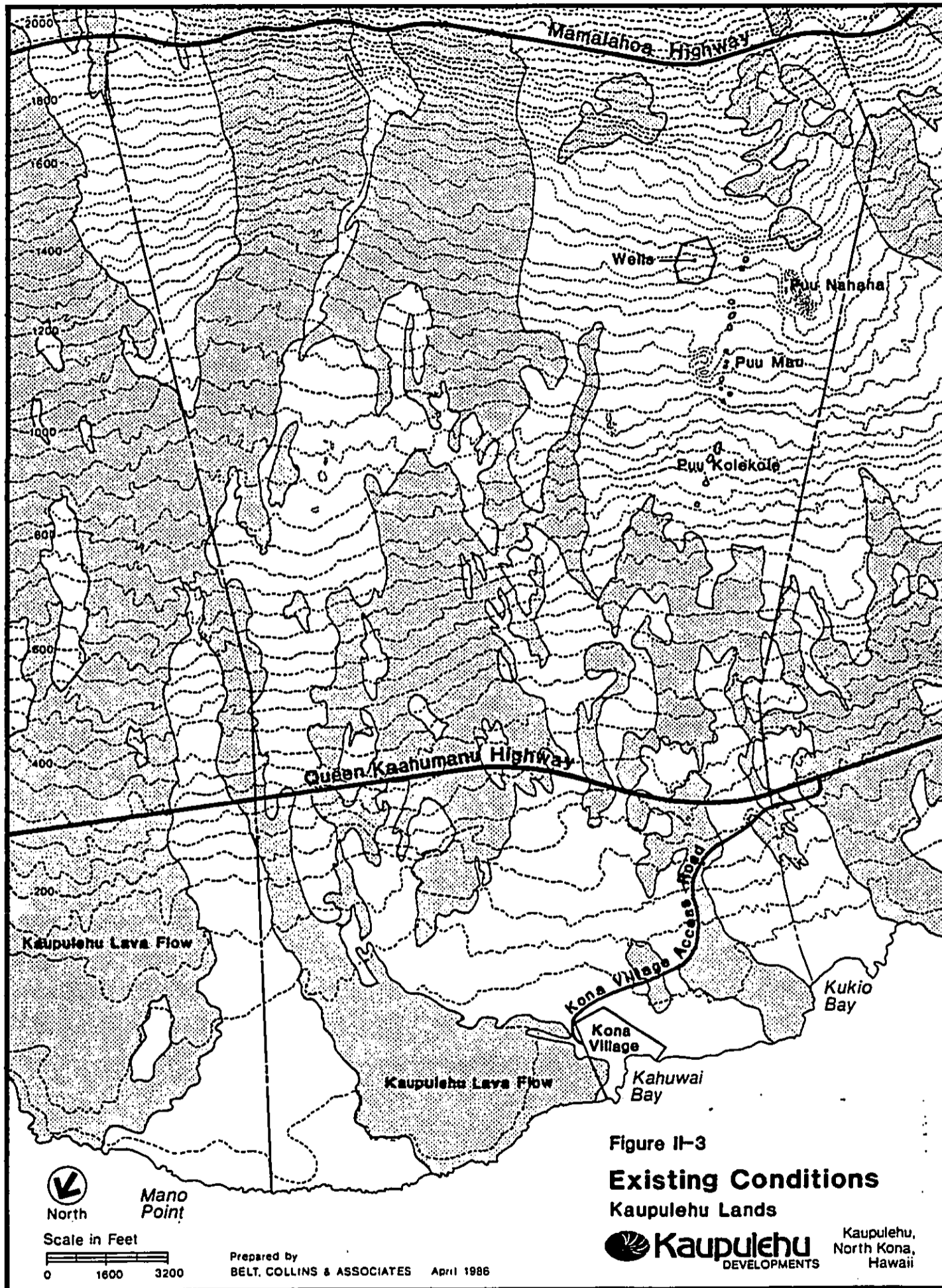


Figure II-3  
**Existing Conditions**  
 Kaupulehu Lands

**Kaupulehu** DEVELOPMENTS  
 Kaupulehu,  
 North Kona,  
 Hawaii

Prepared by  
 BELT, COLLINS & ASSOCIATES April 1986

In April 1979, Cambridge Pacific, Inc. purchased the stock of Island Copra and Trading Company from Signal Properties. Additionally, Cambridge Pacific, Inc. purchased Hualalai Development Corporation. As a result of this transaction Cambridge Pacific, Inc. then held the master lease for Kaupulehu as well as the sublease for the Kona Village Resort.

In 1981, Cambridge Pacific requested the Land Use Commission to adjust the land use district boundaries by transferring 65 acres within the Urban District to a site north of Kona Village Resort then classified Conservation. To offset the adjustment, 65 acres around Kona Village Resort were requested to be reclassified from Urban to Conservation. A 350-unit hotel-condominium was proposed on the 65 acres site north of Kona Village, and 50 detached condominium units were planned on the site located south of Kona Village Resort. Cambridge Pacific's request was approved by the Land Use Commission in August 1982, Docket #A81-524.

In concert with Cambridge Pacific's development plans, the Bishop Estate issued new development lease provisions in 1982. These provisions were to be given effect as part of the 1961 master lease and established separate provisions as to the Kona Village Resort (60 acres); the Northern Site (65 acres); the Southern Site (32 acres); and the Mauka Subdivision Site (5,000 acres).

In May 1984, Barnwell Hawaiian Properties, Inc., a wholly owned subsidiary of Barnwell Industries, Inc., entered into a joint venture with Cambridge Pacific, Inc. to develop the Kaupulehu lands. Barnwell purchased a 50.1% controlling interest in the venture from Cambridge Pacific, Inc. The joint venture controls the Bishop Estate master lease on parcels TMK 7-2-3:01 and 03 (Kaupulehu Makai and Mauka Lands).

Also in May 1984, a separate partnership, unrelated to Kaupulehu Developments, purchased the sublease for the Kona Village Resort property from Cambridge Pacific, Inc. in an unrelated transaction. Today, Associated Inns and Restaurants Company of America (AIRCOA) operates the Kona Village Resort for that partnership.

The lease term for the 60-acre Kona Village Resort parcel, TMK 3-7-03:2, together with an area of about 156 acres classified in the Urban District, is for 66 years from January 1, 1983. The land which includes the proposed Kaupulehu Developments resort development, TMK 3-7-03:1, is under a lease agreement which expires December 31, 2025.

### **3. DEVELOPMENT CONCEPT**

The development concept for the Kaupulehu Resort is a low density project integrating a luxury or super-luxury oceanfront hotel and beach club, beach and golf resort condominiums, and a full range of facilities and amenities, including two championship golf courses.

Figure II-4 illustrates the proposed development concept for the Kaupulehu makai lands. In addition to the currently proposed resort development at Kaupulehu Resort, the concept shows a small boat marina, a condominium complex, and a golf course on Urban and Conservation land on the north portion of the makai property. The northern site is planned for long-term development which is beyond the time frame of this urban boundary amendment request. Appropriate requests to allow development will be submitted when the currently proposed project is fully complete and Kaupulehu Developments is prepared to proceed with further development. This is projected to be in 15 to 20 years. An assessment of the environmental impacts for this potential future development is not included in this document as the time frame for development is beyond the scope of this Environmental Impact Statement.

The "proposed project" also includes expansion of Kona Village Resort facilities. The reclassification request would allow Kona Village Resort to expand its operations by providing additional Urban District shoreline property adjacent to its north boundary. About 9.5 acres of reclassified Urban land would be combined with existing Urban classified land both north and south of the resort to accommodate 50 new units.

#### **3.1 STATEMENT OF OBJECTIVES**

Kaupulehu Developments' primary objective is to develop portions of its makai lands as an economically viable self-contained resort/residential community in conformance with the Hawaii County General Plan Intermediate Resort designation for the area, while adhering to environmentally sensitive design standards. Kaupulehu Developments intends to provide a range of amenities that would be competitive in the world-class market. The proposed development would be compatible with the existing adjacent Kona Village Resort.

Kona Village Resort's primary objective is to remain a competitive destination resort by adding new units to meet increasing market demand as demonstrated by its rising occupancy rates.

#### **3.2 DESCRIPTION OF PROPOSED DEVELOPMENT**

Approximate acreages to be devoted to each major land use category and the range of units planned at Kaupulehu Resort are as follows:



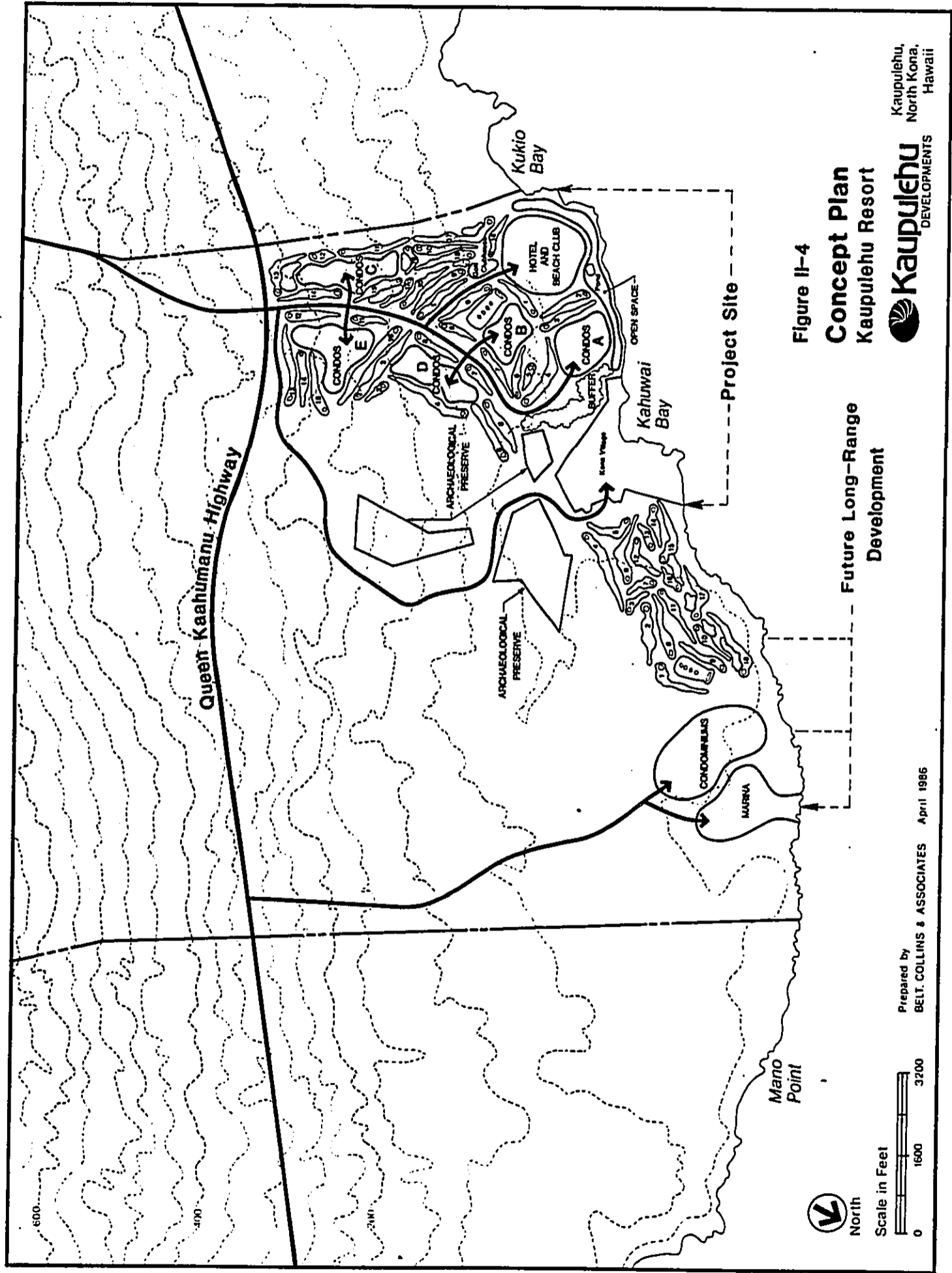


Figure II-4

**Concept Plan**  
Kaupulehu Resort



Kaupulehu,  
North Kona,  
Hawaii

Prepared by  
BELT, COLLINS & ASSOCIATES April 1986

**Kaupulehu Resort  
Land Use by Acreage and Units**

<u>Land Use</u>	<u>Approximate Acreage</u>	<u>Planning Range Number of Units</u>
Hotel	60	600-900
Beach Club	5	
Beach Condominiums	60	50-150
Golf Condominiums	60	300-450
Golf Courses (2)		
Open Space, Buffer, Roadways, and Service Areas	<u>438</u>	
	623	

The focal point of the project is a 600- to 900-room hotel with beach club on about 60 acres inland of Kumukey Point, with Kahawai Beach to the north and Kukio beach to the south. About 60 acres in two sites north of the hotel will be for 50 to 150 resort condominium units designed to be compatible with the general character of the existing Kona Village Resort. Inland of the beach condominiums and the hotel, 300 to 450 condominium units will be situated on about 60 acres within the golf courses.

The main entrance road is proposed from Queen Kaahumanu Highway. From this road a separate roadway winding around the archaeological preserves will lead to the Kona Village Resort, replacing the existing roadway from Huehue Ranch lands. The checkpoint on the existing Kona Village access road will be relocated to the new access road. All roadways will be built to County standards. There will be no direct roadway connection between Kona Village Resort and Kaupulehu Developments land.

At Kona Village Resort, about 9.5 acres of reclassified Urban land would be combined with existing Urban classified land both north and south of Kona Village Resort to develop additional facilities at Kona Village Resort. Expansion will include five shoreline acres south of Kona Village Resort for 29 new units, 15 shoreline acres north of Kona Village Resort for 25 new units, and two acres for parking and tennis facilities. See the following table for proposed land uses at Kona Village Resort.

**Kona Village Resort Land Use**

<u>Acres</u>	<u>Use</u>
60*	Existing Kona Village Resort (TMK 7-2-3:2)
1*	Tennis court
1*	Parking lot expansion
5*	29 new units south of existing resort
<u>15**</u>	25 new units north of existing resort
82	

\* In existing Urban district

\*\* About 9.5 acres to be part of Kaupulehu Developments' petition for District Boundary change from Conservation to Urban

The configuration of the proposed expanded Kona Village Resort site as shown in Figure II-4 and in other figures of this report differs from the site as shown in the Draft Environmental Impact Statement. The rectangular shaped northern expansion portion of the Kona Village site is now triangular shaped, based on Kona Village Partnership's modified site plan. Previously, the northern portion of the Kona Village site was comprised of 2.5 acres of existing Urban land and 12.5 acres of Conservation land that needed to be reclassified Urban to allow expansion. Due to the new configuration, 5.5 acres of existing land will be combined with 9.5 acres of Conservation/Urban land that need to be reclassified Urban.

The proposed change in the Kona Village Resort northern boundary will not significantly alter the impact of the overall project. An additional archaeological survey has been performed to cover the area which will be part of the project but which was not previously covered in other surveys. It should be noted that the total acreage requested for reclassification by the State Land Use Commission remains the same: 575 acres from the Conservation to the Urban district and 123 acres from Urban back to Conservation.

The combined Kona Village Resort and proposed Kaupulehu Resort facilities constitute one intermediate resort under County General Plan designation. As such, the facilities are limited to 1,500 units total. Kona Village Resort currently has 100 units and plans to build 54 additional units. At the same time, 4 existing units will be converted to other uses, giving Kona Village Resort a total of 150 units. Should Kona Village Partnership exercise its right to develop up to 140 additional units at Kona Village Resort in the future, Kaupulehu Developments will restrict development at Kaupulehu Resort to 1,210 units so that the total number of units at both resorts are consistent with current County intermediate resort designation.

### **3.2.1 Natural and Cultural Resources**

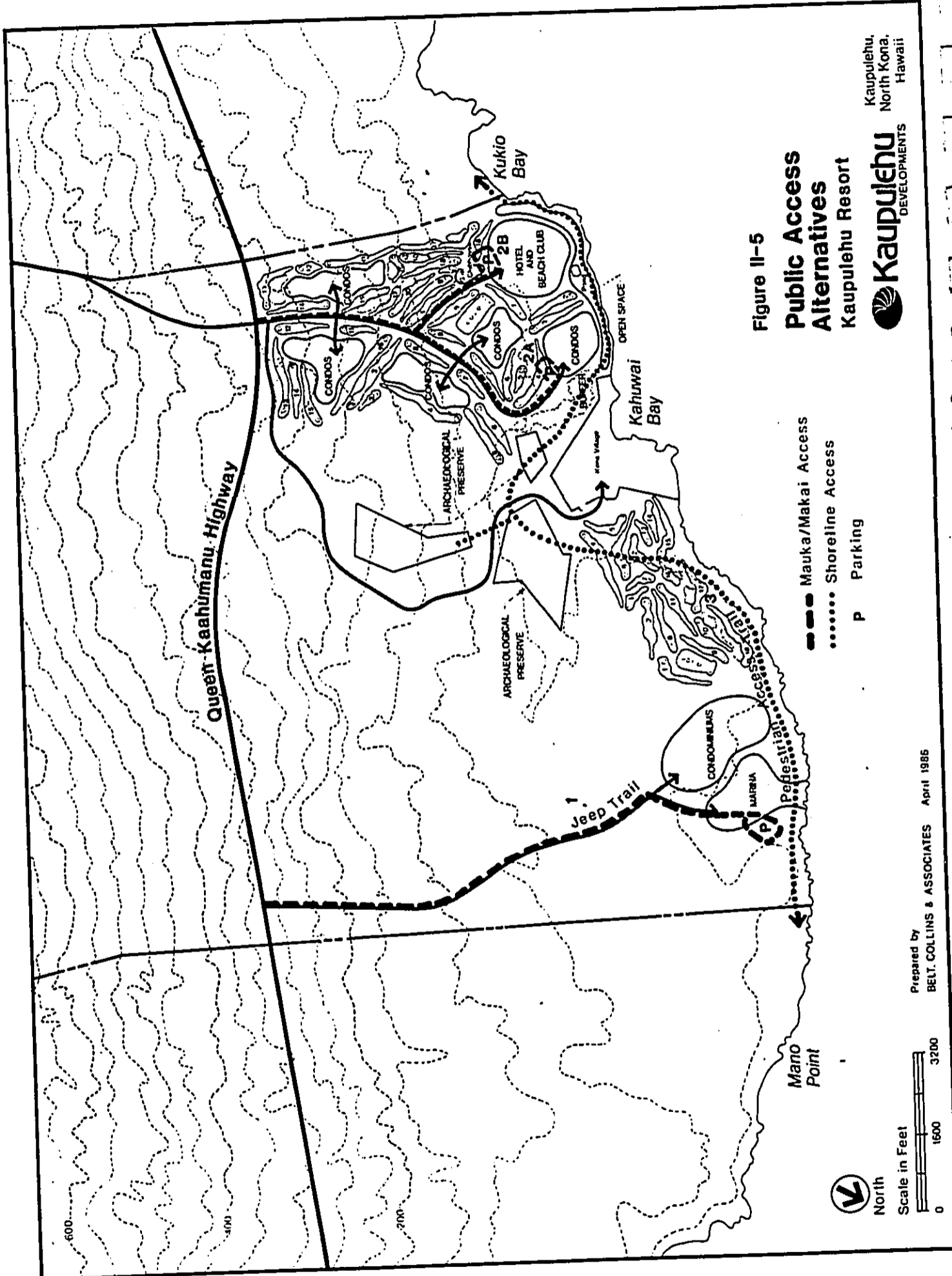
Natural and cultural resources at the project site have been the subject of various studies summarized elsewhere in this report. Kaupulehu Developments plans to integrate features such as ponds and archaeological sites into the overall design of the resort development. An open space area between the shoreline and the hotel, beach club, and beach condominiums will ensure the preservation of a wide stretch of shoreline open space. In addition, three inland archaeological preserves will be an integral part of the project, providing visitors the opportunity to view examples of Hawaiian culture.

### **3.2.2 Public Access**

The applicant intends to provide public access to the shoreline from Queen Kaahumanu Highway and facilitate pedestrian access along the property's shoreline. See Figure II-5 for a conceptual depiction of the proposed access.

Scheduled first is a northern access from Queen Kaahumanu Highway by bulldozed jeep trail. There will be parking by the future marina site, and access to the shoreline will be from the parking area. When future development occurs, the roadway will be paved.

A second access from Queen Kaahumanu Highway will be provided near the southern end of the project site at the time development occurs. Two alternative routes are being considered during this preliminary stage of planning. The proposed route will be determined after timely consultation with the County and adjacent land owners. The two alternatives are as follows:



1. Vehicular access from Queen Kaahumanu Highway by way of the main project entrance road to the shoreline condominium site, with parking near the condominium site. Pedestrian access would be around or through the condominium site to the shoreline.
2. Vehicular access from Queen Kaahumanu Highway by way of the main project entrance road to the northern boundary of the hotel and beach club site, where parking would be located. Pedestrian access would be around or through the hotel and beach club site to the shoreline.

Lateral pedestrian access will be provided after mauka/makai access is in place. Public pedestrian access will extend from the southern boundary with the proposed Kukio Beach Resort to the northern boundary of the site, and will be coordinated with public shoreline access on adjacent property. On Kaupulehu Developments' property, the path will generally follow the shoreline, going in front of Waiakuhi marsh. The Kaupulehu Resort shoreline path will most likely go inland around Kona Village Resort in order to facilitate pedestrian access to the proposed archaeological preserves and to mitigate potential adverse impacts on the secluded Kona Village Resort.

### **3.2.3 Need for District Boundary Amendments**

To accommodate resort development at the southern end of the makai lands, which are more suitable for development than the northern marina site, and to provide a buffer around the existing Kona Village, Kaupulehu Developments is requesting the State Land Use Commission to amend the State Land District Boundaries. The amendment would also allow Kona Village Resort to strengthen its viability by providing sufficient Urban land to accommodate the proposed expansion. The existing Land Use District Boundaries and the Requested Land Use District Boundaries are shown in Figures II-6 and II-7.

## **3.3 NEED FOR THE PROJECT**

### **3.3.1 Introduction**

A market study prepared by Ming Chew Associates (1985) analyzes the demand for resort facilities at Kaupulehu and the Kohala Coast Resort Region (Appendix A). Information covered in this section includes data on the Kohala region as well as Kona because the location and qualities of the proposed Kaupulehu site are more similar to those of Kohala in terms of ambience, topographical and climatic conditions, and potential market. The proposed resort site also lies closer to the boundary that separates North Kona and South Kohala, while most other developments in Kona are south of the Keahole Airport.

The general approach of the study was to identify and assess the trends for the markets that could be served by the Kaupulehu Resort.

### **3.3.2 Hawaii County Visitor Industry**

Over the past 15 years, the number of visitors to the neighbor islands in general has increased at a faster rate than the number to the State of Hawaii as a whole. The proportion of westbound neighbor island visitors intending to visit the Big Island peaked at almost 40 percent in 1971, before beginning a decline to 20.5 percent in 1984. Ming Chew Associates anticipates that the proportion of westbound visitors to

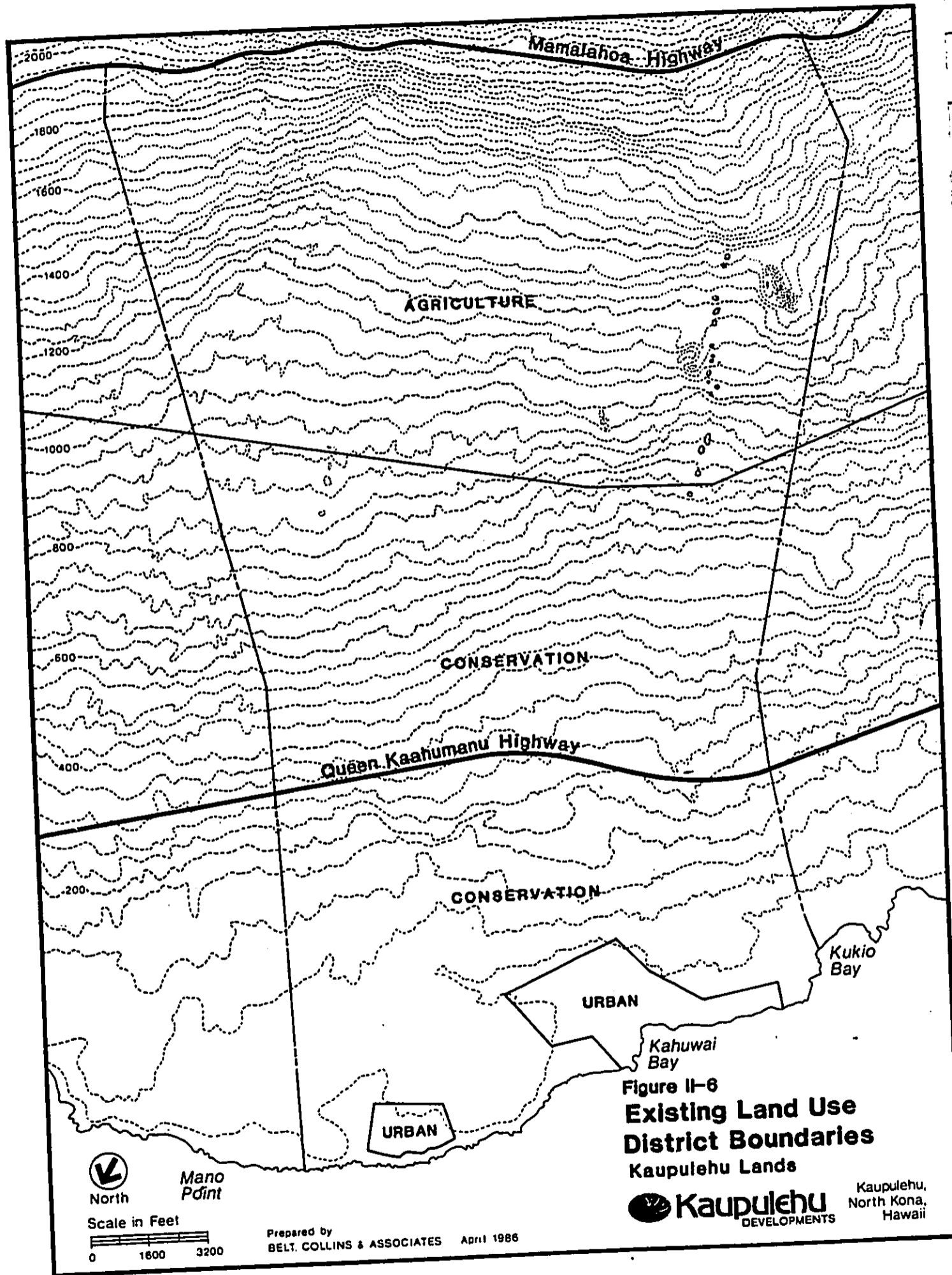
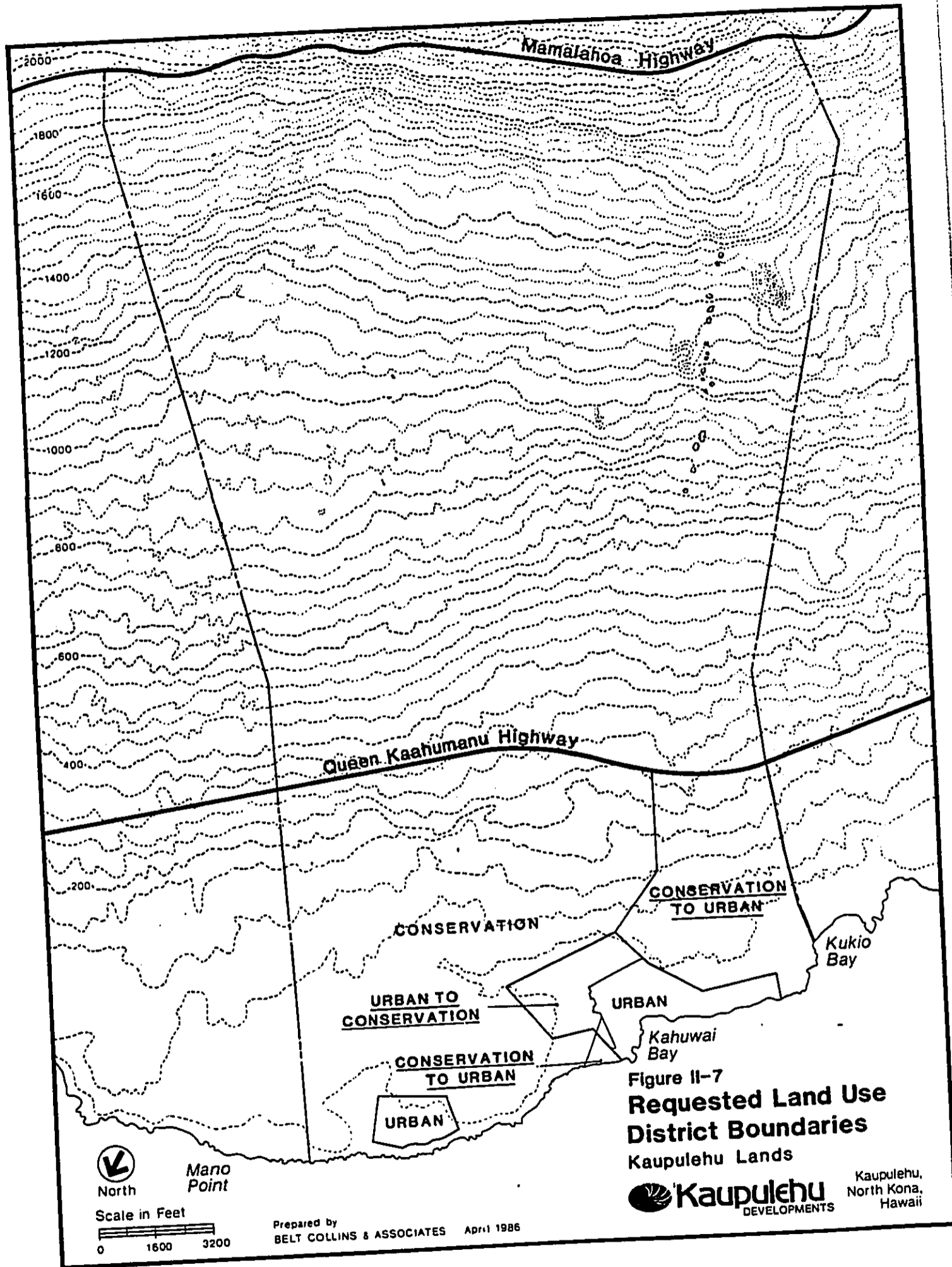


Figure II-6  
**Existing Land Use  
 District Boundaries**  
 Kaupulehu Lands

**Kaupulehu**  
 DEVELOPMENTS  
 Kaupulehu,  
 North Kona,  
 Hawaii



Hawaii County will rebound in 1985 and increase to 32 percent by 2000. It is expected that the number of visitors to the Big Island of Hawaii will increase from an estimated level of 763,000 in 1984, to 1,400,000 by 2000, almost a doubling of the visitor population. This assessment reflects increased promotion of neighbor island destinations, preference for neighbor island amenities by repeat visitors to the State, the recent addition of new visitor facilities on the Island of Hawaii, and the availability of direct flights from the U.S. Mainland to Keahole Airport in Kona.

An increasing proportion of eastbound visitors is also expected to visit Hawaii County. Japan Air Lines, the major eastbound carrier, has increased its promotional efforts to stimulate travel to the neighbor islands as a new travel experience. As a result, the number of eastbound visitors to the island is expected to increase from 193,000 in 1984 to 550,000 by 2000. Combined eastbound and westbound travel to the island is projected to more than double, increasing from 956,000 in 1984 to 1,950,000 by 2000.

### **3.3.3 Market Analysis for Transient Accommodations**

#### **3.3.3.1 Island of Hawaii**

The demand for transient accommodations in Hawaii has expanded dramatically due to rapid growth of state tourism. Furthermore, each delineated market segment now has grown sufficiently to support a wide variety of accommodations, as well as recreation and amusement facilities.

From 1970 to 1984, the total number of transient accommodation units in Hawaii County increased from 3,486 to 7,511, a gain of 115 percent. Occupied rooms increased 91 percent during the same period from an estimated 2,182 occupied units in 1970 to 4,159 occupied units in 1984.

Table VI-1 in the Ming Chew study summarizes the number and location of transient units on the Big Island by price range. The relative rates are indicative of the character of the areas and the general images these major areas have created for themselves. Projects which are members of the Hawaii Visitors Bureau (HVB) contain a total of 5,841 units. More than half of these units are located in Kona (3,328). The next largest concentration is in North and South Kohala (1,296), followed closely by the number in Hilo (1,134). The estimated average published room rate in South Kohala, at \$173, far exceeds those of the other areas. It is expected that the proposed Kaupulehu Developments makai development, like the Kona Village Resort to which it will be adjacent, will have room rates similar to those of South Kohala because of the high quality, luxury nature of the resort plans.

Ming Chew forecast the transient accommodations needed by the county of Hawaii between 1985 and 2000. The total number of occupied rooms is expected to be 4,900 in 1985, 8,000 in 1990, 10,500 in 1995, and 12,900 in 2000, or an increase of 8,000 units in 15 years.

Ming Chew projects a net demand in North and South Kohala of an additional 3,100 units by 1990, 4,900 units by 1995, and 6,600 units by 2000, with 70 to 90 percent of this new demand likely to be accommodated in Waikoloa, Mauna Lani and Mauna Kea Properties projects.



### **3.3.3.2 Kaupulehu Resort Project**

The proposed Kaupulehu Resort project, which is comparable to the luxury and super-luxury resorts in the Kohala Coast Resort Region, has several advantages in terms of its future market demand. The site is situated such that it will be the first resort encountered by visitors to Kohala who arrive through the Keahole Airport. As a gateway project to the Kohala Coast Resort Region, the proposed development would have enhanced visibility as well as closer proximity to the airport and easier access to activities and facilities in Kona. Also, the site has an established locational identity, being adjacent to the existing Kona Village Resort. The long operating period and the high return-guest ratio of this resort implies that the prospects for pent-up demand of resort properties in the vicinity are good. Thus, some increment of pent-up demand probably already exists for properties at the proposed site.

Discussions are ongoing with the world renowned Princess Hotels International to be the operator of the proposed resort hotel. Assuming that an organization with the reputation, track record, and marketing and operating capability of a Princess Hotels would be involved in the planning, development and operations of the proposed project, Ming Chew projects a demand for transient accommodations (hotel and condominium units) at the Kaupulehu project of 345 to 655 units by 1990, 595 to 1025 units by 1995, and 820 to 1460 units by 2000.

### **3.3.4 Market Analysis for Resort Multifamily Units**

Based on analyses of Kohala sales activity and multifamily unit activity in other resort regions, Ming Chew Associates projected the demand for multifamily units in Kohala for 1985, 1990, 1995 and 2000. It then projected the net demand for multifamily units at the Kaupulehu site: 200 by 1990, 400 to 600 by 1995, and 600 to 1,200 by 2000. About half of the units would be used for transient accommodation and half for other uses. Units would include higher-quality beach-frontage units, mid-quality units (such as those at the Mauna Lani Terrace), and lower-quality smaller units.

### **3.3.5 Market Analysis for Golf Course**

The net additional demand for golfing activity in the proposed Kaupulehu Resort is projected by Ming Chew Associates to be about 125 annual rounds per hotel room. Projected hotel demand would be approximately 25,000 to 75,000 annual rounds in 1990, 50,000 to 100,000 in 1995, and 62,000 to 112,000 annual rounds in 2000. Demand from occupants of other resort sources, such as condominiums, is estimated to increase annual rounds to a total of 31,000 to 81,000 by 1990, 62,000 to 119,000 by 1995, and 81,000 to 150,000 by 2000. This amount of play is not likely to be accommodated by courses presently in the region. Table VI-2 in the Ming Chew study shows the distribution of neighbor island transient accommodations by major resort regions in the state in 1985, and includes the distribution of golf courses among the resorts. The table shows that the number of golf courses in Kona is relatively limited, especially in relation to the inventory of accommodations.

In order for the golf courses at the proposed Kaupulehu resort to reflect the high quality envisioned for the entire resort, Ming Chew Associates estimates that play would be limited to about 45,000 rounds annually per course. This standard results in a demand for 0.7 to 1.8 courses in 1990, 1.4 to 2.6 courses in 1995, and 1.8 to 3.3 courses in 2000. Thus, one high-quality championship golf course would be needed by the time the proposed hotel begins operations in 1990. A second golf course may be needed by about 1995, and additional courses are expected to be of use beyond that time.

**3.3.6 Summary of Projected Marketability for Kaupulehu Developments**

The table, "Projected Marketability," from the Ming Chew Associates report summarizes the projected marketability of total hotel rooms, condominium units, and golf course rounds at the Kaupulehu Developments project.

**3.4 NUMBER OF UNITS PROPOSED**

The range of hotel rooms and condominium units has been established for planning purposes based on recommendations by Ming Chew Associates. This range is presented in the following table.

-----

PROJECTED MARKETABILITY<sup>(1)</sup>  
KAUPULEHU RESORT  
Kohala Coast Resort Region  
County of Hawaii, State of Hawaii  
1990-2000

	Projected Marketability		
	1990	1995	2000
HOTEL ROOMS	200-600	400-800	500-900
LOW-RISE MULTIFAMILY UNITS			
Higher-Quality	50	100-150	150-300
Mid-Quality	100	200-300	300-600
Lower-Quality	50	100-150	150-300
	200	400-600	600-1,200
TOTAL (ROOMS, UNITS)	400-800	800-1,400	1,100-2,100
GOLF ROUNDS, ANNUAL	31,000-81,000	52,000-119,000	81,000-150,000

(1) Cumulative demand in excess of February 1985 inventory.

Source: Ming Chew Associates

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The focal point of the southern site is a proposed 600-900 room luxury hotel with beach club situated inland of Kumukehu Point. Approximately 60 acres adjacent to the Kona Village Resort on the south would be the site of 50-150 beach condominium units designed to blend with the general character of existing Kona Village. Inland of the luxury condominiums and the hotel, 300-450 condominium units would be situated on approximately 60 acres within the golf courses.

Two 18-hole championship golf courses would tie the hotel, the oceanfront condominiums and the inland condominiums together while providing open space, recreation, and privacy. The golf courses would also provide a buffer between Kona Village Resort, the proposed hotel and resort condominiums, and Queen Kaahumanu Highway. To reinforce the unique identity of Kona Village Resort, a new separate road would provide access and a tree buffer would be planted between Kona Village Resort and the beach condominiums of Kaupulehu Developments.

-----  
**RANGE OF UNITS AND DENSITIES PROPOSED**

<u>U s e</u>	<u>Approximate Acreage</u>	<u>Planning Range # of Units</u>	<u>Approximate Density Units/Acre</u>
Hotel	60	600-900	10-15
Beach Club	5	1	NA
Beach Condominiums	60	50-150	1-3
Golf Condominiums	60	300-450	5-8
Golf Courses (2), Open Spaces, Buffer, Roadways and Service Areas	<u>438</u>	NA	NA
Total	623		

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**3.5 PROJECT SCHEDULE**

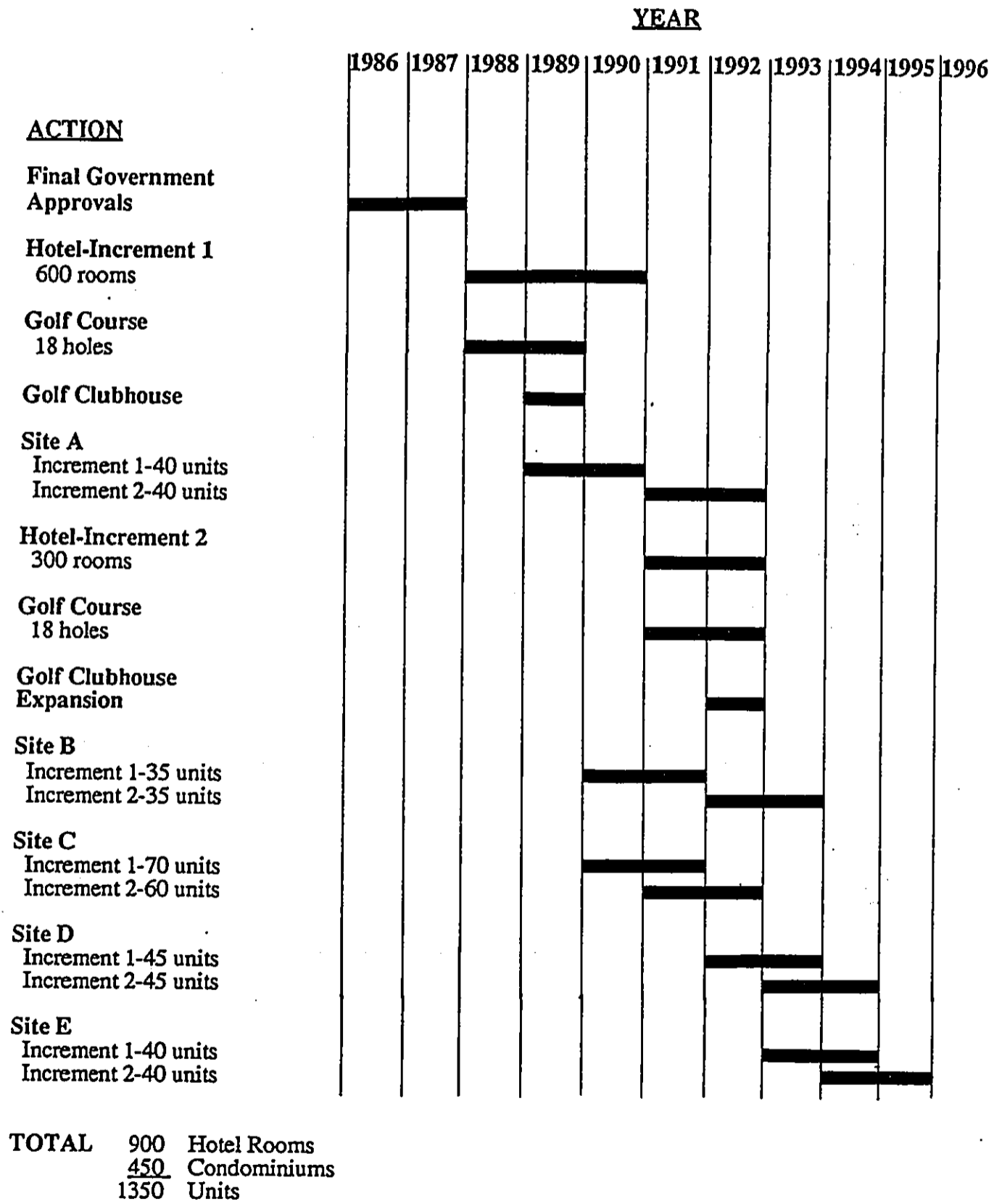
The preliminary development schedule for the proposed Kaupulehu Developments resort assumes the construction of 900 hotel rooms and 450 condominium units. See the "General Development Schedule."

It is anticipated that the first golf course and clubhouse will be completed within two years after obtaining final government land use approvals and that the second golf course and golf course expansion will be completed within five years after obtaining government approval.

It is expected that the first increment of 600 hotel units will be completed about a year after completion of the first golf course. An additional 300 units will be constructed to coincide with the completion of the second golf course.

The beach and golf condominium units will be constructed incrementally as shown in the General Development Schedule.

## GENERAL DEVELOPMENT SCHEDULE



### 3.6 COSTS AND SELLING PRICES

At the current preliminary stage of plan development for Kaupulehu Resort, it is difficult to predict total construction costs with accuracy. Based on prevailing industry rates, the following table gives an estimate of construction cost for the various components of the development.

Estimated selling prices for the condominium units were derived from market analysis and are shown in Table VII-6 in Appendix A, Market Analysis for Proposed Resort at Kaupulehu.

-----  
**ESTIMATED CONSTRUCTION COSTS<sup>1</sup>**  
**Proposed Kaupulehu Resort**

<u>Project</u>	<u>Estimated Construction Cost</u>
Luxury Hotel (900 Rooms)	\$ 144,000,000
Beach Condominium A (80 units)	21,000,000
Beach Condominium B (70 units)	19,000,000
Golf Condominium C (130 units)	18,000,000
Golf Condominium D (90 units)	12,000,000
Golf Condominium E (80 units)	11,000,000
Golf Courses	13,000,000
Clubhouse	1,500,000
Beach Club	500,000
Infrastructure (including Roads and Utilities)	17,000,000
Landscaping	<u>3,000,000</u>
TOTAL	<u>\$ 260,000,000</u>

<sup>1</sup>All costs are order-of-magnitude in 1986 dollars.

Source: Belt, Collins & Associates

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# Chapter III

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## Chapter III

## CHAPTER III

### ALTERNATIVES TO THE PROPOSED ACTION

#### 1. Introduction

In the description of alternatives to the proposed action, discussion is limited to "known alternatives for the action which could feasibly attain the objectives of the action" (State of Hawaii, Hawaii Revised Statutes, Chapter 343), even if such actions may be more costly. Feasible actions which reduce or eliminate environmental risks or costs must be considered. Taking this into consideration, alternatives have been limited to the following: 1) "no action" alternative (no boundary amendment request) which would entail no development on Kaupulehu makai lands, 2) "no action" alternative (no boundary amendment request) which would entail development of currently designated Urban land, and 3) development of the petition lands as a lower density resort similar to Kona Village Resort.

All alternatives fail to meet the objective of establishing a high quality, low to medium density, economically viable and competitive resort facility at Kaupulehu Resort. They would not meet Kona Village's objective of maintaining a viable destination retreat resort.

#### 2. No-Action Alternative

With the no-project alternative, no financial or other resources would be expended and the land at the proposed Kaupulehu Resort site would remain in its current unused state. No benefits, economic or otherwise, would accrue to Kaupulehu Developments or to the State and County of Hawaii. No additional benefits would accrue to the State or County if Kona Village Resort were to remain at its current size. Without the project, employment opportunities would be diminished and potential economic benefits to residents of the region, particularly the North Kona and South Kohala Districts, would not be realized.

This alternative would maintain the status quo of the area, leaving Kona Village Resort in its relatively isolated position. This may benefit the existing resort by maintaining the local visitor population and visual aesthetics of the makai Kaupulehu area. However, without the new units at Kona Village Resort, the operators would not be able to meet the resort's increasing demand, which is reflected by the rising occupancy rates.

Under either the proposed plan or the no-action alternative, it is anticipated that the candidate endangered species, Sesbania arborea, would continue to exist, and perhaps multiply, in a healthy environment. Under either plan, natural and cultural resources would be maintained, but probably would be enhanced under the proposed project.

#### 3. Development of Land Currently Designated Urban

An alternative course of action would be to develop the land now in the Urban District, that which surrounds Kona Village Resort plus that which constitutes the north marina/condominium site. In order to incorporate most of the facilities which



are part of Kaupulehu Developments' current concept plan, all of the land area around the existing Kona Village Resort would have to be developed.

The primary reasons why this alternative was rejected are the following:

First, only 258 acres now designated Urban are available. This acreage is insufficient to accommodate the proposed low-density resort and condominium development and the golf courses in their entirety. Recreational amenities or the total number of units developed or both would have to be reduced, or the density increased. This would not achieve Kaupulehu Developments' goal of developing a quality, low-density resort destination area. Further, there would not be sufficient additional space for Kona Village Resort's proposed new units.

Second, the southern site is more environmentally suitable for development at the present time than the northern site. This is partly because the layout of the land is more appropriate for the low-density nature of the project; hence a larger, more open land area is appropriate. Focusing development at one site is also more economically feasible than simultaneously initiating development at two locations.

Third, returning much of the land abutting the perimeter of Kona Village Resort to the Conservation District will assure more privacy and open space to guests of Kona Village Resort than if the land remained in the Urban District. In addition, it will insure protection of the archaeological sites located within the proposed preserves.

The social and environmental impacts related to project development, which are discussed in this report, would tend to be comparable under either the proposed concept plan or focusing development only on land designated as Urban. By maintaining the desired number of units, social and environmental impacts may actually tend to be slightly greater under this alternative due to its greater density. Less open space would be available, making the site look more congested and decreasing the quality of Kaupulehu Resort facilities.

#### **4. Lower Density Alternative**

Under a lower density alternative, the number of hotel rooms and condominium units would be held to the minimum number of the development range, building 950 units instead of the maximum proposed number of 1,500 units total for Kaupulehu Resort and Kona Village Resort. At 950 units total, the proposed Kaupulehu Resort and Kona Village Resort would have more open space and a more rural atmosphere. However, such a resort area would be operating close to its economic limits and any fluctuation in visitor useage may make resort operations infeasible.

The environmental effects of this lower density plan would result in impacts similar to those of full project development. However, the capacity to accommodate visitors would be lower, and fewer jobs would be created.

This alternative would entail slightly reduced cost of necessary infrastructure, including water and energy, and also a reduced amount of solid and liquid waste generated by the resort, as well as less air and noise pollution generated from traffic.

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# Chapter IV

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## Chapter IV

## CHAPTER IV

### DESCRIPTION OF AFFECTED ENVIRONMENT AND PROBABLE ENVIRONMENTAL CONSEQUENCES

#### 1. PHYSICAL ENVIRONMENT

##### 1.1 PHYSIOGRAPHY AND GEOLOGY

###### 1.1.1 Existing Conditions

The Island of Hawaii is made up of five volcanoes: Kohala, Mauna Kea, Mauna Loa, Hualalai, and Kilauea. The ahupuaa of Kaupulehu is located on the northwest flank of the Hualalai Volcano. Geologically, Hualalai is in a late mountain building stage which is characterized by a volcanic cap of siliceous andesite lavas and the existence of ash beds which mantle portions of the volcanic shield. Hualalai is primarily composed of highly permeable alkali-basaltic lavas which erupt somewhat explosively due to their high gas content.

All volcanic rocks of the Hualalai Volcano are grouped together as members of the Hualalai volcanic series and all are basalts except for the Waawaa volcanics. The Hualalai volcanic series are mostly recent although a few flows may be late Pleistocene in age. Hualalai was last active in 1800-1801. This flow, called the Kaupulehu Lava Flow, entered the ocean at the northern boundary of the Kaupulehu Developments property. The flow is characterized by numerous accretionary lava balls, aa channels, lava stalactites, and brown, red, and black spattering bordering the channel.

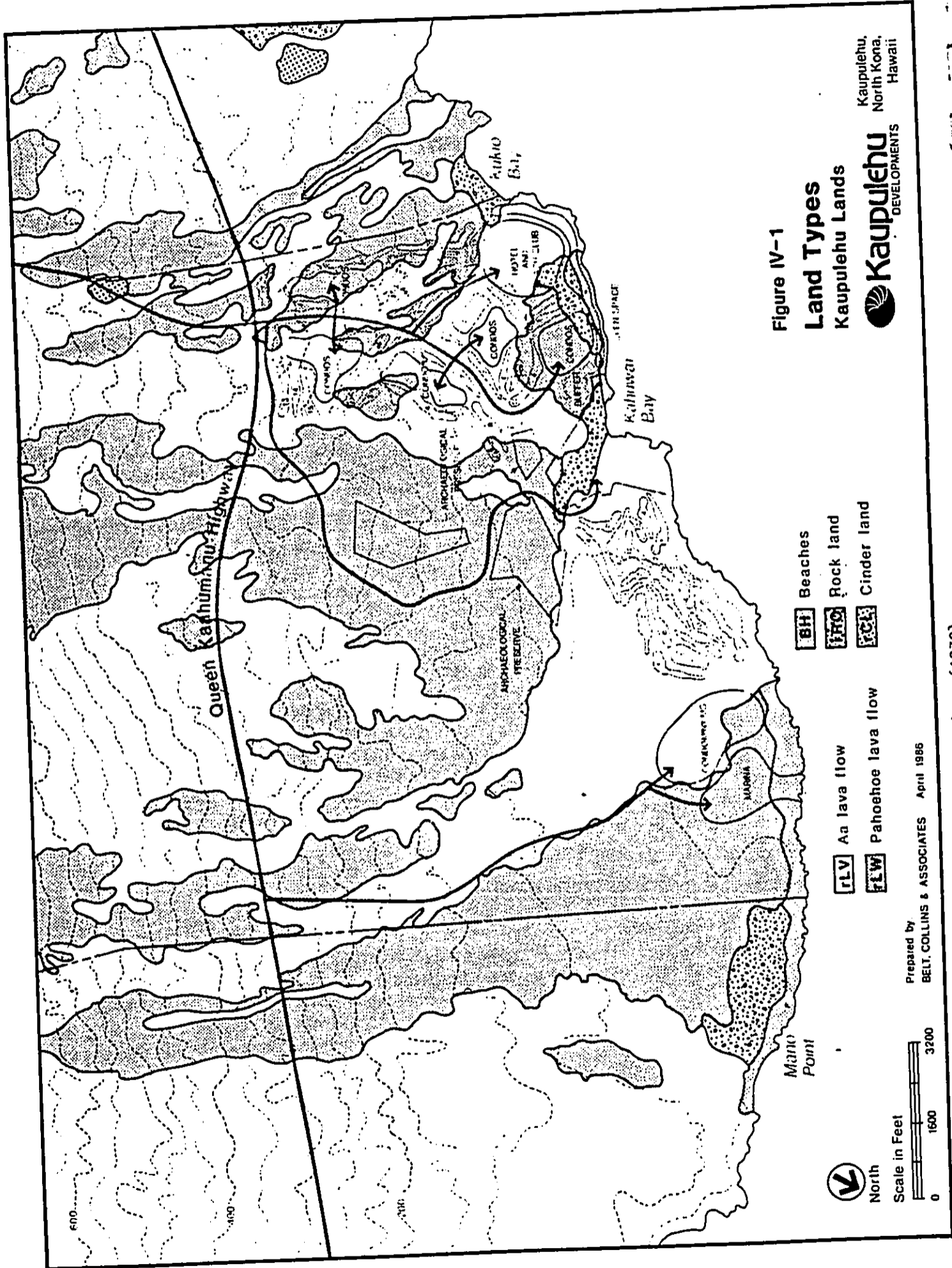
The seaward portion of Kaupulehu, which consists of 2,889 acres makai of the Queen Kaahumanu Highway, is characterized by both aa and pahoehoe lavas with little or no soil or ground cover. Vegetation on the site is sparse. Both recent and prehistoric lava flows dominate the landscape. The land slopes gently seaward from an elevation of 300 feet along Queen Kaahumanu Highway to sea level at the coastline. The overall slope of land in the makai Kaupulehu area is approximately 5 percent and the topographic relief is a consequence of layering and buckling of successive lava flows rather than erosion.

##### 1.2 SOILS

###### 1.2.1 Existing Conditions

Four different land types have been identified on the Kaupulehu makai lands by the U.S. Department of Agriculture Soil Conservation Service (SCS) (December 1973) in a comprehensive soil survey of the Island of Hawaii. None of the four are agriculturally significant. See Figure IV-1 for the distribution of land types on Kaupulehu makai lands.

- (1) Aa Lava Flows (rLV). This lava has practically no soil cover and is generally bare of vegetation. The surfaces of aa flows are masses of clinkerly, hard, sharp pieces piled in tumbled heaps that are difficult to traverse on foot. It has been demonstrated that the clinkerly aa surface can be easily moved and crushed by bulldozers into a relatively smooth surface of cobbles one to four inches in size. Aa lava flows cover a large portion of the project site, particularly areas of planned development.



- (2) Pahoehoe Lava Flows (rLW). Pahoehoe lava flows, as the aa flows, are a miscellaneous land type with meager soil covering. The surface of the pahoehoe lava is generally much smoother than that of the adjacent aa. The only soil in this land type is found in cracks and depressions, having been transported there by wind and storm water runoff. Pahoehoe lava flows cover much of the area of the archaeological preserves and the beach condominiums.
- (3) Rock Land (rRO). The third miscellaneous land type, rock land, consists of pahoehoe bedrock covered in places with a thin layer of transported soil. Lava outcrops are exposed over 50 to 90 percent of the surface. The little soil that is present is generally confined to holes and cracks in the bedrock. At the project site, rock land is generally behind beach areas, in the Kaupulehu beach condominium and hotel sites, and existing Kona Village site.
- (4) Beach Areas (BH). Beaches are mapped as a land type and are long, narrow, sloping areas of sand and gravel along the coastline. At the project site the beach area stretches from the Kona Village Resort expansion area south of the existing resort to the south lava flow at the Kaupulehu Resort site. The sand is mostly coarse grained and well sorted, a mixture of particles of marine origin and black basaltic chips.

A recent inspection of the Kaupulehu makai lands and adjacent property shows some discrepancies between actual conditions and the 1973 mapped distribution of land types. The area immediately behind the shoreline at the northern future marina/condominium site appears to now be exposed pahoehoe lava rather than "beach". On the other hand, the area designated "rock land" at Kukio Bay is currently a light colored sandy beach.

The University of Hawaii Land Study Bureau (1985) has classified all lands on the Island of Hawaii as to their value for various agricultural activities. The study first identified soil types within specific areas, which were then further evaluated as to environmental and physiographic factors such as precipitation, availability of irrigation water, slope, and stoniness. Areas were then assigned a master productivity rating which characterized their overall agricultural potential. Ratings are A-Very Good, B-Good, C-Fair, D-Poor, and E-Very Poor. The land types at the project site are all rated E. They are E319, bare aa lands with no soil materials; E287 and E320, bare pahoehoe with no soil materials; and E327, coarse textured sand. All are well to excessively well drained.

Three classes of agriculturally important lands have been established within the Agricultural Lands of Importance to the State of Hawaii (ALISH) system: (1) Prime Agricultural Land, (2) Unique Agricultural Land, and (3) Other Important Agricultural Land. None of the land within the project site is classified in the ALISH classification system due to its unsuitability for agricultural use.

#### 1.2.2 Impact on Soils and Agricultural Potential

The land on which development will occur is relatively flat, and it is expected that little mass grading will be required. The task of rough grading for building pads, roadways, and landscaped areas will probably be more difficult on the pahoehoe lava than on the aa. Although the surface of pahoehoe lava is generally smoother, reshaping it is more difficult. In contrast, although the aa surface is jagged and extremely difficult to traverse on foot, it is easily shaped by bulldozers to the clinker layer which can be crushed to a smooth, very porous, cobble surface. Most of the Kaupulehu Resort structures will be built on aa lava.

There is insufficient soil cover in all of the development area to support the proposed golf courses and other resort landscaping. Hence, importation of soil will be required. Since the proposed project is in the initial stages of planning and no site plans are available, the amount of imported materials is currently unknown.

None of the land at the project site has agricultural potential and therefore the implementation of the concept plan will have no impact on the actual or potential agricultural productivity of the site.

Construction of resort units at Kaupulehu Resort and Kona Village Resort will provide additional supply of transient accommodations. The ensuing increased demand for local agricultural products may increase agricultural production elsewhere on the Island of Hawaii. South Kohala and North Kona resorts make regular purchases of local products such as fruit, nuts, vegetables, meat, and fish, and it is expected that facilities serving the proposed development will do likewise.

As a secondary impact, some agricultural lands might be converted to urban use to accommodate employee housing. Most likely, however, there will be only slight impact on highly productive agricultural lands.

### **1.3 CLIMATE**

#### **1.3.1 Existing Conditions**

Kaupulehu lies within the area between Honokohau and Anaehoomalu called Kekaha, meaning dry, sunbaked land. Rainfall at the coast averages only 7 to 8 inches annually. There is very little rainfall below the 1,000-foot elevation and only 25 to 30 inches a year at the 2,000-foot elevation.

Mean annual temperature in the area is about 78 degrees F. with relatively small daily and seasonal fluctuations. Daytime temperatures above 88 degrees F. or nighttime lows below 63 degrees F. are rare.

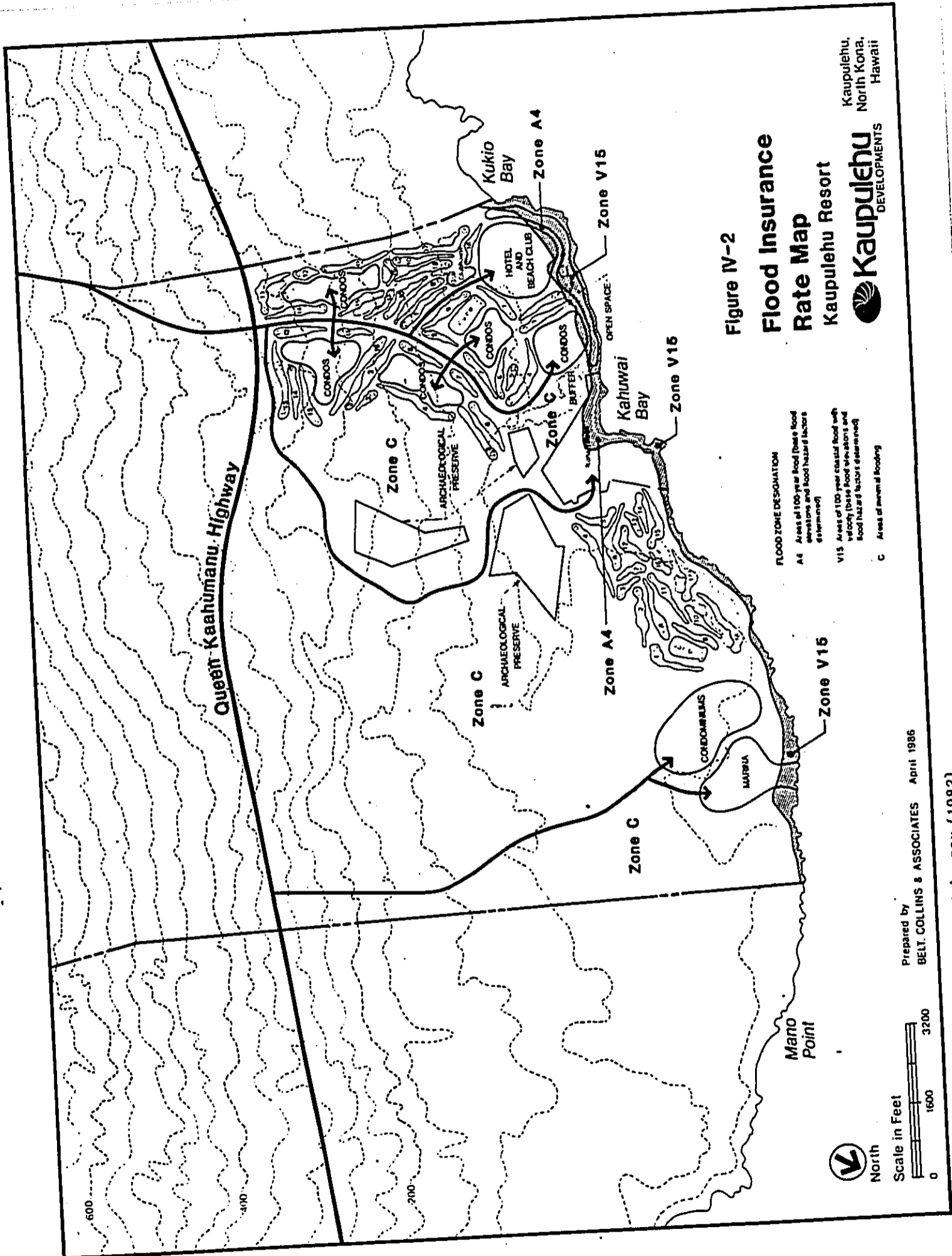
### **1.4 NATURAL HAZARDS**

#### **1.4.1 Storm Waves and Tsunamis**

Except for the area adjacent to the shoreline, the property has been designated Zone C, area of minimal flooding, on the Flood Insurance Rate Maps (FIRM) prepared by the U.S. Army Corps of Engineers (1982). (See Figure IV-2.) The coastal areas of the property are subject to tsunami flood hazards. These areas are designated Zones A4 and V15, and are within the 100-year flood boundary. Along the Kaupulehu coastline many areas have been identified in the 100-year flood zone with a velocity (wave action) of 15, hence Zone V15. Base flood elevations range from 4 to 9 feet above mean sea level and flooding limits range from 0 to 500 feet inland of the shoreline.

#### **1.4.2 Volcanoes and Seismic Activity**

The proposed Kaupulehu Resort will sit on a base of lava and ash deposited by recent prehistoric eruptions of the Hualalai volcano. The shield of Hualalai stands 8,271 feet tall and is the western-most of the five volcanoes which comprise the Island of Hawaii. It is one of three historically active volcanoes on the island.



**Figure IV-2**  
**Flood Insurance Rate Map**  
 Kaupulehu Resort  
 Kaupulehu, North Kona, Hawaii

**FLOOD ZONE DESIGNATION**  
 A4 Areas of 100-year flood (base flood elevations and flood hazard factors determined)  
 V15 Areas of 100-year coastal flood with velocity (base flood elevations and flood hazard factors determined)  
 C Areas of minimal flooding

North  
 Scale in Feet  
 0 1600 3200

Prepared by  
 BELT, COLLINS & ASSOCIATES April 1986

Source: Federal Emergency Management Agency (1982)



The rift zone of Hualalai runs northwest to southeast and is identified by an alignment of cinder cones along the summit and flanks. Historic eruptions of Hualalai occurred in 1800-1801 in two separate outbreaks. Lava flows emerged from the northwest volcanic rift zone to create what is known today as the Kaupulehu Lava Flow.

Hualalai has been dormant for the past 185 years, yet it has produced some volcanically-related activity, such as earthquakes, which indicates that the magmatic core is still alive (Kona Regional Plan, 1982). Observations by the Hawaii Volcano Observatory geologists have identified an eruptive pattern involving an outbreak every 50 years for the past 10,000 years. This pattern ended with the most recently recorded eruption (1800-1801). Several thousand earthquakes were generated in 1929 by the movement of magma toward the summit of Hualalai, but no eruption took place. This seismic swarm caused reports of damage to property in the central Kona area.

Although there appears to be no immediately predictable danger from lava flows, earthquake activity can be expected. Underground movement will undoubtedly recur in the future. According to the Kona Regional Plan (1982), historic data on the frequency of seismic activity shows that earthquakes of a level of 6.4 Richter Scale Magnitude occur on an average of every 62 years.

#### **1.4.3 Probable Impacts**

Structures at Kona Village Resort and Kaupulehu Resort will be built to governmental standards to be resistant to seismic shock. They will not be built in a coastal high hazard area.

### **1.5 SURFACE WATER AND DRAINAGE**

#### **1.5.1 Existing Conditions**

The Kaupulehu Development property in the lee of Mauna Kea, Mauna Loa, and Hualalai is an area of low rainfall amounts and intensities. The land is comprised of porous and unweathered lavas and has sparse soil cover. As a consequence, there are no naturally occurring drainageways and surface runoff is virtually non-existent.

#### **1.5.2 Probable Impacts**

The two golf courses in the Kaupulehu Resort master plan will require irrigation which will affect the flow of groundwater toward the coastline. Should the source of irrigation water be brackish water wells, there is a potential effect on offshore salinity levels.

Surface water runoff will increase as a result of development. The extent of runoff will depend on the nature of the fill used in creating the golf courses, the increase in paving and other impermeable surfaces that will occur within the proposed resort and residential areas, and the configuration of the storm drainage system that will be installed. The design intent of the drainage system will be to limit or avoid stormwater runoff to the shoreline and to handle the runoff on-site.

## 1.6 GROUNDWATER

### 1.6.1 Existing Conditions

Based on wells drilled within and near the project site, groundwater beneath the 11,000-acre Kaupulehu Developments land occurs as a basal lens in hydraulic continuity with seawater at the shoreline and saline water at a depth beneath the lens itself. Groundwater levels, quality, and other parameters of wells in the region are summarized in Figure IV-3. In general, groundwater is too salty for use within the coastal zone which extends from the shoreline to at least two miles inland. Wells located about three miles inland produce brackish water which is of acceptable quality for irrigation and livestock use. Kona Village Resort currently utilizes two such wells (no. 4858-01 & 02). A portion of the supply from these wells is treated by electro dialysis for potable consumption.

Four wells which produce water of potable quality have been drilled at high elevations at distances from 3.6 to 7.3 miles from the shoreline. Based on observed water levels, three of these (wells 4559-01, 4658-01, and 4850-01) apparently tap the basal lens. Water in the fourth well (no. 4650-01) stands 2450 feet above sea level, very likely held at a much higher level by intrusives associated with the northern principal rift zone of Hualalai.

Previous estimates of the rate of groundwater flow through the basal lens have focused on areas north of Kaupulehu. For this northerly area, groundwater flow rate calculations have ranged from three to seven million gallons per day per coastal mile, the variations resulting from assumptions of contributing area, evapotranspiration rates, and other analytic differences. Groundwater flow in the Kaupulehu area is less than to the north due to its smaller inland watershed. A rate of about two million gallons per day per coastal mile is a conservative estimate of the rate of groundwater flow.

### 1.6.2 Probable Impacts

Potable water will be drawn from two wells at higher elevations in the Kaupulehu mauka lands. This withdrawal is not expected to adversely alter groundwater conditions in the project area. Groundwater supply in the region will not be affected by water withdrawals from the Kaupulehu wells.

## 1.7 NEARSHORE PHYSICAL CONDITIONS

### 1.7.1 Existing Conditions

Marine waters off Kaupulehu's coastline are classified as open coastal, Class AA according to Title 11, Chapter 54, State Department of Health, Water Quality Standards. All open coastal waters are also classified according to bottom subtypes. At Kaupulehu, the bottom subtypes are Sand Beaches and Lava Rock Shores-Class II.

The objective of Class AA is that these waters remain in their natural pristine state as nearly as possible. Uses to be protected in Class AA waters are oceanographic research, support and propagation of shellfish and other marine life, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment. Other uses compatible with these objectives may occur.

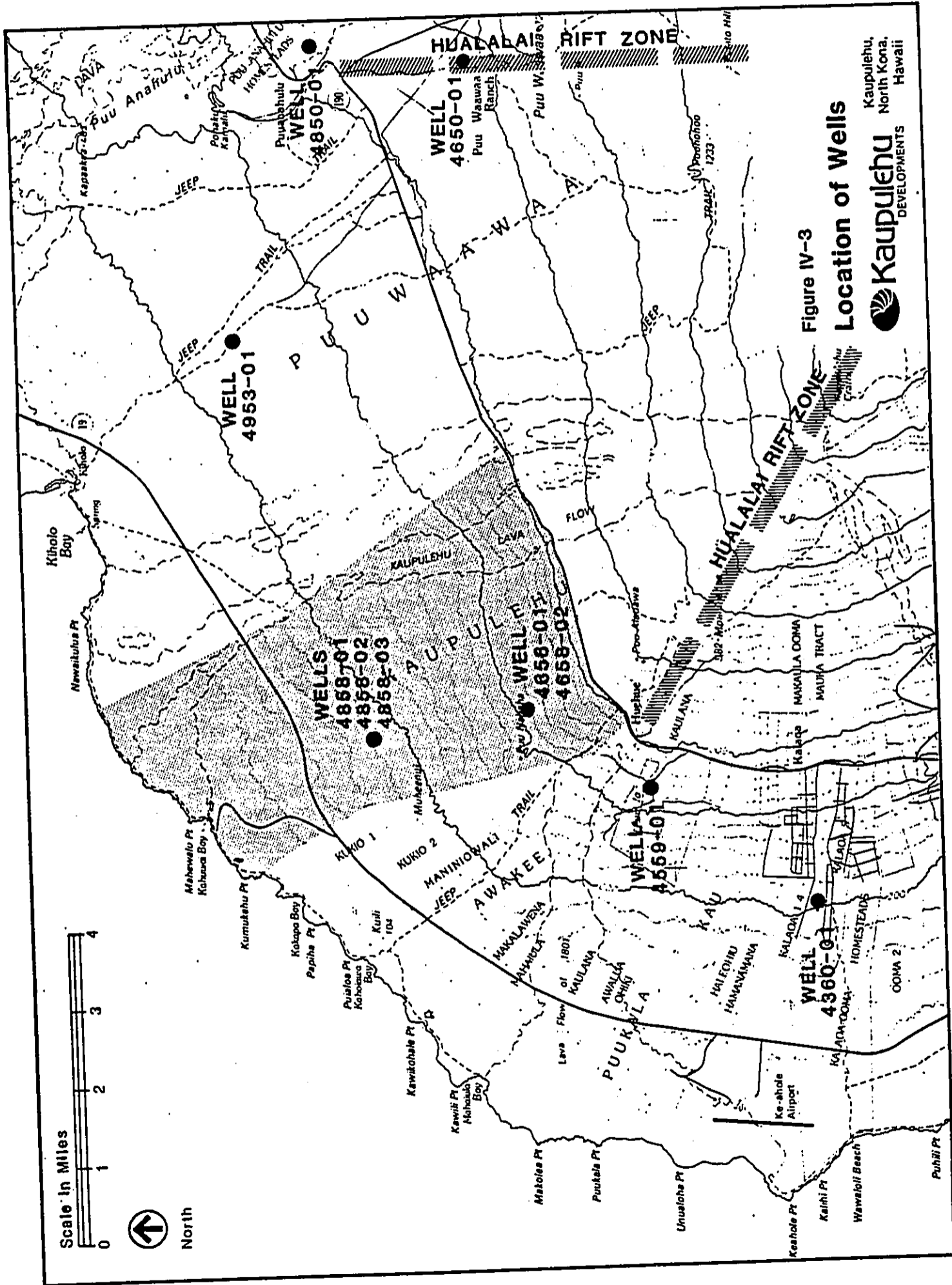


Figure IV-3  
Location of Wells

**Kaupulehu**  
DEVELOPMENTS  
Kaupulehu,  
North Kona,  
Hawaii

Summary of Wells in the Vicinity of Kaupulehu

Well Number	4360-01	4559-01	4650-01	4658-01	4658-02	4850-01	4858-01	4858-02	4858-03	4953-01
Name	Kalaoa	Huehue Ranch	Puu Waawaa	Kaupulehu	Kaupulehu	Puu Anahulu	Kona Village	Kona Village	Kona Village	Kiholo
Year Drilled	1968	1985	1978	1981	1986	1979	1960	1968	1973	1972
Distance from the Shoreline (miles)	3.03	4.45	7.29	3.63	--	6.3	2.13	2.13	2.13	2.65
Ground Elevation (ft.)	680	1579	2550	1344.41	1350	2317	501	503	500	932
Casing Diameter (inc.)	10	10	6	12	--	7	4	8	10	12
Total Well Depth	702	1655	4896	1412	1465	5000	528	523	534	971
Solid Casing Length (ft.)	682	1579	2593	1362*	1350	2500	517	503	514	926
Louwered Casing Length (ft.)	20	30	0	50*	80	100	11	20	20	40
Open Hole Length (ft.)	0	46	2303	0*	35	2400	0	0	0	5
Elevation at Bottom of Well (ft., msl)	-22	-76	-2346	-68*	-115	-2683	-27	-20	-34	-39
Static Water Level	+3.2	+7.8	+245	6.9*	12.6**	+18	+1.8	+1.8	+1.8	+2.6
Pumping Rate (GPM)	150	150	35	500	575	35	25	90	100	700
Drawdown (ft.)	0.6	17	Not known	30	18.5	Not known	Not known	Not known	10.5	0.8
Chloride Content (MGL)	740	90	28	40	38	30	360	430	600	345
Current Use	Unused	Unused	Domestic	Unused	Unused	Domestic	Unused	Domestic	Domestic	Irrigation

\* Data reported in "Kaupulehu Water Lands Source at Kaupulehu, North Kona, Hawaii" by Fukunaga & Associates, Inc., July 1981.

\*\* Water level as presented in Water Resources International, Inc. report to the State Division of Water & Land Development. Level conflicts with information for nearby well 4658-01.

It is the objective of Class II marine bottom ecosystems that they be used for protective purposes, including the propagation of fish, shellfish, and wildlife, and for recreational purposes not to be limited in any way. Uses to be protected in this class of marine bottom ecosystem are uses compatible with the objective.

#### 1.7.2 Probable Impacts

With the establishment of public access to the shoreline, more people will frequent nearshore areas and the water off these areas. Recreational pursuits will include fishing as well as other ocean sports. The greatest likely impact of improved access will be the increased removal of fish from the reef area. However, it is expected that precautions will be taken to allow the waters to remain close to their current natural state. This might include imparting information to the public about fragile ecosystems through signs or other means.

### 1.8 COASTAL PONDS

#### 1.8.1 Existing Conditions

Several studies of the anchialine pond resources on the Island of Hawaii have been conducted, including those by Machiolek and Brock in 1974 and IO Consultants in 1985. These studies have indicated that anchialine ponds are present within the Kaupulehu Resort boundaries.

Shoreline pools without surface connections to the sea, yet showing tidal rhythms and having measurable salinities were first termed "anchialine" by Holthuis in 1973 (from the Greek "anchialos", or near the sea). In the United States, anchialine ponds are known to occur only in Hawaii, on the leeward coast of the islands of Maui and Hawaii. On Hawaii, they exist mostly on the Kona coast. Biologically, many of the West Hawaii ponds are unique ecosystems; they harbor a number of endemic aquatic life, notably the small red shrimps (Halocaridina rubra and Metabetaeus lohena), and unusual algal crusts (Schizothrix caricola and Rhizoclonium sp.) (Brock, 1985:1 and 21).

In February 1986, OI Consultants, Inc., conducted an aerial and ground survey of the water bodies on the Kaupulehu site. The resulting report is attached to this document as Appendix B.

Eight ponds were identified and examined during the survey (see Figure IV-4 for their location). According to the strict definition, all eight bodies of water can be termed "anchialine." It is worth noting, however, that anchialine ponds undergo a natural process of aging, which changes them from barren lava pools to grasslands with little or no standing water, and at any given stage ponds can have characteristics that make them more or less "anchialine." The eight ponds examined during OI Consultants' survey represent the spectrum of pond evolutionary conditions. Three ponds are considered to be typically anchialine in nature, one is almost completely filled with leaf litter, and one is wet only at high tide. The remaining three ponds and surrounding areas may be more properly considered wetlands, being typified by complete coverage by dense growths of sedges and grasses.

The total number of anchialine ponds in the Hawaiian Islands is estimated to be about 450 to 500. Hence, the eight ponds at Kaupulehu represent a very small portion (1.6 percent) of the total pond resource in Hawaii.

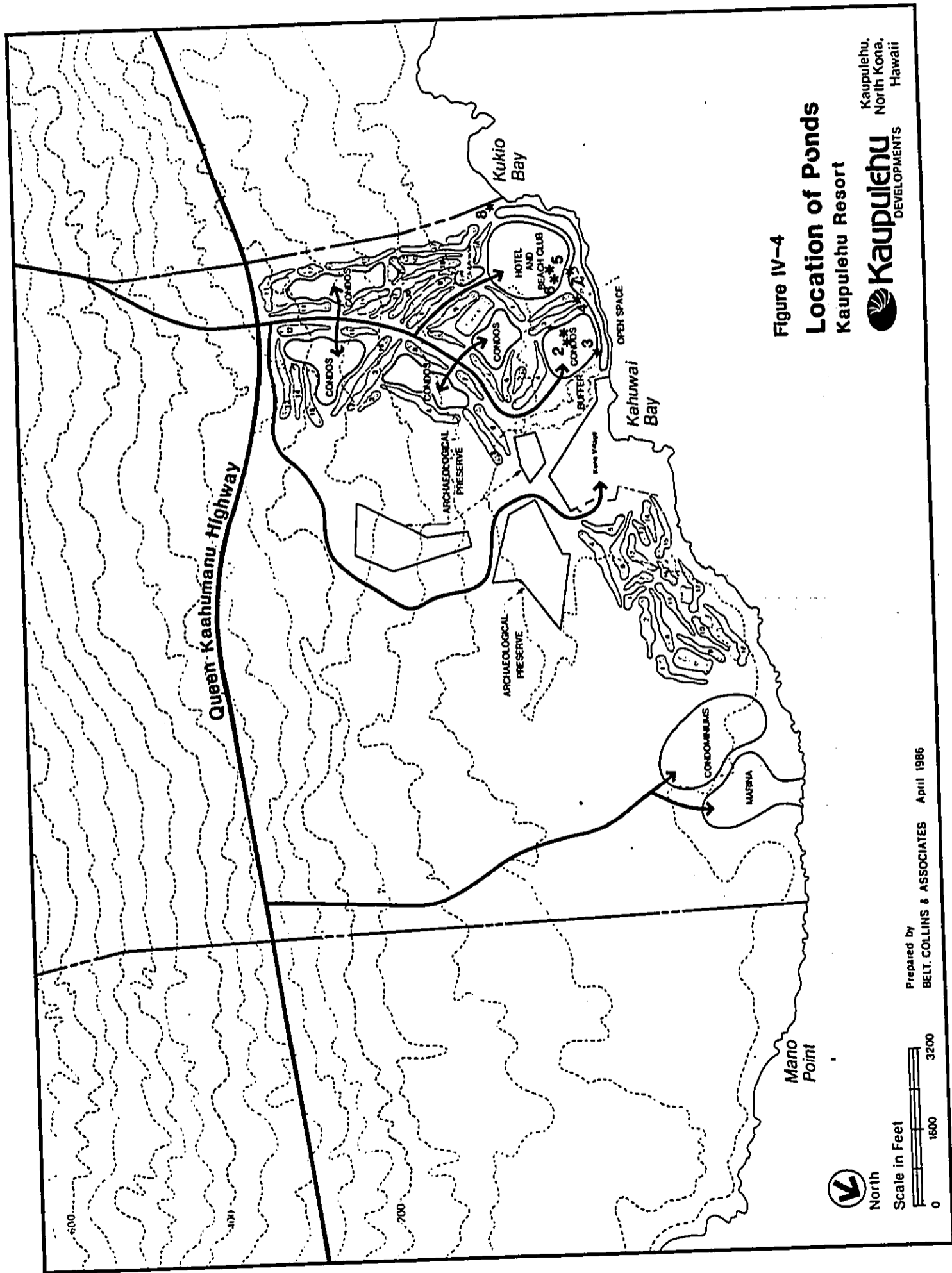


Figure IV-4  
**Location of Ponds**  
 Kaupulehu Resort  
**Kaupulehu**  
 DEVELOPMENTS  
 Kaupulehu,  
 North Kona,  
 Hawaii



Scale in Feet  
 0 1600 3200

Prepared by  
 BELT, COLLINS & ASSOCIATES April 1986

The recent OI Consultants survey was conducted during low tide (tides during the daylight hours of the survey period were generally low). Consequently, the ponds were observed at their minimum size; it can be expected that during high tide all of the water areas would be larger. Ponds located by OI Consultants are briefly described below.

**Pond 1.** Located in a fold in the lava plates, this pond is surrounded by kiawe. Elliptical in shape, the pond consists of a small open water area (about 230 square feet at the time of the survey) covered by blue-green algal floc, and an intermittently wet area of 1,200 square feet covered by grass. Maximum water depth at low tide was three inches.

**Pond 2.** This pond is a barren, rubble-filled depression, with an actual open water area of only 3 square feet. The intermittently wet area is about 760 square feet; its bottom is covered by fine gravel.

**Pond 3.** This pond is located in a dense milo grove near the shoreline and is relatively steep-sided. It covers an area of 1,800 feet and is almost completely covered with leaf litter. At low tide, water barely covers the bottom.

**Pond 4.** This marsh area behind a band of coastal strand vegetation is comprised of two distinct areas: a large area of 700 square feet of organic sediment and a smaller area of 100 square feet of barren lava plate covered with open water.

**Ponds 5 and 6.** Both are located on the inland side of a barren lava strip used as a roadway. Pond 5 (160 square feet) is steep-sided and surrounded by thickets of kiawe and pluchea. The bottom is partly bare lava and partly fine sediment/rubble. Pond 6 is circular, a 960-square-foot area of organic sediment and vegetation roots.

**Pond 7.** This is an area of open water in Waiakuhi marsh. Surveyed previously by OI Consultants in 1985, Waiakuhi marsh is an extensive (51,000 square feet) shallow grassy depression surrounded by kiawe, milo, and palm trees. The open water area is about 1,600 square feet and was 0.75 feet deep at low tide. It is choked with an aquatic macrophyte typically found in brackish waters. The remaining portion of Waiakuhi marsh is covered with a dense growth of grasses.

**Pond 8.** A 7,500-square-foot area on the lava flow near the boundary with Huehue Ranch, Pond 8 has no visible open water area at low tide and is covered with a dense growth of grasses.

The above ponds were studied and information on flora, fauna, salinity, size and other characteristics, was collected. This information is summarized in the following table.

Ponds that are heavily vegetated or have intermittent wetness are considered older and in the process of transition to wetlands. Included in this category are portions of ponds 1 and 2, and all of ponds 3, 4, 6, 7, and 8. On the other hand, youthful ponds contain permanently wet areas with brackish water fauna, barren lava edges, and little aquatic vegetation; pond 5, and portions of ponds 1 and 2 are considered relatively youthful.

Five of the ponds contained standing water, with ponds 6, 8, and 3 having no standing water at the time of the survey. Those with standing water, ponds 1, 2, 4, 5 and 7, were found to contain typical anchialine pond fauna. Snails (*Melania* sp.) were

Summary of Survey Data Taken January 19, 1986  
at Kaupulehu, North Kona, Hawaii

PARAMETER	Pond Number							
	1	2	3	4	5	6	7	8
<b>HYPSOGRAPHY</b>								
Length (ft)	51	76	90	35	16	31	40	100
Width (ft)	24	10	20	23	10	31	40	75
Area (ft <sup>2</sup> )	1224	760	1800	805	160	961	1600	7500
Depth (ft)	.25	.25		.10	.50		.75	
<b>WATER QUALITY</b>								
Salinity (ppt)	3	2	-	-	3	-	4	-
Temperature (deg C)	24.0	26.2	-	-	27.5	-	21.7	-
Dissolved Oxygen (mg/l)	11.7	9.4	-	-	11.4	-	8.0	-
Nitrate (uM)	92.0	164.5	-	-	163.5	-	155.0	-
Ammonium (uM)	3.05	3.57	-	-	4.01	-	1.70	-
Phosphate (uM)	3.68	5.02	-	-	4.74	-	5.27	-
Chlorophyll (ug/l)	8.46	1.07	-	-	.28	-	.88	-
<b>TERRESTRIAL FLORA</b>								
Sporobolus virginicus		2			1			1
Scaevola taccada	1			2		1	1	1
Pluchea odorata	3	3		3	3	3	3	3
Prosopis pallida	3	2			3		3	3
Thespesia populnea			3				3	
Morinda citrifolia							2	
Sesuvium portulacastrum						3		
Bacopa monniera	2	3		3			3	3
Scirpus validus				2			3	
Cladium leptostachyum	3	2					3	
Fimbristylis pycnocephala								
Cocos nucifera			1	1				
Hibiscus tiliaceus			1	3				
<b>AQUATIC FLORA</b>								
Chaetophora		1			2		3	
Schizothrix	1				2			
Blue-green algal floc	3		1				3	
Chara sp.								
<b>AQUATIC FAUNA</b>								
Melania sp.	3	3	3	2	3		1	
Amphipoda	3	1	*	1	2		3	
Halocaridina rubra	2	3	*	2	3		1	
Metabetaeus lohena					1			

Abundance Code:

1 = present      3 = very abundant  
2 = common      \* = seen in previous surveys



common to abundant in these ponds as well as in Waiakuhi Pond. The small red shrimp, or opaeula (Halocaridina rubra), were observed as abundant in ponds 2 and 5, and also present in ponds 1, 4, and 7. In a previous survey they were also observed in pond 3 (OI Consultants, 1985). A less common shrimp, known as Metabetaeus lohena, was found only in pond 5. Metabetaeus lohena has been identified by the U.S. Fish and Wildlife Service as a Category 2 species in reference to the Endangered Species Act. This category indicates that the species should be listed as endangered or threatened, but insufficient data is available to assess their status accurately enough to be listed.

Because of the low tide situation, only four ponds were deep enough to take water quality samples. Salinity in these ponds ranged from two to four parts per thousand (ppt). The average anchialine pond is 7 ppt, while that of sea water is 35 ppt. Water temperatures ranged from less than 22° C to 27.5° C. Dissolved oxygen levels were high in all ponds; 8.0 to 11.7 milligrams per liter (mg/l). Dissolved nutrient levels were also high.

OI Consultants suggests that the heavy overgrowth of grasses, including Scirpus validus, Cladium leptostachyum, and Frimbristylis pycnocephala, within ponds 4, 7, and 8, may actually allow these ponds to be considered wetlands. Waiakuhi Pond, pond 7, was described as being composed of "several adjoining marshy areas" in the flora study conducted by Char and Associates (1985) for this project.

Although no water birds were observed the day of the survey, this area does have water bird habitat potential, as evidenced by the sighting of indigenous and endemic water birds in nearby wetlands.

### 1.8.2 Probable Impacts

Anchialine ponds in the Hawaiian Islands are considered an irreplaceable resource as a whole. The ponds on Kaupulehu Developments property represent a very small percentage of the total resource and, further, are probably not important examples of the type when compared to others in the West Hawaii area.

It is Kaupulehu Developments' intent to preserve all of the ponds surveyed that are within its property boundaries. The current concept master plan for Kaupulehu Resort shows that some of the ponds are in the areas generally designated for beach condominium, hotel and beach club, and golf course development. Where possible, ponds will be integrated into the resort design and presentation; some could be used as natural design elements in the golf course and other landscaped areas. Should it be necessary, the master plan will be altered to accommodate the ponds, particularly in the beach condominium and shoreline golf course areas. Pond 8 appears to be on both sides of the southern boundary line between Kaupulehu Developments and Huehue Ranch lands. As in the case of the other ponds, Kaupulehu Developments intends to preserve that portion of pond 8 which is on its land.

Based on the fact that no filling of ponds is projected, OI Consultants expect direct and indirect impacts on the anchialine pond and wetland resources at Kaupulehu to be negligible. The OI Consultants' study states that a pond located immediately adjacent to the Waikoloa golf course shows no signs of negative impacts after golf course construction and several years of golf activity. Thus, it is reasonable to assume that ponds near the golf course at Kaupulehu Resort or those that are part of the golf course, would also be minimally affected by construction activities and operation of the resort. No direct impacts to ponds within or near the Open Space shoreline area are expected to occur.

Construction may result in some erosion, while golf course irrigation and maintenance will probably involve the use of treated sewage water and pesticides (primarily herbicides), respectively. None of these factors are anticipated to occur at a level which would harm the ponds. Moreover, the natural drainage and continuous flushing of the ponds would ensure that potential pollutants have a minimal effect.

### **1.8.3 Mitigation Measures**

Precautions will be taken during the construction period so that clearing and grubbing of surrounding areas and earthmoving will not disturb the ponds.

To preserve the integrity of the ponds, there will be some open area directly around the ponds, lessening the possible encroachment of foreign organic material. Pathways around the ponds will be of the appropriate natural materials and follow the existing contour of the terrain as much as possible.

Kaupulehu Developments recognizes that pond management will be necessary to preserve the ponds as natural environments. It is expected that increased human activity around the ponds due to better access by the public and resort guests will increase the possibility of the introduction of unwanted species. An educational program including interpretive signage might be considered.

## **1.9 MARINE ENVIRONMENT**

A reconnaissance survey of the marine environment offshore from the project site (from Kahuwai Bay to Kukio Bay) was conducted in May 1985 by Steven Dollar, marine research consultant (Appendix C). A description of the marine environment according to his findings follows.

### **1.9.1 Existing Conditions**

#### **1.9.1.1 Shoreline**

The shoreline from Kahuwai Bay to Kukio Bay is composed of two main structural features. From the Kona Village Resort to the northern edge of the prehistoric flow at the southern property line, the shoreline is composed of a basaltic ledge of pahoehoe lava. This intertidal platform is flooded in places to form tide pools. None of these tide pools are separated from the ocean on a permanent basis (they do not constitute anchialine ponds). At the seaward edge of the lava shoreline, the bottom slopes gradually to an offshore bench. Shoreward of the lava bench a coarse, steeply sloping, white sand beach stretches from Kahuwai Bay to Kumukehu Point. Much of the beach is occupied by ghost crabs. A solid growth of beach naupaka (*Scaevola lobelia*) extends to the beach berm along the entire length of the shoreline. The southern shoreline along Kumukehu Point is a very rocky sea cliff of jagged lava boulders.

#### **1.9.1.2 Physiographic and Coral Communities**

Hawaiian coral reefs are among the northernmost in the world and as such are subjected to greater extremes in temperatures than most other areas. In addition, Hawaii is located in a very isolated position in the center of the Pacific, and is "upstream" of the major centers of coral evolution in the Indo-Pacific. As a result, the Hawaiian coral fauna is extremely low in number of species; there are only about 35 Hawaiian coral species compared to upwards of 200 on most reefs located at lower latitudes and nearer to continental areas.

The offshore marine environment was surveyed at four different stations along the area of coastline where development is proposed in order to identify the physiographic and coral communities. The same general pattern exists at all stations with regard to coral community structure. Cover is lowest at the near-shore transect, intermediate at mid-depths, and highest at the deep reef. This general pattern is consistent throughout all stations. However, there are differences which should be noted.

The major difference in physiographic makeup between the stations is that Station 1, north of the Kona Village Resort, is essentially unique when compared to the other four stations. This area is located off the small parcel of land just to the north of Mahewalu Point. The nearshore surge zone at this site is composed of large basaltic boulders essentially devoid of attached fauna. As one moves seaward from the boulders the bottom becomes a limestone-encrusted pavement with small corals. These corals are small, flat encrustations due to the high degree of wave stress. Although coral cover is low in this zone, it is higher than all other shallow transects taken off the proposed development parcel. Seaward of the basalt platform, the reef structure assumes the standard configuration that is found off much of west Hawaii. At depths of 25 to 60 feet, the major reef-building zone is divided into two separate areas. The shallower region is dominated by the coral Porites lobata, a sturdy hemispherical or encrusting growth capable of withstanding the impact of storm wave stress. At depths of 35 feet or greater, the dominant bottom cover is a combination of P. lobata and P. compressa, which is a colony growth form of long thin fingers attached at their bases to form dense thickets.

This pattern of coral abundance represents the general scheme of reef structure found throughout much of the Hawaiian Islands. The unique feature of Station 1 at Kaupulehu is the compressed horizontal distance over which all three major zones occur. There are less than 100 yards between the shoreline and the deep limit of coral growth.

All of the other stations sampled, located south of the first station, were strikingly different from Station 1. This is mainly due to the broad flat bench-like structure extending offshore from Kahuwai Bay to Kukio Bay. Parts of the area are exposed basalt covered with a thin veneer of calcium carbonate. Other areas have a fairly thick deposit of calcium carbonate as evidenced by the boring activity of several species of sea urchins. Where boring activity is highest, the reef takes on a honeycombed appearance and the density of sea urchins, particularly Echinometra matheai, is on the order of 30 per square meter.

Coral cover on the offshore bench is low due to wave stress. In general, the corals that did occur were all small colonies of either Porites lobata or Pocillopora meandrina. Wave stress is considered a dominant force in shaping Hawaiian coral communities and the environmental setting at Kaupulehu does not seem to be an exception to this scheme.

The outer edge of the reef bench is marked by a sharp ledge and cliff 10 to 15 feet high. The walls of the cliff are often undercut with caves and crevices and the base of the cliff is marked by an area of large basaltic boulders. Coral communities here are similar to the deep Porites lobata-compressa zone of Station 1.

### 1.9.1.3 Reef Fish Community Structure

The transect station north of the Kona Village Resort was the richest in terms of number of species and number of individuals. The fish community at this area was quite similar to those typically encountered along most of the Kona Coast.

In the deeper areas, small herbivorous surgeonfish (Zebrasoma flavescens, Acanthurus nigroris, Ctenochaetus strigosus) were abundant. Many larger planktivorous damselfish (Abudefduf abdominalis, Chromis verator) were encountered at the high-relief seaward edge of the reef ledge as were some snappers. Many squirrelfish (Holocentrids) were seen in holes at this site. The overall richness of the fish fauna at this locality was largely a result of the many species of butterflyfish (Chaetodonts), wrasse (Labridae), surgeonfish, and goatfish (Mullids) encountered along the transect.

The shallow area of the northern transect site, had a lower overall number of species and individuals, probably due to the high degree of wave stress and low relief of the area. Small surgeonfish were not quite as abundant. Larger surgeonfish (Acanthurus xanthopterus, A. mata) were also seen in the shallow area.

Stations 2, 3, and 4, located on the submerged carbonate-basalt platform, were similar to each other in terms of fish abundance. The numbers of both species and individuals tended to be lower at the shelf stations, a likely consequence of less vertical relief. At the intermediate depth transects, the fish community was similar to that seen in deeper water but the diversity tended to be lower, a result of both fewer species and number of individuals. This is probably a consequence of the relatively flat biotope. The shallowest transects at these stations had few fish. The fish that were observed were primarily triggerfish and large surgeonfish. The overall absence of fish in this biotope is almost certainly attributable to the scarcity of holes, ledges or other refuges.

#### 1.9.1.4 Other Marine Life

The design of the reef survey was such that no cryptic organisms or species living within interstitial spaces of the reef surface were enumerated. Since this is the habitat of the majority of mollusks and crustacea, detailed species counts were not included in the transecting scheme. No dominant communities of these classes of biota were observed during the reef surveys at any of the study stations.

With the exception of the humpback whale (Megaptera novaengliae), which is occasionally sighted offshore during winter months, no rare or endangered species were observed within the Kaupulehu coastline. Green sea turtles (Chelonia mydas), which are currently listed as "threatened" on the Federal Endangered and Threatened Species list, are frequently observed within offshore areas. Also existing in the coastal waters of the Kona Coast is the hawksbill turtle (Eretmochelys imbricata), Federally listed as an endangered species. It is prohibited by law to take any of these turtles.

#### 1.9.2 Probable Impacts and Mitigation Measures

Implementation of the proposed action will entail grading, vegetation removal, construction of buildings and resort-related facilities, and other changes to the environment on several hundred acres of land. As a result, the potential exists for impacts to the offshore environment. Major sources of impact include: (1) increased sedimentation from runoff or wind following grading; (2) changes in groundwater discharge, particularly from nutrient loads as a result of irrigation by treated wastewater and golf course fertilization; (3) changes in the shoreline, including better coastline access; and (4) changes in runoff. Potential impacts from these sources are described below.

### 1.9.2.1 Increased Sedimentation

In most cases in Hawaii the greatest potential impact on the marine environment is the result of nearshore development practices and their resulting increase in sediment loads delivered to the nearshore environment. The offshore environment at Kaupulehu does not appear to be subjected to any level of natural sedimentation from land runoff. During the grading period, sediment could be transported by wind and runoff. Dust carried by wind as a result of golf course construction has reportedly been a major problem at other resorts. In Kaupulehu, however, winds are less severe than they are in resort areas further north along the coast. Hence, less of a sedimentation problem caused by airborne dust can be expected.

Increased sedimentation may not be a problem with regard to Kaupulehu Resort development and Kona Village expansion because the ground cover of most of the land to be graded is raw lava that has not been weathered to an appreciable extent and has little or no soil cover. Sedimentation increases due to runoff during construction could have more of an impact on increasing ocean sediment loads. The climate at the proposed project site is one of the driest in Hawaii, lessening the likelihood of substantial rainfall during construction. In the event of heavy rainfall, the porous nature of the lava fields is such that sheet flow carrying suspended sediment toward the ocean is highly unlikely. Most of the rainwater that enters the ocean as runoff appears to do so following percolation through surface rock layers to the water table, resulting in groundwater extrusion at the shoreline. Moving through the basal rock serves to filter out the sediment. Consequently, the primary effect of rainfall may be largely beneficial, serving to decrease airborne dust.

### 1.9.2.2 Increased Nutrient Loading

Maintaining the landscape of the resort proposed by Kaupulehu Developments, which includes a golf course, requires the use of fertilizers and irrigation with treated sewage effluent. This creates the potential to add a substantial amount of nutrients to both the marine and freshwater systems. It is not anticipated that the Kaupulehu area will be affected by the addition of nutrients to its waters. Several factors explain this:

- o The offshore zone has unrestricted circulation caused by tides, current, wind, and wave action, which promotes rapid dilution and water exchange.
- o Much of the nutrient load will be taken up by the vegetation on the golf courses.
- o All of the development effluent will be treated to the secondary level of sewage treatment.

Since the proposed Kaupulehu Developments resort plan calls for the treatment of all of its sewage at the secondary level, there does not appear to be any potential for significant impact to the marine environment.

The use of pesticides, herbicides, and fungicides on golf courses in Hawaii is relatively insignificant, especially when compared to its use in sugarcane and pineapple cultivation. Most of these chemicals break down into inert compounds quickly. The use of these chemicals is strictly regulated and takes into account the potential for seepage into surrounding waters. Taking these factors into consideration, the impact on marine waters appears to be insignificant.

### 1.9.2.3 Changes in Storm Runoff

At this time there are no estimates of how drainage patterns might be changed as a result of the development. There appear to be no areas within the project boundaries where marine systems have been adversely affected by runoff to date; the Kona Village Resort has not had an impact on runoff. It is expected that this will remain the case with Kona Village expansion and Kaupulehu Resort development.

If analyses indicate that the proposed changes in land use and drainage patterns might result in substantial changes in water quality, additional field surveys will be conducted to determine the best location for the discharge of drainage and to assess the significance of expected water quality with respect to marine community structure.

### 1.9.2.4 Shoreline Modification and Shoreline Use

There are currently no plans for shoreline alterations at the proposed project site. Therefore, any alterations to the shoreline from site development would be the result of the indirect mechanisms discussed in the previous sections.

Increased access will occur as a result of project development. This will increase the number of people using the shoreline area. The primary group to use the area, besides hotel visitors, would probably be fishermen. With an increase in pole and spear fishermen, it is likely that reef fish populations along the shoreline would decrease, especially with respect to those species highly desirable for eating.

## 1.10 FLORA

### 1.10.1 Existing Conditions

A botanical survey of Kaupulehu Developments' makai lands, including those proposed for reclassification, was conducted in April 1985 by Char and Associates, botanical and environmental consultants (Appendix D). The object of the survey was to inventory the flora; describe the major vegetation types; search for rare, threatened or endangered plant species; and identify areas of potential environmental concern.

With the exception of the existing landscaping at Kona Village Resort, vegetation on the makai Kaupulehu lands was found to be sparse due to lack of soil cover and water. Seventy species of plants were seen during the survey, of which 26 are native plants (15 indigenous and 11 endemic to the Hawaiian Islands). One candidate endangered species was found: the tree ohai (Sesbania arborea).

Four vegetation types are recognized within the site: scrub vegetation on lava; kiawe thicket; strand; and wetlands. Following is a general description of each.

Scrub Vegetation on Lava. The project site is predominantly covered with pahoehoe lava, with a'a lava interspersed. Vegetative cover on the older pahoehoe flows varies from 10 to 20 percent, while that on newer lava may vary from 3 to 8 percent. On the pahoehoe flows, vegetation consists of a very open scrub composed of widely scattered kiawe trees and small shrubs of ilima (Sida cordifolia), indigo (Indigofera suffruticosa), uhaloa, and nehe (Lipochaeta lamarum). Fountaingrass (Pennisetum setaceum) is common. Herbs and other grasses encountered occasionally include Ageratum conyzoides, ihi (Portulaca cyanosperma), pua-kala (Argemone glauca), Spergularia sp., Eragrostis tenella, and Panicum spp.

Widely scattered on the aa flows in the project area are a few plants such as uhaloa (Waltheria indica var. americana) and fountaingrass.

One individual of the tree ohai (Sesbania arborea), a category 1 candidate endangered species, was found in this vegetation type. A category 1 plant is defined as one for which the U.S. Fish and Wildlife Service has sufficient information to support the biological appropriateness of it being listed as Endangered or Threatened. Although large populations of this plant species are found on Molokai, the tree ohai has never been reported from the Island of Hawaii.

**Kiawe Thicket.** The kiawe thicket, as do the strand and wetland vegetation types, occupy only a small portion of the study area near the coast. The kiawe thicket is located directly behind the strand and around the wetlands area. Kiawe trees are denser and taller here because of the fresh water seepage along the coast. In addition to kiawe trees, a number of shrubs, vines, herbs, and grasses were found in the more open areas of the thicket, including uhaloa, pluchea (Pluchea odorata), koali-awahia (Ipomoea indica), scarlet-fruited passionflower (Passiflora foetida), alena (Boerhavia diffusa), ihi (Portulaca tiliaceus), and fountaingrass.

A few trees of coconut (Cocos nucifera), milo (Thespesia populnea), Christmas-berry (Schinus terebinthifolius), and hau (Hibiscus tiliaceus) can sometimes be found in this vegetation type.

**Strand.** Strand vegetation is found on the sandy area between Waiakuhi Pond and Kona Village Resort. Beach naupaka or naupaka-kahakai (Scaevola taccada) is the dominant plant and shrubs of naupaka form large patches 1 to 2 meters tall. Low growing plants such as Bermuda grass (Cynodon dactylon), aki aki (Sporobolus virginicus), and pohuehue (Ipomoea brasiliensis) form small to medium sized mats between the naupaka patches.

A few small trees of tree heliotrope (Messerschmidia argentea), coconut, kou (Cordia subcordata), and false Kamani (Terminalia catappa) can be found scattered among the naupaka shrubs.

Waiakuhi Pond, as well as other ponds on the site, are often considered as marsh land (see Section 1.8 of this chapter). Most of the marshy areas consist of a semi-dry organic muck. Makai sedge (Scirpus validus) covers most of these areas. Patches of 'uki (Cladium leptostachyum), water hyssop (Bacopa monniera), makaloa (Cyperus laevigatus), and 'ohelo-kai (Lycium sandwicense), are occasionally encountered. A thicket of American mangroves (Rhizophora mangle) exists in the shoreline area adjacent to Waiakuhi Pond.

#### 1.10.2 Probable Impacts

Kaupulehu Resort development and Kona Village expansion will require clearing, grading, construction of buildings and related resort amenities, and landscaping. These activities will cause major changes in the vegetation communities which now exist at the project site. Vegetation cover and density will increase and changes in species composition will be made through landscaping as well as through natural processes. The water and soil brought to the site will encourage the growth of species adapted to more moist environments and discourage the growth of those species adapted to the naturally dry lava environment.

### 1.10.3 Mitigation Measures

Although development of the project area will result in the loss of a number of native plants, the same species are also found in similar habitats throughout the North and South Kona areas. Development will not have a significant impact on the total island populations of those species found within the project area.

At the time of the botanical survey, the area in the vicinity of the proposed endangered plant Sesbania arborea was planned for golf course use. As a mitigating measure, the Kaupulehu Resort concept plan was revised so that the plant is now near an archaeological preserve rather than resort facilities. Char and Associates' recommendation that an undisturbed site of at least a 100-foot diameter be established around the plant to keep the area intact can now be met.

Consideration will be given to the use of indigenous and endemic plants in resort landscaping. Native plant species adapted to the dry conditions in the area would require less water, soil, and maintenance. Potential species include the Sesbania, nehe (Lipochaeta lamarum), ilima (Sida cordifolia, Sida fallax), maiapilo (Capparis sandwichinana), and pua-kala (Argemone glauca). Coastal and wetland plants native to the area may be appropriate in landscaping as well. These include naupaka kahakai, hau, and water hyssop. The native fan palm or loulou (Pritchardia affinis), which occurs at the neighboring Kukio Bay site, could also be used in these areas.

## 1.11 FAUNA

### 1.11.1 Existing Conditions

A survey of the animal and bird life on Kaupulehu makai lands was conducted in April 1985 by Phillip L. Bruner (Appendix E). The field survey was to document the species present in the study area and assess their habitat. The results confirmed the presence of indigenous and migratory bird species, mongoose, dogs and cats, mice, goat, and donkey. No threatened or endangered species were encountered and no evidence of such species being at the project site was found.

**Birds.** The native black-crowned night heron (Nycticorax nycticorax) was the only waterbird seen from the proposed project land. The single bird was recorded as it flew from the Kaupulehu wetlands toward the ponds at Kona Village Resort. Incidental observations made at the Kona Village grounds found 6 herons foraging around the fishponds. It is likely that the patch of mangroves located on the Kaupulehu project site acts as a roost and perhaps even a rookery for this species. Another waterbird which is likely to forage on the wetlands within the Kaupulehu project site, but which was not observed there, is the native Hawaiian stilt (Himantopus mexicanus knudseni).

Migratory species such as the Pacific golden plover (Pluvialis fulva), sanderling (Calidris alba), and wandering tattler (Heteroscelus incanus) were observed on the site. The ruddy turnstone (Arenaria interpres), was not observed but is likely to occur on the site.

A total of eleven species of introduced birds were recorded during the survey. The most abundant were the Japanese whiteeye (Zosterops japonica) and Zebra Dove (Geopelia striata). The common myna (Acridotheres tristis), and spotted dove (Streptopelia chinensis) both roost in large numbers in the mangrove thicket adjacent to Waiakui Pond.



A number of game birds have been introduced over the years to the island of Hawaii. Populations of these species tend to be very localized. A larger game bird common to the Kona coast is the gray francolin (Francolinus pondicerianus). Other species which, although not recorded, might occur in the area and include Erckel's francolin (Francolinus erckelii), black francolin (Francolinus francolinus), and Japanese quail (Coturnix japonica).

**Mammals.** Mammals known to be present on the property include the mouse, feral goat (Capra hircus), mongoose, feral donkey ("Kona Nightingale") (Equus asinus), and cats and dogs. In the case of the cat, dog, goat and donkey, evidence of their existence on the site was found in tracks, scats, and/or skeletal remains. None of these mammals are listed as endangered or threatened species. Kaupulehu is reported by Van Riper and Van Riper III (1982) to be one of the last areas in Hawaii to still harbor feral donkeys.

The native Hawaiian hoary bat (Lasiurus cinereus semotus), listed on both the Federal and State endangered species list, has been observed in the Kailua-Kona area. However, no bats were observed during the survey.

#### 1.11.2 Probable Impacts

Landscaping of large areas now consisting of bare lava and open grassland will undoubtedly create a new and more diversified habitat that will increase the present population of most introduced birds on the Kaupulehu property, especially the common myna and house sparrow (Passer domesticus). The clearing of some of the encroaching vegetation in the wetland may make this area more attractive to waterbirds, particularly if some shallow wading and mud/sand flats are created. The size of the eventual wetland and its proximity to development will determine its future value as a wetland refuge for native and migratory waterbirds.

Golf course development and other open landscaped areas will create increased habitat for the Pacific golden plover and other species. Those species which are adapted to drier habitats, particularly the game birds, will probably move from the property.

Sites that will be covered by resort structures will be removed from the potential use of most mammals, except perhaps the mouse, which could nest in buildings. The increased human presence, particularly in the food handling areas, may also lead to some increase in the number of mice, rats, and mongooses. Birds, most probably those which have been introduced to Hawaii, may make use of the buildings for roosting sites. It is likely that these species, such as the myna, house sparrow, and rock dove (Columba livia), would not be daunted by the establishment of buildings on the property.

Feral donkey, known to be attracted to portions of the project site that contain watering and foraging areas, will probably move to alternate undeveloped areas as buildings and other resort amenities are constructed and put into use.

Waiakuhi Pond could be made to serve both an aesthetic as well as a functional role in Hawaii's limited wetland refuges. Bruner suggests that efforts be made to create a wetland that would be suitable to native waterbirds. Such a wetland could become an asset to the natural beauty of the final development scheme.

The retention of patches of native vegetation could help maintain a population of those bird and mammal species which require such a habitat for subsistence.

## 1.12 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

### 1.12.1 Existing Conditions

The proposed Kaupulehu Resort and Kona Village Resort are situated in the ahupuaa of Kaupulehu in the North Kona District. The area, like much of the Kohala/Kona Coast Region, contains many historical resources and archaeological remains. Due to the area's low rainfall, sparse vegetation, and extensive lava, much of the land north of Kailua, including Kaupulehu, is occasionally called Kekaha, or dry sunbaked land. The recorded history of this section of the West Hawaii coastal area dates back to the 1790's when the powerful Hawaiian chief Kameeiamoku lived at Kaupulehu (Kamakau 1961).

#### 1.12.1.1 Studies Conducted

The lands of Kaupulehu have been the subject of several surveys. Besides the most recent study prepared for Kaupulehu Developments by Paul H. Rosendahl, Ph.D., Inc. (PHRI) (Walker and Rosendahl 1986), seven other archaeological studies involving Kaupulehu land have been conducted. A brief review of earlier studies, those conducted between 1930 and 1985, is included in the following discussion.

The first recorded survey was conducted by John E. Reinecke in 1930. Reinecke located seven coastal sites in Kaupulehu during a study of the west coast of Hawaii Island for the Bishop Museum. In 1963, Lloyd Soehren and Kenneth Emory conducted a survey of the Kaupulehu area for the B.P. Bishop Estate, relocating some of the sites identified by Reinecke and locating additional sites inland. The B.P. Bishop Museum conducted a study for the Hawaii County Planning Department in 1970 (Emory 1970); this inventory was based solely on existing records, and did not involve any field work. In 1971, additional sites were located during a surface survey of the Kailua-Kawaihae road corridor for the State Department of Transportation by the Parks Division of the State Department Land and Natural Resources (Ching 1971). Two surveys were carried out by the State of Hawaii (1971 and 1975), during the Statewide Inventory of Historic Places. In 1981, Cambridge Pacific, Inc. requested the Bishop Museum to conduct a survey of two coastal areas for a State Land Use Boundary amendment which was subsequently approved in 1982 (Komori 1981). Several previously recorded sites were relocated and additional sites were found.

A more recent archaeological study of Kaupulehu was conducted for Kaupulehu Developments on the makai Kaupulehu parcel, that area of the ahupuaa which falls seaward of the Queen Kaahumanu Highway. This survey took place in September 1984 and was carried out by the B.P. Bishop Museum (Carter 1985). The objectives of the reconnaissance survey were to:

- 1) locate and record previously undocumented sites;
- 2) relocate previously recorded sites, noting present condition;
- 3) identify and locate any areas with probable subsurface deposits; and
- 4) recommend appropriate work details for subsequent archaeological investigations.

Carter identified 198 sites in the project area, including 151 new and 47 previously identified sites. Within these sites 802 features were identified. Based on the findings of this study, an intensive survey program was recommended for sites within one general and eight specific study areas. Such an intensive survey includes test excavations, intensive mapping, and treatment of human remains.

### 1.12.1.2 Archaeological Survey and Test Excavations of Project Site

In February and March 1986, PHRI undertook an archaeological survey and testing project at the proposed Kaupulehu Resort development site. The purpose of the work was to recover sufficient archaeological data to determine and document the significance of the archaeological remains on the site. The scope of work for PHRI's survey was based on recommendations contained in the Carter study and consultations with staff of the State Historic Preservation Office, the Hawaii County Planning Department, and the Kamehameha Schools Hawaiian Studies Institute. PHRI also conducted an archaeological field inspection of the Kona Village 15-acre expansion site north of the existing resort facilities in April 1986. This area had not been surveyed in recent previous studies (PHRI, 1986).

The study tasks included an aerial reconnaissance survey of the approximately 80-acre lava flow, supplemented by sample pedestrian transects; an intensive surface survey of 41 previously identified sites; test excavations at 21 previously identified sites; laboratory analysis of data recovered from the reconnaissance survey and test excavation; and the preparation of a written report discussing the data and recommending appropriate further action. See Figure IV-5 for the location of sites surveyed and tested.

An intensive survey was conducted at a total of 53 sites within the overall project area. Of these, 46 sites (including 138+ features) were previously recorded and seven (including 60+ features) were newly identified. The features were made up of a range of types, consisting mostly of walled shelters and enclosures, trails, a lava formation, walls, cairns, platforms, cleared leveled areas, rock alignments, terraces, overhang shelters, midden deposits, pahoehoe clearings, walled pahoehoe clearings, petroglyphs and burials. For a more detailed description of the sites see Appendix G.

As is typical of this region, the archaeological sites are concentrated near the shoreline, while the inland areas are more sparse. The archaeological setting is characterized by three major zones: a narrow, arid coastal habitation zone associated principally with the exploitation of various marine resources; a sloping, barren middle zone characterized by exposed aa and pahoehoe lavas; and an upland habitation zone associated with agricultural exploitation. A forest zone, still further inland, was also exploited, but not inhabited. This study (Walker and Rosendahl 1986), concentrated on the archaeological remains concentrated in the narrow coastal zone, and the movement of people along the foot trails through the barren intermediate zone that connects the coastal and inland areas of habitation and exploitation.

The significance or uniqueness of archaeological sites is usually assessed by identifying the interpretive, cultural, and research value of each site and its features. Interpretive value associates archaeological resources with their potential for public education and recreation. Cultural value, within the framework of this study, refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values. Research value refers to sites which contribute information useful to the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization.

Individual site evaluations and recommendations for further action are included in Tables 1 and 2 of Appendix G. In summary, based on the findings, 35 sites are believed to require no further work. Nine sites, including 6 foot trails, are recommended for preservation, interpretive development and inclusion into the landscaping of the proposed resort development. Nine other sites are recommended

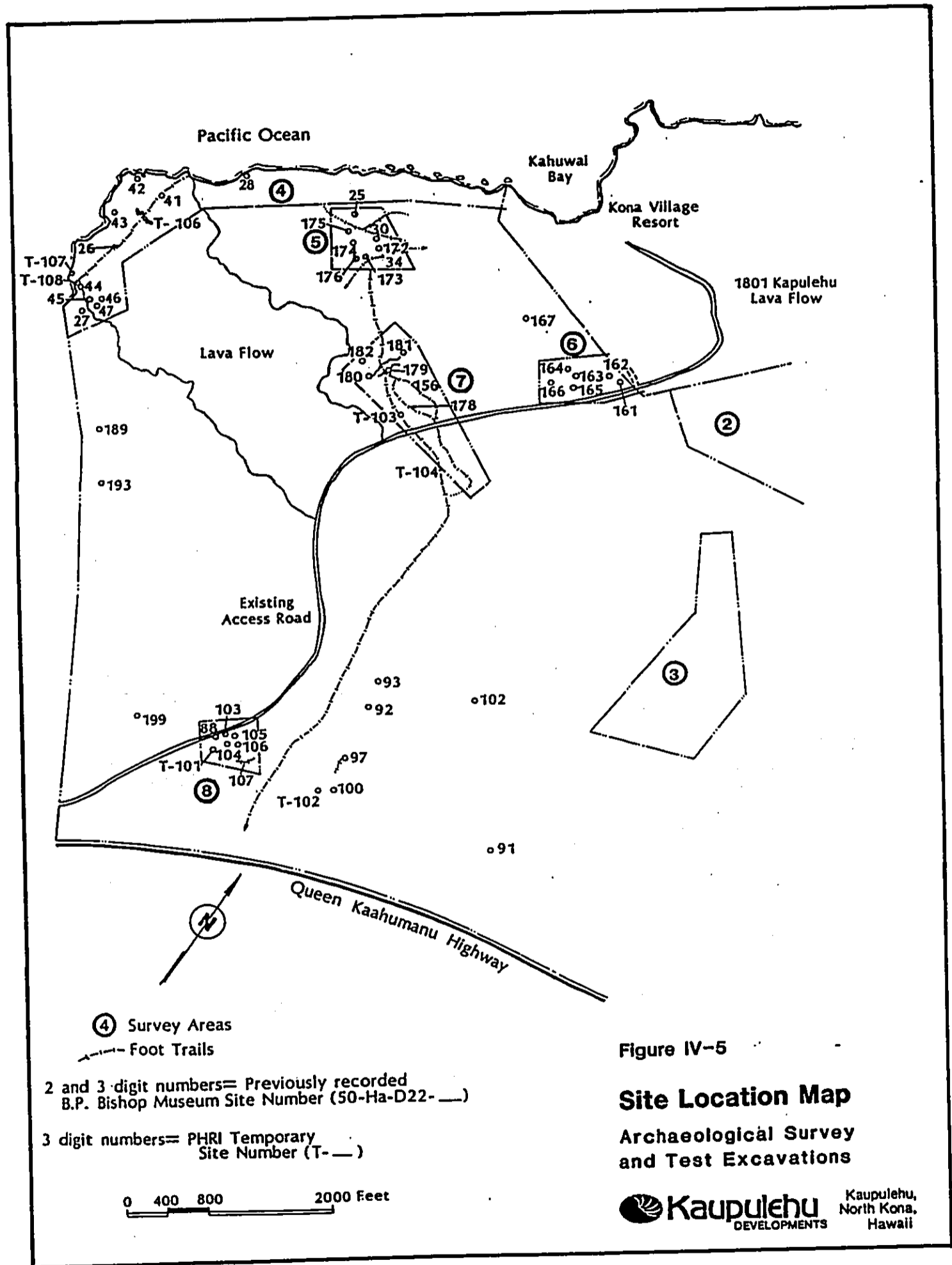


Figure IV-5  
**Site Location Map**  
 Archaeological Survey  
 and Test Excavations

**Kaupulehu** DEVELOPMENTS  
 Kaupulehu, North Kona, Hawaii

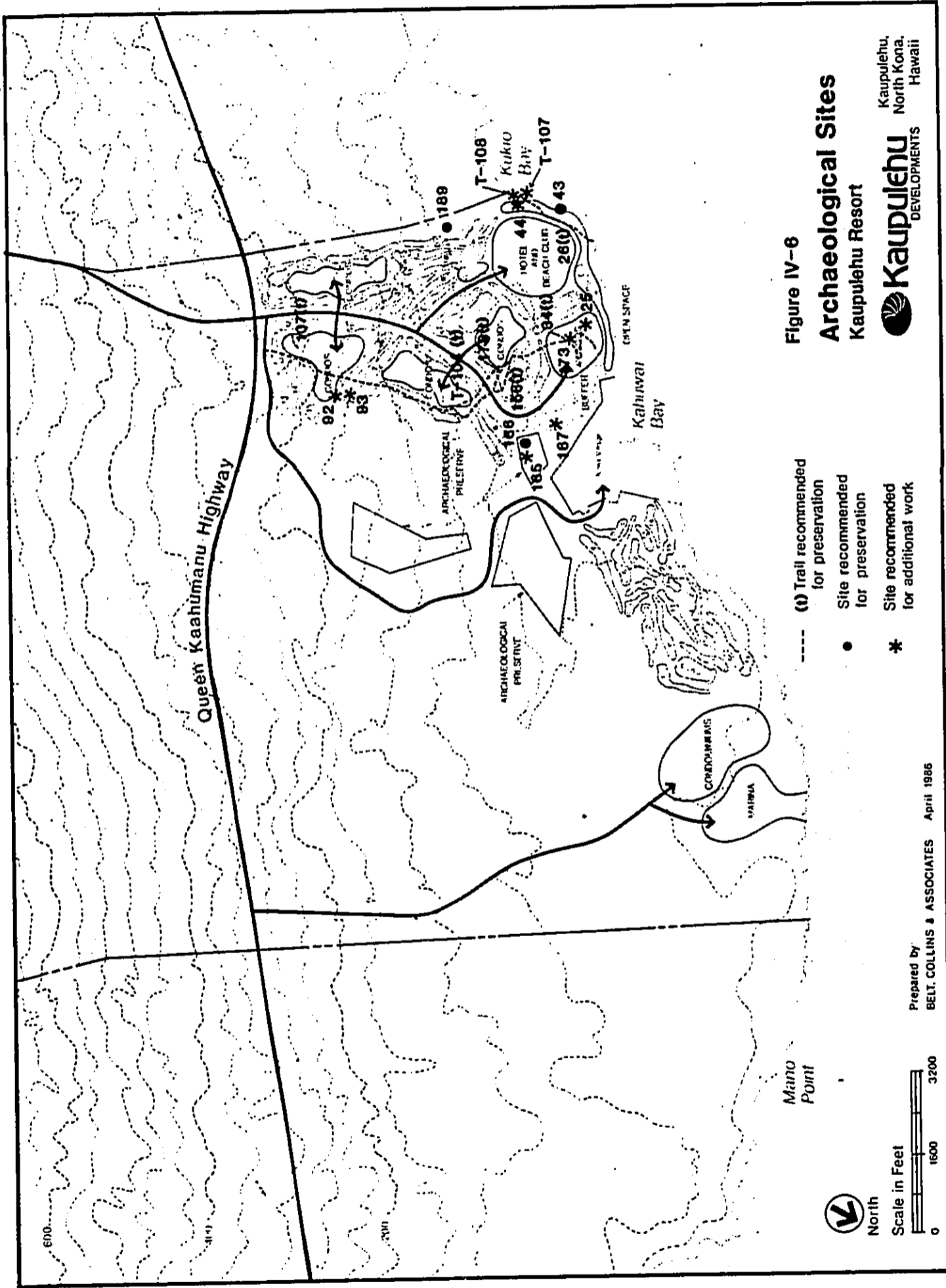
for further work in the form of intensive archaeological testing and/or mitigation (salvage research excavations and/or preserve). See Figure IV-6 for the location of the 18 sites recommended for preservation or further work.

Sites Recommended for Preservation

- 26 Coastal foot trail with high interpretive and cultural value. Completed detailed recording.
- 34 Foot trail with high interpretive and cultural value. Probably an extension of the main coastal-inland trail. Completed detailed recording.
- 43 Habitation complex with high interpretive and cultural value. Completed detailed recording and test excavations.
- 107 Foot trail with high interpretive and cultural value. Probably a branch of the main coastal-inland trail. Completed detailed recording.
- 156 Foot trail with high interpretive and cultural value. Probably an extension of the main coastal-inland trail. Completed detailed recording.
- 166 Habitation complex with high interpretive and cultural value. Contains waterworn cobble concentration and a possible shrine. Completed detailed recording and test excavations.
- 178 Foot trail with high interpretive and cultural value. Probably a branch of the main coastal-inland trail. Completed detailed recording.
- 189 Complex, tentatively interpreted as a boundary marker situated near the Kukio-Kaupulehu ahupuaa boundary, with possible shrines. High cultural value. Completed detailed recording.
- T-104 (Newly identified site) Foot trail with high interpretive and cultural value. Probably a branch of the main coastal-inland trail. Completed detailed recording.

Sites Recommended for Further Work

- 25 Habitation/burial complex. High cultural and scientific research value. Completed detailed recording.
- 44 Complex of undetermined function. Low to high cultural and scientific research value.
- 92 Habitation complex. High cultural, interpretive, and scientific research value. Completed detailed recording and test excavations.
- 93 Habitation/burial complex. High cultural and scientific research value. Completed detailed recording and test excavations.
- 165 Habitation/burial complex. High interpretive and cultural value. Completed detailed recording and test excavations.



- 167 Habitation/burial complex. High cultural value. Completed detailed recording.
- 173 Habitation/burial complex. High cultural and scientific research value. Completed detailed recording and test excavations.
- T-107 Complex of undetermined function. Low to high cultural and scientific research value. Completed detailed recording.
- T-108 Habitation complex. High scientific research value and medium to high cultural value. Completed detailed recording and test excavations.

The Kona Village Resort 15-acre expansion site consists mostly of barren lava. PHRI identified only one site in the inspection area: a worn, historic period foot trail which begins near the shoreline north of the expansion site and continues inland across the northwestern corner of the site on pahoehoe lava. The trail appears mainly as a shallow depression with several areas of cobble fill. Large white coral boulders are placed at intervals along the length of the trail.

Due to the revised configuration of the Kona Village Resort's northern expansion site, additional archaeological field inspection was conducted in May 1986. Field work was carried out to determine the presence or absence of archaeological sites of significance within the 9.5-acre expansion area within the Conservation District (see Appendix G, pages G-21 to G-24). This site consists of the dry lava landscape typical of the area. No new archaeological sites were located within the revised portion of the expansion site; however, a portion of the previously identified trail was located.

#### **1.12.1.3 Probable Impacts**

Because most of the sites identified by PHRI for preservation or further work are located in the coastal area and development will be concentrated in this vicinity, many of the archaeological sites could be affected. However, major negative impacts will be avoided as Kaupulehu Developments intends to follow PHRI's recommendations for preservation or further study of certain significant sites. Kaupulehu Developments recognizes the importance of the West Hawaii coastal region as the repository of significant historic and archaeological sites and intends to incorporate many of them into its overall development plan.

Improved public and resort guest access to the archaeological sites will have both a positive and negative impact; it will provide opportunities for cultural and educational enrichment while at the same time increase the possibility of degradation of the sites.

#### **1.12.1.4 Mitigation Measures**

The nine sites recommended for preservation, including the historic foot trails, will be incorporated into the concept master plan. The nine sites recommended for further work before physical destruction will either undergo this work or be preserved and integrated into Kaupulehu Resort development.

Further, Kaupulehu Developments proposes to establish 3 large archaeological preserves in the makai Kaupulehu lands, outside the proposed Urban boundary. These preserve areas contain concentrations of representative archaeological and historic sites identified by Carter. They would be managed as a recreational and educational resource, and would serve to maintain the archaeological sites in an undisturbed state.

It may be appropriate to integrate the developing Ala Kahakai Trail System (AKTS), into the historic coastal trail system on the resort site (Na Aia Hele 1973). The AKTS is proposed by state and private organizations to be incrementally established along the Kona/Kohala coast.

Additional mitigation measures proposed by PHRI will be followed. These include the accurate location and plotting by professional surveyors of all identified sites, and the monitoring of all grubbing activity in the vicinity of identified sites by a qualified archaeologist. Should artifacts or buried cultural features or deposits be encountered during construction, work in the area would be suspended until the monitoring archaeologist could inspect and evaluate such remains.

The Hawaii County Planning Department agrees that the physical preservation of the foot trail, which is partially on the 15-acre Kona Village north expansion site, would not be required, but recommends accurate locational plotting of the trail and that limited documentation research be conducted before project development. The operators of Kona Village Resort will consider PHRI's recommendation to alternately preserve the trail and incorporate representative sections into the overall landscape design of planned expansion.



## 2. SOCIOECONOMIC CONSIDERATIONS

### 2.1 EXISTING CONDITIONS

Although the proposed Kaupulehu Resort will be located in the North Kona District, market characteristics of the development are most similar to those of neighboring West Hawaii resorts in the South Kohala District. The resort will be a planned, self-contained visitor destination area providing a luxury hotel, residential resort condominiums, and extensive recreational amenities. This concept for Kaupulehu Resort is compatible with the character and atmosphere of high quality, master planned resorts of the Kohala Coast Resort Region and is therefore expected to attract like clientele. For these reasons, data on social and economic conditions are provided for both the North Kona and South Kohala Districts.

Kona Village Resort is an established visitor destination on Kaupulehu lands. Although Kona Village Resort and the planned Kaupulehu Resort will retain distinct individual identities and cater to somewhat different markets, both are part of the same designated Intermediate Resort area and are included in the analysis of socioeconomic factors.

#### 2.1.1 Primary Economic Activities

The primary economic activities of the North Kona District have changed dramatically over the past several years due to the decrease in agricultural activities, including ranching and coffee production, coupled with the rise in visitor-related activities. North Kona experienced a building boom in the 1960's and 1970's, which resulted in the construction of new hotel, condominium and residential units. This construction activity spread to neighboring South Kohala. Today, the North Kona and South Kohala Districts constitute the center of the island's visitor industry.

The availability of large parcels of land under single ownership and the enactment of horizontal property regime laws were and remain key factors in permitting high quality planned development in several resort areas along the Kona and Kohala coast. There are currently six existing resort areas along this coast: Mauna Kea Resort, Mauna Lani Resort, Waikoloa Resort, Keauhou Resort, Kona Village Resort, and Kailua-Kona. Other resorts are proposed and are in varying stages of the permitting process.

#### 2.1.2 Population

Almost a third of the population of the Island of Hawaii resides in the West Hawaii area, which consists of North and South Kohala and North and South Kona. The North Kona district experienced the most rapid growth, at 11 percent per year between 1970 and 1980. The combined annual growth rate of the four regions was 6.6 percent in the same period. There were 8,960 households in the Kona and Kohala districts in 1980, with an average household size of about 3 persons per household.

The dramatic growth rate in population for the North Kona and South Kohala districts was primarily due to the increased activity in the visitor industry. In 1970 the number of visitors to the State was almost 1.8 million; by 1979 this figure approached 4 million.

According to the 1980 U.S. Census, the total resident population of the North Kona District was 13,748, almost triple the number of people residing there in 1970. The South Kohala District also experienced rapid population growth during the decade. In 1970, approximately 2,300 persons resided in South Kohala, most of them in the upland areas around Waimea. By 1980, the South Kohala population had nearly doubled to 4,600. Many of the new residents of North Kona and South Kohala were young Caucasians who moved to the area.

The median age in all four districts in 1980 approximated that of the County as a whole (29.4 years) and the State as a whole (28.3), ranging from 28.8 years in North Kona to 32.0 years in North Kohala. As seen in the following table, the median family incomes of the North and South Kona Districts in 1980 were above the County average of \$19,132, while those of the Kohalas were lower.

Median Family Income  
Kona and Kohala Districts

<u>District</u>	<u>Median Family Income (1979)</u>
North Kona	\$ 21,134
South Kona	20,068
North Kohala	15,719
South Kohala	17,923
County of Hawaii	19,132
State of Hawaii	22,750

Source: State of Hawaii 1983 Data Book

**2.1.3 Employment Patterns**

Data on the labor force indicates that in the decade between 1970 and 1980, North Kona and South Kohala had substantial increases in the number and percentage of workers in professional and technical occupations, and in sales and service occupations. Many were employed by hotels and other visitor-related businesses. In 1980, hotel-related industries accounted for 64.2 percent of employment in North Kona, 49.8 percent of employment in South Kohala, and 45.6 percent in North Kohala. The unemployment rate in the Kona and Kohala Districts was lower than that for the island as a whole, 5.9 percent versus 7 percent.

The occupations emerging from the visitor industry base of the West Hawaii economy, such as those mentioned above, account for about 46 percent of the total employment. Managerial and professional occupations account for about 19 percent of the districts' employment, while agricultural production and operations-related employment each represent between about 10 and 13 percent of the total.

**2.1.4 Social and Community Concerns**

Surveys of County residents taken in 1982 (Ward Research) show that a majority of those polled agree that tourism is good for the island and that new hotels and condominiums are needed to provide more jobs for residents of the Kohalas (Public Affairs Advisory Services, 1979; and 1980). Major advantages are perceived to be employment opportunities and the strengthening of local businesses. Although less frequently perceived, disadvantages tend to involve housing impacts, potential impacts to the environment or historic sites, and reduced open space (Ibid.:3-5).

Cultural adaptation to changing social mores and patterns of interaction as a result of change brought about by increasing resort development is perceived to have taken place relatively smoothly. Friction between various ethnic groups is thought to be decreasing. Although cultural erosion is recognized, informants feel that visitor industry growth and the associated influx of visitors and new residents contribute only partially to this condition. Other contributing factors cited were television and other media. Moreover, positive aspects associated with increased resort development were also perceived, such as increased opportunities for experiences not normally available within a relatively isolated rural community.

Common concerns centered around the potential impact of the visitor industry on family structure and on public use of facilities, particularly beaches, in the vicinity of new resort facilities.

## 2.2 PROBABLE IMPACTS

Environment Capital Managers, Inc. (ECMI) performed a public revenue-cost and economic impact analysis for Kaupulehu Developments (March 1986), centering on the effect that Kaupulehu Resort would have on the economy both locally and statewide. Much of the remainder of this section is based on ECMI's report which is appended to this document as Appendix H.

The ECMI analysis takes into account the 1,350 hotel and condominium units, two golf courses, related resort amenities, and infrastructure to be built at Kaupulehu Resort. It does not include the 50 new units of the Kona Village Resort expansion. The Kona Village Resort units represent about only 3.7 percent of the units planned for Kaupulehu Resort. Hence, ECMI had concluded that the basic findings of its analysis are not significantly affected by consideration of the additional KVR units.

### 2.2.1 Public Revenue Analysis

The Kaupulehu Resort project will provide the State and County of Hawaii with additional sources of revenues and, simultaneously, will increase the burden on available public resources. To assess the impact of the project, incremental revenues and costs were estimated and fully charged to the project to calculate the revenue-cost ratio.

The approach taken by ECMI was to first identify the kinds of revenue and cost elements to be considered, then estimate the dollar amount that should be associated with each element, and finally compare the discounted present values of the various revenue and cost totals. The objective of the analysis was to determine whether the additional County and State government revenues generated as a result of the project would offset the necessary additional costs. The study time period used by ECMI is 1988 to 2000.

As shown in the following table, the Kaupulehu Resort project is estimated to have a favorable revenue-cost ratio of 4.0 to 1.0, or an additional \$4.00 in public revenue generated for every dollar of public cost caused by the proposed resort. For comparison purposes, the U.S. Army Corps of Engineers recommends proceeding with a project if there is a one-to-one ratio or greater.

The cumulative discounted public revenues amounted to \$31.2-million in 1986 dollars. Note that the combined "general excise tax" variable contributed over \$17.3-million or over half of the total.

**Revenue-Cost Analysis Summary**  
(in 1986 dollars)

Variable Description	Present Value	
General Excise Tax/Construction	\$ 7,678,397	
General Excise Tax/Hotel & Condo	7,473,077	
General Excise Tax/Golf	568,980	
General Excise Tax/Personal Consumption	1,645,134	
Corporate Income Tax/Condo Sales	125,275	
Corporate Income Tax/Rental & Golf	904,854	
Personal Income Tax	2,774,817	
Real Property Tax	10,045,660	
<b>PUBLIC REVENUES</b>		<b>\$ 31,216,194</b>
Lower Education	\$ 3,425,586	
Higher Education	2,181,925	
Health Services	437,900	
Mass Transit Service	84,952	
Police Service	975,382	
Fire Service	754,213	
<b>PUBLIC COSTS</b>		<b>\$ 7,859,958</b>
<b>REVENUE - COST RATIO</b>		<b>4.0 to 1.0</b>

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Source: Environment Capital Managers, Inc.

## 2.2.2 Impact Analysis

ECMI used the State of Hawaii, Department of Planning and Economic Development input-output model to project impacts on the economy as a result of Kaupulehu Resort development. The model provides information on the inter-relationships among all sectors of the State's economy. An application of the model is the formulation of output, income, and employment multipliers which can be applied to estimate direct, indirect and induced impacts of a given project. The direct effect is the immediate primary impact of a project on the economy, the indirect effect is the secondary impact, and the induced effect is the subsequent round of changes in the economy which is "time-compressed" into a single value (ECMI:21).

For the Kaupulehu Resort project, effects were analyzed for a future date when the resort would be in full operation. Results should be viewed as order of magnitudes that may exist should the project be developed as currently envisioned.

### 2.2.2.1 Output Effects

Output effects are changes that could occur to the total value of goods and services produced within the State's economy. ECMI estimates that, at full operation, the Kaupulehu Resort project would generate an average \$46.2-million a year (in 1986 dollars) from the operation of the hotel, condominium rentals, and the golf course, with the following direct and indirect effects:

Direct	\$ 46.2-million
Indirect	20.9-million
Induced	<u>36.0-million</u>
Total	\$ 103.1-million

### 2.2.2.2 Income Effects

This impact represents increased income to households based on the direct output estimate of \$46.2-million. Household income in the State would increase by \$39.2-million taking into account direct and indirect effects:

Direct	\$ 17.0-million
Indirect	7.7-million
Induced	<u>14.5-million</u>
Total	\$ 39.21-million

### 2.2.2.3 Employment Effects

Development of Kaupulehu Resort will generate both long-term operational employment and short-term construction employment.

**Operational Employment.** ECMI estimates that almost 1,850 new jobs will be created directly and that over 3,500 jobs will be created in total:

Direct	1,847 jobs
Indirect	550 jobs
Induced	<u>1,154 jobs</u>
Total	3,511 jobs

The numbers above include both full-time, part-time, and seasonal on-call jobs, so that the 1,847 direct jobs, for instance, can be equated to 1,060 full-time equivalent jobs.

The 100-unit Kona Village Resort currently employs about 200 persons, and is expected to offer additional employment opportunities as the 50 new units are added.

Average annual employee salaries are assumed by ECMI to be \$21,300 for general and administrative staff, \$13,700 for hotel and condominium workers, and \$15,000 for golf course workers.

Experience shows that luxury resorts in West Hawaii similar to the proposed Kaupulehu Resort have hired most of their employees from the Island of Hawaii. As a result of the extensive planned resort development on the Kohala/Kona coast over the next decades, however, it is expected that job opportunities will increase at a higher rate than the local population. Hence, in-migrants from outside the County will be needed to fill some positions at the various resorts, including Kaupulehu Resort and Kona Village Resort.

The existing labor pool of the County consists of: 1) unemployed or underemployed persons; 2) labor market entrants, including high school graduates; and 3) persons working elsewhere on the island.

**Construction Period Employment.** ECMI has projected direct construction period employment based on the Kaupulehu Resort development schedule and a DPED multiplier of .019 jobs per \$1,000 of construction cost (DPED, unpublished multipliers). Construction cost includes the cost of off-site infrastructure, the golf course, the condominium units and the hotel and beach club.

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**Construction Employment  
 Kaupulehu Resort**

<u>Year</u>	<u>Construction Cost</u>	<u>Direct Jobs*</u>
1988	\$ 43,867,000	833
1989	50,167,000	953
1990	51,710,000	982
1991	54,790,000	1,041
1992	52,420,000	996
1993	22,140,000	421
1994	16,740,000	318
1995	5,400,000	103

\* Number of direct jobs created in the current year. Annual jobs not cumulative.

Source: ECMI, March 1986  
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Direct employment of construction period workers will stimulate additional purchases of goods and services on the island and elsewhere in the State, resulting in indirect and induced employment. In its 1982 revised model of the construction industry in Hawaii, DPED estimated that 1.4 additional full-time jobs are created for every full-time job in the building construction industry.

The types of construction jobs to be generated by Kaupulehu Resort and Kona Village Resort are expected to be distributed similarly to those of the industry as a whole. About 70 percent of construction employment can be expected to be in skilled craft and labor positions. About 5 percent would be professional or technical and about 9 percent managerial. Due to specialized skill requirements, the latter two categories are most likely to call for a number of off-island workers who come from larger and more diversified labor pools.

### 2.2.3 Population Impacts

Two types of population impacts will occur as a result of the Kaupulehu Resort development: an increase in on-site population due to the visitors and residents at the resort, and an increase in off-site population resulting indirectly from resort development and the new employment it generates. Associated with increased employment is the in-migration of workers to fill positions not filled by current residents.

#### 2.2.3.1 On-Site Population Impact

The on-site population will consist of visitors staying at the resort's hotel and condominium units which have been incorporated into the visitor rental pool as well as permanent condominium residents. To calculate the de facto population, ECMI assumes two persons per hotel or condominium unit and a 70 percent occupancy rate:

<u>Year</u>	<u>De Facto Population</u>
1989	588
1990	952
1991	1,246
1992	1,540
1993	1,624
1994	1,708
1995	1,792
1996 to 2000	1,890

#### 2.2.3.2 Off-Site Population Impact

The Kaupulehu Resort development and Kona Village expansion will generally contribute to the growth of the island's resident population as people move to the County to work at the resorts. Some employees will no doubt bring dependents, especially if they are household heads. It is unknown what percentage of employees will be recent in-migrants to the Island of Hawaii. Assuming one full-time equivalent employee represents one person employed full-time and a single household, with an average household size of 2.9, ten percent in-migrant employees would account for an increase in population of about 300 at full operation of the resort in 1996. An increase or decrease in the number of in-migrant workers would entail a corresponding increase or decrease in population growth on the island.

### 2.2.4 Housing Impacts

Construction and operational employees of Kaupulehu Resort and Kona Village Resort who are in-migrants to the County will generate a demand for housing, as will job-takers from within the County who move to be closer to work or establish new residences. People already residing within the County may cause a shift in demand to areas in the vicinity of the resorts.

Indirect housing demands are also generated as a result of resort development. These demands are caused by workers whose employment is indirectly supported by the resort development and by new workers filling positions vacated by others who would take jobs at Kaupulehu Resort and Kona Village Resort. The indirect employee housing demands are extremely hard to predict, partly due to the difficulty in understanding how many times job turnover occurs down the line as a result of an initial job change and how much new housing is needed for each subsequent change.

#### **2.2.4.1 Construction Employee Housing**

Construction employment is temporary and thus does not generate the long-term housing demand associated with operational employment. Contractors in South Kohala have reported that construction workers have been able to obtain housing in the short-term rental market, mostly in the Kona Area. Labor agreements frequently provide generous subsistence allowances for construction workers, and therefore affordability is usually not a problem.

#### **2.2.4.2 Operational Employee Housing**

Long-term housing needs are expected to be met for the most part on the open market. It is also expected that employee housing requirements will be stipulated in governmental permit approvals and Kaupulehu Developments intends to abide by conditions of development and assist in ensuring adequate employee housing. Kaupulehu Developments is continuing to discuss housing alternatives with the Hawaii County Housing Agency, Hawaii Housing Authority, and concerned resort developers.

#### **2.2.5 Social Impacts**

In various studies conducted in conjunction with the analysis of potential impacts due to resort development, residents of the Kohala and Kona Districts have expressed concern about the social effects of such development. Concerns center upon the potential effects on the family, social structure, and community character, as well as crime impacts.

Three aspects of resort development can affect the family structure: 1) increased numbers of women in the workforce, 2) shift work, and 3) exposure to persons of the opposite sex. Although increasing numbers of women in the workforce contribute to family income, negative impacts associated with decreasing family cohesion and stability are perceived to be prevalent. This includes lack of supervision of school-age children who then have the opportunity to engage in socially unacceptable behavior. Shift work is a common feature of visitor industry employment. It can be disruptive to family routines, especially when both spouses work in the industry. Lack of shared time at home hinders communication between parents and among parents and children. With exposure to the opposite sex, the chance for mild or serious flirtation increases. These can be reported back to the spouse through gossip networks and can increase jealousy and mistrust, with detrimental effects on the family.

Impacts of resort development on local residents' values, lifestyles, and "quality of life" are indirect and difficult to measure. However, these effects have been felt during the development of the Kohala Coast Resort Region, and are expected to continue to be significant, particularly in the long run. These stresses are expected to evolve as social and economic conditions change. Exposure to new customs may necessitate cultural adjustments, with either negative or positive consequences.



Development of West Hawaii resorts, including Kaupulehu Resort and Kona Village Resort expansion, will increasingly affect the traditional use of public areas, particularly beaches, which are not numerous on the Island of Hawaii. It is perceived that resort development will increase visitor access to recreation areas more commonly used by local residents. On the other hand, Kaupulehu Developments will provide public access from Queen Kaahumanu Highway to the shoreline at Kaupulehu Resort, opening up to local residents as well as visitors a beach area that is currently virtually inaccessible.

Crime is a major concern of island residents; some feel that crime rates rise with increased visitor activity. Crime data nationwide and in Hawaii contain contradictory conclusions. Studies done for projects in Hawaii rarely link major crime with increased tourism. However, the Waimea and Kona police reportedly see a link between visitor industry development and certain types of petty crime, such as theft. They note the spread, over the past several years, of theft at resort development beach parks. Agreeing with studies performed, the local police do not feel there is a connection between increased visitor populations and more serious crimes, such as assault, rape, and murder. They do believe, however, that visitors constitute a market for drug trafficking and that this market will continue to expand along with planned resort facilities, leading to drug-related crimes.

Another area for potential criminal acts is one identified in other visitor industry studies: the indirect effect of tourism on crime through conflicts between long-time residents and newcomers who may be employed at resorts. Physical confrontations may lead to assault charges against either party.

Some of the adverse social effects described above can be expected to increase as more resorts such as Kaupulehu Resort and Kona Village Resort are developed. On the other hand, with increased resort development, local residents become more aculturated to outside influences and are better able to incorporate them into the existing lifestyle.

Positive social effects include the role of the visitor industry as an impetus for the preservation of traditional Hawaiian arts and crafts. A steady demand for traditional products is generated by the visitor market.

### **3. TRANSPORTATION FACILITIES**

#### **3.1 EXISTING TRANSPORTATION FACILITIES**

##### **3.1.1 Highway Network**

Major roadways in the West Hawaii region are shown in Figure II-1. Access to Kaupulehu Resort, Kona Village Resort, and the major resorts in the Kohala Coast Resort Region is provided by Queen Kaahumanu Highway. This limited access State highway connects Kailua-Kona to the south and Kawaihae to the north. The Hawaii Belt Road (Mamalahoa Highway) serves the upland areas of North Kona and South Kohala. Queen Kaahumanu Highway and Mamalahoa Highway are connected by Waimea-Kawaihae Road, Waikoloa Road, Kaimi Nani Street in the Kona Palisade Subdivision and Palani Road in Kailua-Kona.

##### **3.1.2 Airports**

The Kohala Coast Region is serviced by three airports. The Keahole and Waimea-Kohala Airports are operated by the State Department of Transportation. The Waikoloa Airport, located near the Waikoloa Beach Resort, began operating in 1984 and is serviced by Princeville Airways.

The proposed project site is located about 6 miles north of Keahole Airport, the major airport in the region. In September 1983, Keahole Airport began handling direct flights by United Airlines from the U.S. mainland.

A drive of approximately 28 miles to the north and east of the site is the Waimea-Kohala Airport; at an elevation of 2,700 feet, it is the highest airport in the state. This terminal handles only a limited number of scheduled commuter and charter flights and private aircraft.

##### **3.1.3 Harbors**

The Queen Kaahumanu Highway connects Kailua-Kona with the Kawaihae Harbor. Located in the South Kohala District, it is the only deep water harbor in West Hawaii and is used primarily by interisland barges. The primary cargo handled is building materials, consumer goods, large equipment and machinery, as well as the provisions and supplies needed to operate the hotels in South Kohala and Kona. The Honokohau Small Boat Harbor is about 12 miles to the south of the site, within the North Kona District. The harbor has been designed to serve pleasure craft and is one of three sites in the North Kona District which are used for boat launching.

#### **3.2 IMPACTS ON TRANSPORTATION FACILITIES**

##### **3.2.1 Probable Impacts on Roadways and Traffic**

The proposed Kaupulehu Resort is only one among many resort facilities planned for the Kohala/Kona Coast area and estimates of its impact on transportation facilities must be conducted with this in mind. It should be noted that long-range forecasts are only as good as the land use/development scenarios on which they are based. To the extent that the rate of development of coastal resorts (which are the primary driving force in the regional economy) exceeds that which is now planned, traffic volumes may also increase more rapidly than expected. Similarly, slower than

expected development rates will result in less traffic. In view of the foregoing, it is perhaps most useful to treat the following discussion as an indication of the potential problems that may arise in the future rather than an attempt to specify exact time-tables.

### 3.2.1.1 Past and Present Highway Traffic Volumes

**Existing Traffic on Queen Kaahumanu Highway.** The 24-hour traffic counts taken at various locations on Queen Kaahumanu Highway by the Highways Division, Department of Transportation, State of Hawaii, from 1976 to 1984 are summarized in the table, "Historical 24-Hour Traffic Volumes at Selected Locations on Queen Kaahumanu Highway: 1976 through 1984". The counts show significant growth in traffic since the highway opened in 1975.

The State's traffic counts were taken bi-annually, so it is not possible to correlate the increase in traffic on Queen Kaahumanu Highway with the opening of projects at Waikoloa Resort, Mauna Lani Resort, and Mauna Kea Resort. These resorts, however, most likely account for a significant portion of the traffic that is now on Queen Kaahumanu Highway.

In 1984, peak hour traffic on Queen Kaahumanu Highway between the Keahole Airport Road and Waikoloa Road ranged from 7.5 to 9.6 percent of the 24-hour volume. The afternoon peak on Queen Kaahumanu Highway, which occurred from approximately 2:00 to 3:00 pm at Keahole Airport Road and from approximately 3:00 to 4:00 pm at Waikoloa Road, was significantly higher than the morning peak, which occurred from approximately 10:00 to 11:00 am at Keahole Airport Road and from approximately 9:00 to 10:00 am at Waikoloa Road. The directional split of traffic on Queen Kaahumanu Highway for the peak hours was as follows:

Location	Direction Split % of Peak Hour	
	Northbound	Southbound
North Leg, Queen Kaahumanu Highway at Keahole Airport Road		
AM Peak Hour	57	43
PM Peak Hour	46	54
South Leg, Queen Kaahumanu Highway at Waikoloa Road		
AM Peak Hour	49	51
PM Peak Hour	40	60

The most recent vehicle type classification study on Queen Kaahumanu Highway was conducted in 1978 before construction of the Waikoloa and Mauna Lani Resorts. At that time, approximately 94 percent of the trips were made by passenger cars and light single unit trucks, 1.5 percent were made by buses, and 4.5 percent by medium and heavy trucks. It is expected that the composition of traffic will not change dramatically. It is likely that with increased visitor traffic, the percentage of medium and heavy trucks would decrease and that of buses and vans would increase.

HISTORICAL 24-HOUR TRAFFIC VOLUMES AT SELECTED LOCATIONS ON QUEEN KA'AHUMANU HIGHWAY: 1976-1984.

LOCATION	1976		1978		1980		1982		1984	
	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change	Volume	Percent Change
Kawaihae-Waimea Road										
Northbound	1,172		1,500	28.0%	1,292	-13.9%	1,692	31.0%	2,049	21.1%
Southbound	1,186		1,585	33.6%	1,526	-3.7%	1,753	14.9%	2,137	21.9%
Total	2,358		3,085	30.8%	2,818	-8.7%	3,445	22.2%	4,186	21.5%
North of Waikoloa Road										
Northbound	593		886	49.4%	647	-27.0%	1,184	83.0%	1,717	45.0%
Southbound	569		883	55.2%	894	1.2%	1,389	55.4%	1,812	30.5%
Total	1,162		1,769	52.2%	1,541	-12.9%	2,573	67.0%	3,529	37.2%
South of Waikoloa Road										
Northbound	607		850	40.0%	645	-24.1%	1,346	108.7%	1,707	26.8%
Southbound	575		842	46.4%	785	-6.8%	1,489	89.7%	1,893	27.1%
Total	1,182		1,692	43.1%	1,430	-15.5%	2,835	98.3%	3,600	27.0%
North of Keahole Airport Road										
Northbound	858		1,127	31.4%	775	-31.2%	1,487	91.9%	1,966	32.2%
Southbound	851		1,183	39.0%	643	-45.6%	1,520	136.4%	1,945	28.0%
Total	1,709		2,310	35.2%	1,418	-38.6%	3,007	112.1%	3,911	30.1%
South of Keahole Airport Road										
Northbound	1,581		2,233	41.2%	2,113	-5.4%	2,549	20.6%	3,607	41.5%
Southbound	1,594		2,304	44.5%	2,107	-8.6%	2,707	28.5%	3,484	28.7%
Total	3,175		4,537	42.9%	4,220	-7.0%	5,256	24.5%	7,091	34.9%

Source: State of Hawaii, Department of Transportation,  
Department of Transportation

**Traffic on Kaupulehu Resort Entrance Road.** The entry portion of the existing road from Queen Kaahumanu Highway to Kona Village Resort is located on the adjacent property to the south of the proposed new entrance road. The proposed entrance road will involve realignment of the existing road to the north and provision of a new road for Kaupulehu Resort. The realigned Kona Village access road will connect with the Kaupulehu Resort entrance near its intersection with the Queen Kaahumanu Highway. The two entrance roads will provide the desired separate identities for Kaupulehu Resort and Kona Village Resort.

Traffic on the existing Kona Village Resort entrance road was not counted, but traffic on the planned realignment is expected to be light, even including the increased traffic generated by the 50 new units at Kona Village Resort. Many Kona Village Resort guests arrive at the development by taxi and tend to remain on the premises throughout their stay, thereby generating little daily traffic in and out of the resort. At the busiest hour of the day, Kona Village Resort is estimated to generate approximately 70-80 vehicles onto Queen Kaahumanu Highway.

### 3.2.1.2 Project-Related Traffic

**Trip Generation Rate.** Trip generation rates taken from the national traffic publication entitled, "Trip Generation (Third Edition), Institute of Transportation Engineers, 1983," were applied to the different land uses proposed in Kaupulehu to arrive at future trips generated by the proposed project. Origin and destination of trips were determined and assignment of the projected trips to the resorts' circulation system was made. This ultimately determined the number of trips eventually leaving and entering the resort.

**Turning Movements.** In order to project traffic generated by Kaupulehu Resort and Kona Village expansion on Queen Kaahumanu Highway, it is necessary to estimate the turning movements of the traffic entering and leaving the project. An estimate of the turning movements was made based on the existing characteristics and directional split of traffic on Queen Kaahumanu Highway. Thus, for PM peak hour, a directional split of 55 percent southbound and 45 percent northbound was used.

**Vehicle Type Classification.** Data on vehicle type was collected at Mauna Lani Drive in 1984. The data indicates that approximately 97 percent of the trips on the entrance road were made by automobiles, pickup trucks, and vans; 2 percent by medium and heavy trucks; and 1 percent by buses. Based on the similarity of existing land uses in Mauna Lani, it is expected that Kaupulehu Resort would have a similar cross-section of vehicles.

### 3.2.1.3 Forecast of Future Traffic

**Kaupulehu Resort Traffic.** Based on the trip generation rates mentioned in Section 3.2.3.1, Kona Village's estimated traffic, and Kaupulehu Resort's development timetable, future traffic volumes on the entrance road were projected. As shown in the following table, the afternoon peak hour traffic on the entrance road is expected to increase from 119 vehicles per hour (vph) in 1989 to 782 vph in 1995 when the project is expected to be completed. These projections are based on the expected occupancy rates of 70 percent for condominiums and 90 percent for hotel units. During periods with higher occupancy rates, traffic volumes will be higher. The afternoon peak hour traffic was selected for the projection because it represents the period of day with the highest traffic volume.

**Projected PM Peak Hour Traffic on  
Kaupulehu Entrance Road at Expected Occupancy**

<u>Location</u>	<u>Year</u>		
	<u>1989</u>	<u>1992</u>	<u>1995</u>
<b>KAUPULEHU ENTRANCE ROAD</b>			
Inbound from North	24	147	153
Inbound from South	19	121	126
<b>Total Inbound</b>	<b>43</b>	<b>368</b>	<b>379</b>
Outbound to North	34	171	181
Outbound to South	42	210	222
<b>Total Outbound</b>	<b>76</b>	<b>381</b>	<b>403</b>
<b>Total Inbound plus Outbound</b>	<b>119</b>	<b>749</b>	<b>782</b>

**Queen Kaahumanu Highway Traffic.** All the traffic entering or leaving Kaupulehu Resort and Kona Village Resort must use Queen Kaahumanu Highway. Therefore, the proposed project will contribute significantly to the regional and local traffic.

Twenty-four hour traffic counts, taken by the Department of Transportation, State of Hawaii, from 1976 to 1984 on the south leg of the intersection of Queen Kaahumanu Highway and Waikoloa Road and the north leg of the intersection of Queen Kaahumanu Highway and Keahole Airport Road, were analyzed to determine the growth of traffic in the region and its relationship to Kaupulehu Resort. Calculations based on projections of historic counts at both locations and show similar growth patterns. Both locations show significant traffic growth from 1976 to 1984. The projected PM peak hour traffic is shown below.

**Projected PM Peak Hour Traffic on  
Queen Kaahumanu Highway with Proposed Project**

<u>Location</u>	<u>Year</u>		
	<u>1989</u>	<u>1992</u>	<u>1995</u>
Northbound	262	304	346
Southbound	214	249	283
<b>Total</b>	<b>477</b>	<b>553</b>	<b>629</b>

**3.2.1.4 Impact on Level of Service**

**Introduction.** In order to assess the effect that traffic from Kaupulehu Resort and Kona Village expansion will have on the level of service (i.e., the amount of congestion) of Queen Kaahumanu Highway and the project entrance road, the project traffic

was compared against the calculated capacity of the entrance road, Queen Kaahumanu Highway, and the intersection of the two roads for the years 1989, 1992, and 1995. The calculated capacities and levels of service for the project analysis were based on the methodology outlined in the Highway Capacity Manual, Transportation Research Board, 1985.

**Queen Kaahumanu Highway.** Open stretches of Queen Kaahumanu Highway can accommodate as many as 2,500 vehicles per hour in both directions. Current traffic volumes are relatively low and the level of service is "A" at all times on a scale that ranges from "A" to "E." (Level of service A indicates that the operating conditions on a particular roadway is of free flow, with low volumes and high speeds. Level of service E represents the extreme opposite condition where a particular roadway is near or at capacity. Below this level is level of service F which is a forced condition that involves a breakdown in the flow of traffic.) Analysis of the highway suggests that Queen Kaahumanu Highway, in the vicinity of Kaupulehu, will not reach capacity (service level E) within the next 10 years or by the year 1995. Traffic will undoubtedly increase on Queen Kaahumanu Highway, but the level of service would not be higher than C or D within the project's development period.

It is expected that the capacity of the highway will be exceeded after the year 2000. At that time, additional lanes may be needed between Kailua-Kona and the Waimea-Kawaihae Road. The capacities of the connector roads onto Queen Kaahumanu Highway appear to be adequate at this time. However, improved channelized intersections may be required in the future because of the heavy through traffic that would inhibit the turning into and out of the connectors.

**Kaupulehu Entrance Road and Queen Kaahumanu Highway Intersection.** The intersection of Queen Kaahumanu Highway and the Kaupulehu Entrance Road will probably be built as a "T" intersection with left turn lanes and acceleration and deceleration lanes on Queen Kaahumanu Highway. The entrance road would have two lanes, with an additional lane on the outbound lane at the intersection so that traffic can turn left onto Queen Kaahumanu Highway while also allowing traffic to turn right at the same time.

Analysis of the intersection indicate that the facility will have adequate capacity at least until 1995. Additional and longer storage lanes will then be considered to improve the intersection and increase traffic flow through the facility.

### **3.2.2 Probable Impacts on Air Transportation Facilities**

Although Keahole Airport's 6,500-foot runway is adequate to handle wide-bodied jet aircraft traveling interstate, the runway is too short to permit these aircraft to take off with a full load of fuel. For this reason, return flights to the mainland require a stop at General Lyman field in Hilo or Kahului Airport on Maui. These airports have longer runways, and interstate jet aircraft can safely take off filled with fuel and passengers.

The master plan for the Keahole Airport is expected to be updated by the State Department of Transportation. Improvements required to accommodate direct flights to the mainland may be operational within approximately five years if studies indicate such improvements are needed.

The proposed project is not expected to have a significant effect on Keahole Airport's service. The cumulative effect of resort development in West Hawaii, however, may require improvements to the airport.

**3.2.3 Probable Impacts to Harbor Facilities**

The State Department of Transportation believes that the facilities at Kawaihae Harbor are adequate to accommodate the foreseen long-term water transportation needs of West Hawaii.



#### 4. AIR QUALITY IMPACTS

##### 4.1 INTRODUCTION

The proposed project is an "indirect source" of air pollution as defined in the Federal Clean Air Act (U.S. Congress, August 1977) since its primary effect on air quality results from the vehicular traffic which it would generate. Other project-related sources of air pollution addressed below include construction activity and electrical power generation. This section summarizes the results of an air quality impact assessment for the resort performed by James W. Morrow (see Appendix I).

##### 4.2 AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 of Appendix I. Note that Hawaii's standards are not divided into primary and secondary standards as are the federal standards. Moreover, they are more stringent than their federal counterparts and are absolute ceiling values not to be exceeded at all whereas the federal standards allow one exceedance per year. It should also be noted that the Governor recently signed amendments to Chapter 59 (Ambient Air Quality Standards), HRS, making the State's standards for particulate matter and sulfur dioxide the same as national standards (including allowance for one exceedance per year).

Primary standards are intended to protect public health with an adequate margin of safety while secondary standards are intended to protect public welfare through the prevention of damage to soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values. In the case of the automotive pollutants (carbon monoxide (CO), oxides of nitrogen (NOx), and photochemical oxidants (Ox)), there are only primary standards. The carbon monoxide (CO), particulate matter, sulfur dioxide (SO<sub>2</sub>), and nitrogen dioxide (NO<sub>2</sub>) standards are currently under review, but final action has not been taken yet (U.S. Environmental Protection Agency, April 29, 1985). Finally, State Department of Health Regulations (Hawaii, State of, Department of Health, Title 11, Chapter 60) prohibit visible emissions of dust from construction activities.

##### 4.3 EXISTING AIR QUALITY

There is no continuous air monitoring station in the project area. However, in view of the fact that there are no large stationary-sources nor heavy vehicular traffic in the vicinity, it is almost certain that present air quality is good most of the time. Exceptions occur during periods of heavy volcanic activity. In addition to increasing particulate levels, substantial increases in the ambient concentrations of mercury and sulfur dioxide have been recorded during eruptions. Analysis of the airborne particulate matter during one eruption revealed some rather interesting results as unusually high concentrations of selenium, arsenic, indium, gold, and sulfur were found, along with strikingly high concentrations of iridium (Zoller, W.H., et al., December 1983).

##### 4.4 CLIMATE & METEOROLOGY

There is little seasonal or diurnal temperature variation in the project area. Monthly temperature averages vary by only about 6 degrees from the warmest months

(July and August) to the coolest (January and February). An 18-year rainfall record also indicates that the area is rather dry with an annual average of only 10.65 inches. Monthly means range from 2.63 inches in January to 0.14 inch in July.

An annual wind rose for the Mauna Kea Beach Hotel has been prepared by Morrow (1979); it is presented in graphical form in Figure 6 of Appendix I. The data clearly indicate an east-west dichotomy. Closer examination of the raw data reveals the fact that the ESE-ENE winds generally occur during night, early morning and evening hours while the WNW-W winds predominate during the daytime hours. This suggests a strong land-seabreeze regime which apparently dominates air movement in the area. Windroses for 8 a.m. and 2 p.m. clearly illustrate this (see Tables 7 and 8 and Figures 2 and 3 in Appendix I).

#### **4.5 LONG-TERM IMPACT**

##### **4.5.1 Methodology**

Automotive emission factors were generated for calendar years 1986 through 1995 using the Mobile Source Emissions Model (MOBILE-2) (U.S. Environmental Protection Agency, February 1981) and the August, 1983 age distribution for the City & County of Honolulu (Honolulu, City & County of, Department of Data Systems, August 1983). In this instance, microscale screening analyses were performed for the Kaupulehu access road intersection with Queen Ka'ahumanu Highway. The EPA computer model PAL (U.S. Environmental Protection Agency, February 1978) was employed with an array of receptors spaced at 10 meter intervals around the intersection. Since a review of the traffic data indicated that the peak traffic hours tended to be during the afternoon, worst case meteorological conditions were selected accordingly. A wind speed of 1 meter per second, an acute wind/road angle, and neutral stability (Pasquill-Gifford Class "D") (U.S. Environmental Protection Agency, 1973), were all selected to maximize concentration estimates in the vicinity of the intersections.

##### **4.5.2 Projected Ambient Pollutant Concentrations**

Using the PAL model, one-hour carbon monoxide (CO) concentrations were computed for 1986 and 1995. The results of these computations are depicted in Figures 4, 5, 6, and 7 of Appendix I. A mesoscale or regional impact analysis based on annual emissions was also performed as another means of evaluating the impact of the proposed project using the aforementioned emission factors and traffic projections (see Figures 8 and 9 in Appendix I).

In addition to automotive-related emissions, the estimated 37 million kilowatt hours of annual electrical demand by the ultimate development will necessitate the generation of electricity by power plants.

Currently, Big Island electricity is generated primarily by the burning of high sulfur fuel oil, diesel oil, and bagasse, with a small amount also coming from the HGP-A geothermal plant. With the exception of the geothermal plant which emits primarily hydrogen sulfide, all of these result in the emission of various quantities of sulfur oxides, nitrogen oxides, particulates, and hydrocarbons. Coal has also recently been introduced to Hawaii for use in sugar mills during the off-season to replace more expensive oil. This too will result in emissions of the aforementioned major pollutants. It is also notable that the Hilo Electric Light Company (HELCO) has recently signed an

agreement with Thermal Power Company (Honolulu Advertiser, April 1985) to provide 25 megawatts of power by about 1993. By the time the project reaches its full development, it is uncertain how the electrical supply market will be divided among the various types of power plants. There will, however, certainly be a relatively small increase in air pollutant emissions attributable electrical power generation for the proposed project.

#### 4.6 SHORT-TERM IMPACT

The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along Queen Kaahumanu Highway, project access roads, and individual construction sites. However, the most significant impact of this type will be increased particulate emissions due to construction equipment activity, vehicular travel on unpaved roads, and earth moving. Such activity will create particulate emissions as will building and on-site road construction.

EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and a precipitation/evaporation (P/E) index of 50 (Thornwaite, 1931). Although there is little or no soil on the project site, the soil that is brought in may well have a silt content greater than the 30% cited above. This, in conjunction with the relatively dry local climate (P/E Index = 12), suggests a potential for even greater fugitive dust emissions.

#### 4.7 DISCUSSION AND CONCLUSIONS

Projected 1-hour pollutant concentrations at the Kaupulehu Access Road/Queen Kaahumanu Highway intersection indicate compliance with federal and state 1-hour standards under both current and projected traffic conditions. Compliance with the federal and state 8-hour standards can also be inferred from these one-hour concentration estimates.

Traffic generated by the proposed development will result in a net increase in emissions of all three major automotive pollutants in the project area. A rise in emissions is not surprising, since a rather substantial increase in traffic volume is projected to occur in an area which is presently almost pristine. When compared to the 1980 county emissions inventory, the projected increases range from about 0.7% for non-methane hydrocarbons to about 1.7% for nitrogen oxides.

The potential for fugitive dust due to the dry climate and fine soils, makes it very important for adequate dust control measures to be employed during the construction period. There will be existing occupied units downwind of construction areas; particularly during the drier, windier summer months, fugitive dust could be the source of complaints or possible violations of state or federal standards.

Dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. Dust barriers near existing dwellings might be considered if problems arise from wind-driven dust. The soonest possible landscaping of completed areas will also help.

## **5. NOISE IMPACTS**

### **5.1 INTRODUCTION**

Implementation of the proposed Kaupulehu Resort project and expansion of Kona Village Resort will involve an increase in temporary construction-related noises and permanent increases in traffic volumes with associated increased noise levels.

In April 1986, a noise study (See Appendix J) by Y. Ebisu & Associates was conducted for Kaupulehu Developments to:

- (1) describe the existing and future noise environment in the planned resort,
- (2) determine traffic noise level increases and impacts associated with the proposed development,
- (3) determine setback requirements for the future residential and resort units in order to minimize noise impacts from the anticipated project and non-project traffic,
- 4) assess future noise impacts from aircraft operating out of Keahole Airport, and
- 5) assess future noise impacts from construction activities within the resort.

For analysis purposes, Y. Ebisu used the worst case scenario of 100 percent occupancy in all resort units within the proposed project. Under lower occupancy conditions expected to be prevalent most of the time, impacts would be lessened.

### **5.2 EXISTING NOISE LEVELS**

As part of the above study, noise levels were measured in the project area; they were found to be minimal. The major contributor or source of noise was vehicular traffic on Queen Kaahumanu Highway, and to a lesser extent on the existing Kona Village entrance road. Other sources of noise include natural elements such as the wind and shoreline wave break.

### **5.3 FUTURE NOISE LEVELS AND MITIGATION MEASURES**

#### **5.3.1 Traffic and Other Long-Term On-Site Noise**

It is anticipated that the future project will result in an increase in the existing noise levels from related, as well as the generation of new sources of noise from guest activities.

From an assessment of projected noise impacts in the area, it is anticipated that traffic noise alone will be the major source of noise generated by the proposed project. It is estimated that by 1995, when the proposed project is expected to be completed, approximately 38 percent of the total traffic noise increases on Queen Kaahumanu Highway will be attributable to the project. According to the Y. Ebisu noise study, the

level of noise increase along the highway is considered to be significant. However, since existing highway noise levels are moderate, predicted increases in traffic noise are deemed manageable by Y. Ebisu.

Traffic noise will also exist along the internal roadways of the project. However, here, future traffic noise levels are predicted to be lower than on the highway, in the "minimal exposure, unconditionally acceptable" category.

Since traffic is a major source of noise for the resort, special consideration was given to mitigate its impact. Wide buffers are planned between the Queen Kaahumanu Highway and the resort's residential uses, and buffers planned between Kaupulehu Resort's internal road circulation and the resort's residential projects. If the 55 MPH average speed continues along Queen Kaahumanu Highway and reduced speed limits were enforced on the interior resort roadways, setbacks within Kaupulehu will be effective in mitigating noise levels to the year 1995. Other mitigative measures recommended by the Y. Ebisu study include the use of sound attenuation berms where adequate setbacks cannot be achieved and construction of air-conditioned facilities where outdoor noise can be kept outside from closed living accommodations. Installation of planting screens has also been found effective in retarding noise levels at property lines and around buildings. Two golf courses are also planned that will provide additional open space and buffer areas between roadways and resort residential areas.

Other background noise is expected to result from the proposed project, including noise from resort occupants, visitors, employees, mechanical support equipment, transportation vehicles and foliage. In order to maintain the desired resort characteristics of the area, it is expected that background ambient noise levels will be controlled by thoughtful site planning and engineering practices. To mitigate any impact on the adjacent property, a wide landscaped buffer between Kona Village Resort and Kaupulehu Resort will be provided to reduce noise effects on each other.

### **5.3.2 Aircraft Noise**

Noise from aircraft operating out of Keahole Airport, located approximately 6 miles from the project site, is not expected to generate serious adverse impacts. The noise level will be audible above background ambient noise in the resort. However, the frequency of flyby events will remain low and are controllable by pilot and airport flight procedures.

### **5.3.3 Short-Term Construction Noise**

In addition to long-term noise impacts, the proposed project will generate short-term noise impacts. According to the Y. Ebisu study, audible construction noise may be unavoidable during the project construction period which is planned from 1988 through 1995. This noise, however, will not be continuous as individual projects will be developed in segregated time intervals and will be moving from one resort location to another during that period. Depending on the type of construction activity, distances at which outdoor construction noise would be audible range from 500 to 2,000 feet. It can be noted that the resultant noise impacts are not expected to be in the "public health and welfare" category. As an additive measure, mitigative provisions may be applied to reduce the anticipated impacts. Such measures include the use of muffled construction equipment, early phasing of landscaped buffers/berms construction, and, as a minimum, notification of prospective guests at Kaupulehu Resort and Kona Village Resort of the planned construction activity.

## 6. PUBLIC SERVICES AND FACILITIES

### 6.1 SCHOOLS

#### 6.1.1 Existing Facilities

The public schools servicing the West Hawaii region include those numbered below. South Kohala is also the location of two of the County's private schools, Parker School (grades 7 through 12) and Hawaii Preparatory Academy (grades kindergarten through 12). The latter has separate elementary school facilities in Kona which are temporarily located in the Kona Baptist Church.

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#### Public Schools by Area of Residence

<u>Service Region</u>	<u>Elementary or Intermediate Schools</u>	<u>High Schools</u>
North Kohala	1	1
South Kohala	1	1
North and South Kona	7	1
Hilo	13	2

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The two schools serving the project area are Kealakehe Elementary-Intermediate School (grades K through 8), and Konawaena High School (grades 9 through 12).

#### 6.1.2 Probable Impacts

The proposed Kaupulehu Resort development is expected to primarily attract condominium buyers who have completed their child rearing years. Those buyers who intend to reside at Kaupulehu Resort and who have school age children will probably, in most cases, send those children to private schools. These students would thus not be expected to be a burden on the public school system. A portion of the employees at the proposed project are expected to be in-migrants to the West Hawaii region; some will have school-age children who will need to be integrated into the local public school system.

According to Superintendent Francis M. Hatanaka of the State Department of Education (letter of December 13, 1985 in Chapter 12), no significant enrollment impact on public educational facilities is expected. The additional student population resulting from proposed development could easily be accommodated by existing and planned facilities in the area. Additional educational staff may eventually be needed by some schools to meet the overall projected demand for the region.

### 6.2 HEALTH CARE FACILITIES

#### 6.2.1 Existing Facilities

The Island of Hawaii has five hospitals which provide a range of services. Two of the State-operated hospitals are situated in the West Hawaii region; these are the closest to the proposed Kaupulehu Resort and Kona Village Resort, and would therefore be most practical for immediate use by project visitors and residents. The largest

of the two is Kona Hospital. It is the closest facility to the proposed project site and is considered to be a "full service" hospital. Kona Hospital has a total of 79 beds, 53 for acute care and 26 for long-term care, and an active staff of 36 physicians. The Kohala Hospital is located in Kapaa in North Kohala and is primarily a long-term care institution. It has 10 acute care beds, 16 long-term beds and a regular staff of three physicians.

The Life Care Center of Hawaii, which provides intermediate care, is located in Hilo. Various other medical groups on the island provide out-patient clinical services.

### 6.2.2 Probable Impacts

The health care services and facilities in West Hawaii will require upgrading with or without future development in the region; existing facilities seem to be inadequate for the needs of the current regional population. The creation of additional demand can be expected to have an impact on all medical facilities that service the region. The addition of acute care facilities in the region would be important, given the growing resident and visitor population.

The population profile of West Hawaii suggests a need for expanded services in the area of care required for an older population, such as cardiovascular, orthopedic and urological care. The movement of retirees to the region will also contribute to the need for expanded long-term care facilities.

## 6.3 POLICE PROTECTION

### 6.3.1 Existing Facilities

The North Kona District is serviced by the Kona Police Station, while South Kohala is serviced by the Waimea Police Station and South Kona by the Kau Station. The table below indicates the staffing and workload for these districts.

-----  
**Police Services and Workload Indicators in the  
 South Kohala and North and South Kona Districts**

<u>District</u>	<u>Percent of County Resident Population</u>	<u>Number of Uniformed Personnel</u>	<u>Percent of County</u>	<u>Percent of County Index Crimes</u>	<u>Percent of County Traffic Accidents</u>
South Kohala	6.3%	17	6.8%	5.2%	6.7%
North Kona	22.0	55	22.1	29.4	23.5
South Kona	3.3	15	6.0	2.3	2.7

Source: County of Hawaii Police Department, 1985.  
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### 6.3.2 Probable Impacts

According to Police Chief Guy A. Paul of the County of Hawaii Police Department (see December 11, 1985 letter in Chapter XII), from the department's viewpoint, no adverse effects are expected from the proposed project.

However, there probably will be an increase in the need for police services as a result of the increases in de facto population resulting from the proposed project. Most of the demand for new services is expected to be in the areas of traffic control and violations. It is likely that the present police facilities could service the increased activity brought about by the project without requiring additional forces.

## **6.4 FIRE PROTECTION**

### **6.4.1 Existing Facilities**

The Kailua Fire Station, the Waimea Fire Station and the proposed station at the Mauna Lani Resort are within service distance of the proposed project. The Kailua Station which now provides fire protection and rescue services to the area is located approximately 13 miles from the project site. Eleven personnel are usually on duty, staffing a 1,500-gallon per minute (gpm) pumper, a 1,500 gpm ladder pumper, a 1,000 gpm tanker pumper, and an intensive care ambulance. Private protection may also be provided by the volunteer fire company located on the Kona Village Resort property. (See December 5, 1985 letter from Fire Chief Smith, Hawaii County Fire Department, in Chapter XII.)

### **6.4.2 Probable Impacts**

No additional fire protection services will be needed as a result of the project. The developer intends to comply with all relevant County fire, building, and water regulations or codes.

## **6.5 WATER SUPPLY**

### **6.5.1 Existing Conditions**

The County of Hawaii does not have a public water system that serves the Kaupulehu lands. Kona Village Resort has developed its own private water system. It consists of two brackish wells located at the 500-foot elevation (wells 4858-01 and 02), three storage tanks totaling 136,000 gallons, a 4-inch transmission pipeline from the wells to the resort, and dual water distribution pipelines within the resort itself. Two electrolysis plants, each rated at 30,000 gallons per day (GPD), produce potable water from the brackish supply. This water is used for other domestic purposes and landscape irrigation. Total potable and non-potable water use at Kona Village Resort is currently about 70,000 GPD.

### **6.5.2 Probable Impacts**

No public funds will be expended to provide water for the proposed project. Kona Village Resort will expand its existing water system to supply the 50 planned units and will probably need to add another storage tank. Based on a daily water usage rate of 350 GPD per hotel unit, an added supply of 17,500 GPD is needed.

Planned development at Kaupulehu Resort will require a potable water supply of about 0.31 MGD in the first five years and 0.53 MGD after 10 years (refer to the table below). Based on County design standards, this projected demand would ultimately require a pumping capacity of 785 gallons per minute (GPM) from well sources, a standby well and pump equal to the largest well pumping unit, and reservoir storage of 750,000 gallons.



**Kaupulehu Developments  
Projected Potable Water Demand**

<u>Description</u>	<u>Unit</u>	<u>1st Five Years</u>		<u>2nd Five Years</u>		<u>Cumulative Water Demand (GPD)</u>
		<u>No.</u>	<u>Ave. Water Demand (GPD)</u>	<u>No.</u>	<u>Ave. Water Demand (GPD)</u>	
Hotel	Room	600	210,000	300	105,000	315,000
Beach Condominium	Living Unit	40	16,000	40	16,000	32,000
Golf Condominium	Living Unit	105	42,000	265	106,000	148,000
Beach Club	Acre	5	20,000			20,000
Golf Course Clubhouse	Ea.	1	20,000			20,000
<b>Total Potable Demand</b>			<b>308,000</b>		<b>227,000</b>	<b>535,000</b>

As a first step in water system development, well 4658-01 was drilled in 1981 at elevation 1,344 feet (refer to Figure IV-3 for the location of the well). Pump testing demonstrated that potable water can be developed at this distance from the shoreline. Resulting drawdown suggests a practical pumping limit of 400 to 450 GPM for this well. A second well has recently been drilled nearby and its performance is similar to that of the first well. The two wells (one for standby) would provide adequate supply for the first several years of development and a third well would be necessary to complete the 10-year development plan for Kaupulehu Resort. As long as these wells are located with appropriate spacing, an adequate supply can be developed.

In addition to the potable system described above, the two 18-hole golf courses at Kaupulehu Resort will require an irrigation supply of up to 1.5 MGD on the average and as much as 2.0 MGD at some times of the year. Brackish wells will have to be developed for this use.

## **6.6 WASTEWATER TREATMENT AND DISPOSAL**

### **6.6.1 Existing Conditions**

Kona Village Resort is not connected to a County operated sewage system. Some of the Kona Village Resort units are tied to a sewer system using a self-contained secondary treatment plant with a capacity of 30,000 gallons. The remainder of the units have cavittetes.

### 6.6.2 Probable Impacts

It is expected that Kona Village Resort will expand its sewer system to accommodate the 50 new units. No significant adverse impact is anticipated from this expansion.

Kaupulehu Resort will develop a secondary wastewater treatment plant to meet government standards. Treated effluent will probably be used for golf course irrigation and irrigation of other landscaped areas, or will be disposed of in deep wells on Kaupulehu lands.

Although there are advantages in the reuse of wastewater, it is recognized that public health concerns exist. The State Department of Health states: "Reclaimed water is a potentially hazardous substance, since prevailing wastewater treatment processes are generally incapable of removing all of the biological and chemical contaminants that are present in the wastewater. The principal hazard from the use of reclaimed water appears to be the increased exposure of the public to pathogens. The primary area of concern is the direct public contact with wastewater." (Refer to letter of December 31, 1985 in Chapter XI.)

Environmental controls to mitigate any potential adverse effects have been suggested by the Department of Health. These control measures will be considered during Kaupulehu Resort development.

- o Increase public awareness by posting signs for golfers, joggers, etc.
- o Education of golf course and landscape maintenance workers on the proper handling of treated wastewater.
- o Avoidance of potential cross-connection of potable water sources with wastewater.
- o Establishment of reliable operation and maintenance of the wastewater reuse system.
- o Establishment of buffer zones between conflicting uses (residential development and spray irrigation systems).

## 6.7 **SOLID WASTE DISPOSAL**

### 6.7.1 Existing Conditions

Hawaii County does not provide refuse collection service to individual residences or businesses in the West Hawaii area. The Kailua landfill is located near Kailua-Kona and will serve the North Kona District until a planned new landfill site becomes operational. The County Sewers and Sanitation Bureau is considering a new landfill site which would be located about 10 miles east of the Kona Village Resort, in the vicinity of Puuanahulu.

### 6.7.2 Probable Impacts

Solid waste generated by the proposed project is expected to be accommodated at the landfill site mentioned above or at new County operated landfill sites which may come into use in the vicinity.

## 6.8 ELECTRICAL POWER AND COMMUNICATIONS

### 6.8.1 Existing Conditions

Electrical power for Hawaii Island is primarily generated from oil-fired turbines and diesels. Bagasse-fired boilers at the island's sugar companies currently provides about a fifth of the county's generating capacity of 125,900 KW. Electrical power is supplied by Hawaii Electric Light Company (HELCO). However, it does not presently service the Kaupulehu area. Electricity for Kona Village Resort is provided by two 500 KW generators.

### 6.8.2 Probable Impacts

Service for Kaupulehu Resort is expected to be extended to the resort from a new substation to be constructed by HELCO on the mauka side of the Queen Kaahumanu Highway. Kaupulehu Developments will contribute a currently undetermined amount for the construction of the facility. It will work with HELCO staff to establish the approximate load for the resort so that transformer size and generation support requirements can be determined.

It is expected that the 50 new units at Kona Village Resort will obtain their electrical power from the resort's existing generators.

## **7. RECREATIONAL FACILITIES**

### **7.1 EXISTING CONDITIONS**

The recreational resources associated with the shoreline area and immediate surroundings of Kaupulehu include such water-related activities as fishing and skin-diving. Some areas near the site may be used for surfing as well. Portions of the Kaupulehu coastline are not suitable for water-related recreational activities such as swimming and bodysurfing, as the shoreline is either strewn with lava boulders and coral rubble or is made up of rough a'a lava which abruptly drops off to the ocean. Kahuwai Bay, Kaupulehu Bay and Kukio Bay are listed with the State Comprehensive Outdoor Recreation Plan (SCORP) as potential resources. Foot trails along the shoreline are also a valuable potential resource. A foot trail traveling north of Kiholo Bay is now being proposed by SCORP. Archaeological sites of significance are abundant in the area and can be accessed via the coastal foot trails.

There are extensive recreational facilities in both South Kohala and North Kona. Those in North Kona include a golf course, beaches, small boat harbors, historic sites, hunting, and other amenities and attractions. The district has three County beach parks, Pahoehoe White Sands and Kahaluu, the Old Kona Airport State Park, and the Hulihee Palace State Monument. Throughout the district are numerous historic sites, including fishponds, trails, heiaus and buildings. The U.S. Army Corps of Engineers has established wetlands at Honokohau and Kiholo Bay. Several hiking trails are also available in the North Kona District. The Judd Trail provides access to the State Keahou 2 Nene Sanctuary. Bikeways are proposed throughout most of the district.

There is currently one golf course in the North Kona District; the Keauhou-Kona Golf Course located near Keauhou. The proposed Kaloko golf course is to be situated near the Kona Palisade Estates.

Many other recreational amenities similar to those in North Kona are also available in South Kohala and in other neighboring areas of West Hawaii. State and County lands are available for the development of additional public recreational facilities. See Figure IV-7 for the location of recreational facilities in the area of the proposed project.

### **7.2 PROBABLE IMPACTS**

The proposed Kaupulehu Resort concept plan would increase access to the recreational amenities located on the site. New public access ways to the shoreline would be provided by Kaupulehu Developments, giving residents and visitors additional shoreline access. Improved access is likely to lead to increased ocean and other recreational activities. It can be expected that increased use of the coastal area will stimulate more fishing and snorkeling in surrounding waters as well as off Kaupulehu. In the marine study conducted for the project, fish diversity and abundance was reported to be fairly good, especially in the area north of Kona Village. Depending on the popularity of fishing in the vicinity, a decrease in numbers of those species of fish which are most popular for eating could result.

Some insignificant impacts on users of the shoreline resource are expected. Current use of the shoreline area is minimal, and the addition of resort guests and residents is not expected to create serious competition for the use of the resource.

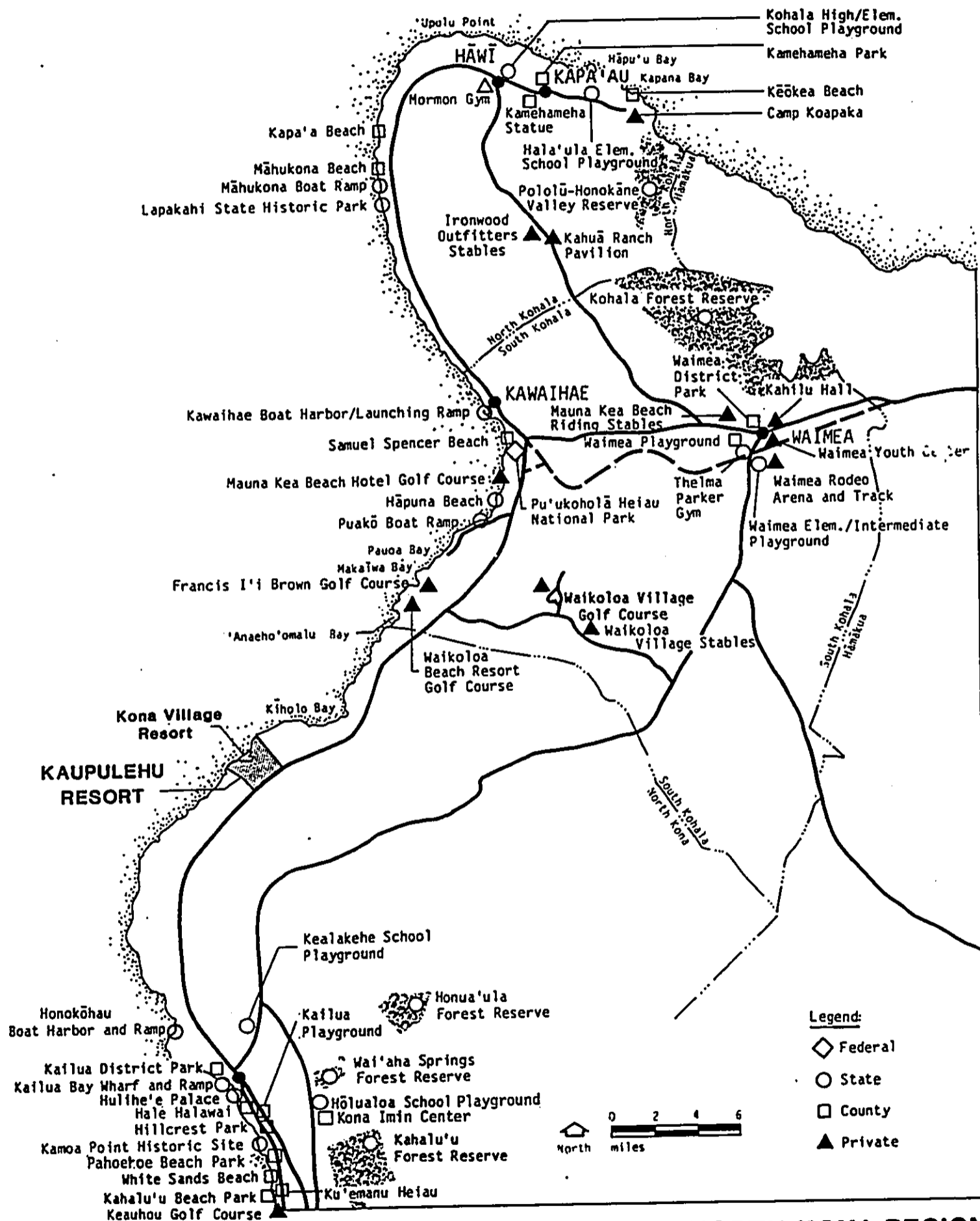


Figure IV-7 RECREATIONAL FACILITIES IN KOHALA/NORTH KONA REGION

Access to archaeological preserves and individual archaeological sites will have the beneficial effect of exposing visitors and guests to Hawaiian culture. On the other hand, it has the potential adverse effect of increasing the likelihood of vandalism.

Kaupulehu Developments intends to have as a major attraction the establishment of two full 18-hole golf courses at Kaupulehu Resort. This would increase the golfing facilities in North Kona and allow for added public enjoyment of the sport.

Residents and visitors of the proposed project are expected to contribute to increased usage of recreational amenities off-site. However, because of the ample planned facilities on-site, the burden on public recreational facilities off-site, as a result of development, is not expected to be significant. Also, the provision of additional on-site recreational opportunities for both resort guests and residents would tend to offset the higher usage of off-site amenities.

## **8. VISUAL IMPACTS**

### **8.1 VISUAL CHARACTER OF THE PROJECT SITE**

The proposed Kaupulehu Resort will be sited on approximately 600 acres of coastal lava land makai of the Queen Kaahumanu Highway. The area is dry and sparsely vegetated. Prehistoric lava flows dominate the landscape. The slope of the land is very gradual from about 200 feet above sea level down to the beach, which is made up of variously sized basaltic boulders, coral rubble, and white sand. Along the shoreline is scattered coastal strand vegetation which is predominantly gray-green in color. Several wetland areas add more intense greenery to the site. Waiakuhi Pond is a significant feature here. A mangrove thicket makes up a dense dark green patch within the shoreline area. Toward the Queen Kaahumanu Highway, the vegetation and landscape change to dry kiawe scrub vegetation among the aa lava. The dominant feature of the site is the Kaupulehu lava flow of 1800-1801, which cuts a major swath through the site. Because it is a relatively recent lava flow, it has little to no vegetation.

The natural features on the property which stand out most conspicuously are the lava flow, the mangrove thicket adjacent to Waiakuhi Pond and the vegetation-rimmed shoreline.

### **8.2 EXPECTED VIEWS OF THE PROPOSED PROJECT FROM THE HIGHWAY AND SHORELINE**

Kaupulehu Resort would become visible as one approaches the site from the east or west, traveling along the Queen Kaahumanu Highway; closer to the highway the view would include several golf course holes and two clusters of golf condominiums. The rest of the resort would be visible in the distance and look somewhat like an oasis on the lava landscape. No structures would eliminate the highway travelers' ocean view.

At present, access to the site is via the Kona Village Resort road on neighboring property to the south. The road cuts directly through a lava field on the proposed Kaupulehu Resort property, and traveling on it provides an excellent view of the development site. Upon the establishment of a new access on Kaupulehu land, both the Kona Village Resort and the proposed Kaupulehu Resort will use the same exit off Queen Kaahumanu Highway. Just after exiting the highway, the road will diverge to create a separate access to each resort. On entering the Kaupulehu Resort road, one would first see several golf course holes and a cluster of low-rise condominiums on either side of the road. The makai view, expanding out over the site, would be of the gently sloping golf course surrounding the condominiums, hotel, and beach club. A bright blue ocean would serve as a backdrop to the hotel and beach club located adjacent to the shoreline and approximately one mile makai of the Queen Kaahumanu Highway.

Viewed from the shoreline, the development will appear open and uncluttered. The structures will be well set back from the coastline, behind a band of open shoreline, ponds and wetlands around Waiakuhi Pond. Observed from the ocean, looking mauka, the green golf course would serve as a backdrop to the hotel, beach club, and resort condominiums. While the Kona Village Resort is set in Kahuwai Bay, the proposed Kaupulehu Resort will be sited on, and around, Kumukehu Point, just north of Kukio Bay. The siting of the two resorts should provide a subtle but pleasant contrast to the viewer.

### 8.3 VISUAL IMPACTS OF DEVELOPMENT

A sufficient distance between the resorts will be maintained to allow a vegetative buffer zone as well as a feeling of spaciousness and privacy for the two resorts. A vegetative buffer zone will be established between the proposed Kaupulehu Resort and the existing Kona Village Resort to the north. The shoreline area will also serve as a visual and open space buffer to the development.

Portions of Kaupulehu Resort will be visible from the Kona Village Resort. A condominium is proposed just south of the buffer zone, beyond the two golf course holes, the hotel and beach club. These facilities will extend about three-fourths of a mile south of the Kona Village Resort. Some of the structures may be large enough to be visible over the vegetative buffer. However, the low-rise, low-density design of Kaupulehu Resort should reduce these impacts. Although the development will remove some of the remote quality of the Kona Village Resort, it is expected that peace and privacy, an important attribute of the area, will be maintained.

Throughout the proposed development there will be extensive landscaping in addition to the golf courses. This will soften the impact of buildings on the landscape, although the buildings, too, will be designed to complement the environment in which they are placed.

The proposed Kaupulehu Resort is adjacent to the Huehue property and Kukio Bay to the south. The owner of this property is applying to the County of Hawaii for a General Plan Amendment from Conservation to Intermediate Resort. Should this development occur, the two resorts would be within clear visibility of one another. The Kukio site would sit at a slightly lower elevation and mauka of the Kaupulehu Resort hotel site development. The Kaupulehu Resort hotel site is presently planned to be built on the relatively recent 1800-1801 lava flow mauka of the Kumukehu Point shoreline, while the Kukio resort would sit next to Kukio Bay on an older, and therefore more eroded, lava flow.

It is likely that the Kaupulehu Resort would be completed prior to the Kukio Beach Resort as Kaupulehu Resort is further along in the permitting process. Hence, the view south from Kaupulehu Resort will be unhampered until the Kukio Beach Resort is developed. At this point, given the implementation of mitigation measures, such as terracing, adequate setbacks, generous landscaping, and inclusion of buffer areas in the Kukio plans, the visual impact of the two resorts on one another should be minimal. Fairly open and private resorts can be maintained within close proximity to one another, depending on the design and layout of the projects.



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# Chapter V

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# Chapter V

## CHAPTER V

### RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES, AND CONTROLS FOR THE AFFECTED AREA

#### I. STATE LAND USE LAW

All lands in the State have been placed in one of four land use districts (Urban, Agriculture, Conservation, or Rural) by the State Land Use Commission (SLUC). State Land Use District Boundary Reviews have been undertaken by the State Land Use Commission to update its Land Use District Maps. Besides this SLUC-initiated review, provisions for applicant-initiated amendments to the district boundaries have been established in Section 205-4 of the Hawai'i Revised Statutes (HRS) and further promulgated in the State Land Use Commission: Rules of Practice and Procedure and District Regulations (December 21, 1975, as amended).

#### I.1 EXISTING AND PROPOSED DISTRICT BOUNDARIES

The existing State Land Use District boundaries are shown in Figure II-6. Kaupulehu Developments is currently requesting amendments to the State Land Use District Boundaries that would change the designation of 575 acres from Conservation to Urban and 123 acres from Urban to Conservation. Figure II-7 shows the proposed District boundary amendments.

Note that the Kaupulehu Developments concept master plan also proposes use of a small portion of land in the Agriculture District in conjunction with Kaupulehu Resort development. This land is on Kaupulehu Developments' property mauka of Queen Kaahumanu Highway and will be used for the siting of water wells. No boundary change is needed for this use.

#### I.2 REQUIREMENTS FOR BOUNDARY AMENDMENTS

Section 205-17, HRS, sets forth the following decision-making criteria for reclassification of district boundaries by the State Land Use Commission:

- (1) The extent to which the proposed reclassification conforms to the applicable goals, objectives, and policies of the Hawaii state plan and related to the applicable priority guidelines of the Hawaii state plan and the adopted functional plans;
- (2) The extent to which the proposed reclassification conforms to the applicable district standards; and
- (3) The impact of the proposed reclassification on the following areas of state concern:
  - (A) Preservation or maintenance of important natural systems or habitats;
  - (B) Maintenance of valued cultural, historical, or natural resources;

- (C) Maintenance of other natural resources relevant to Hawaii's economy, including, but not limited to, agricultural resources;
- (D) Commitment of state funds and resources;
- (E) Provision for employment opportunities and economic development; and
- (F) Provision for housing opportunities for all income groups, and gap groups.

The subject matters of these criteria are addressed in the following discussions in this chapter and also those in Chapter IV regarding probable impacts on the environment. Based upon these discussions, the proposed project meets the criteria contained in Section 205-17, HRS.

The SLUC District Regulations require that the application for a boundary amendment show that it is "reasonable, not violative of Section 205-2 and consistent with the Interim Statewide Land Use Guidance Policies." The reasons for the requested changes in the State Land Use District Boundaries are discussed in Section 3, Chapter II of this document. The consistency of the proposed district designations with Section 205-2, HRS and with the Interim Statewide Land Use Guidance Policies are discussed in the following sections. A discussion of how the proposed revisions meet the special requirements for petitions for urban classification then follows.

#### 1.2.1 Section 205-2, Hawaii Revised Statutes

The proposed amendments to the State Land Use District boundaries are not violative of the basic standards for determining boundaries that are set forth in Section 205-2, HRS. Relevant standards from this section are quoted below and a discussion of the proposed designations' consistency with the stated standard follows each quote.

- "Conservation districts shall include areas necessary for
- a. protecting watersheds and water sources;
  - b. preserving scenic and historic areas;
  - c. providing park lands, wilderness, and beach reserves;
  - d. conserving endemic plants, fish, and wildlife;
  - e. preventing floods and soil erosion;
  - f. forestry;
  - g. open space areas whose existing openness, natural condition, or present state of use, if retained would enhance the present or potential value of abutting or surrounding communities, or would maintain or enhance the conservation of natural or scenic resources;
  - h. areas of value for recreational purposes;
  - i. other related activities;
  - j. and other permitted uses not detrimental to a multiple use conservation concept."

(NOTE: letters added for ease of reference in following discussion.)

**Discussion:** An examination of the proposed Conservation to Urban redesignation in reference to each of the above-listed points follows.

- a. The Conservation District land that is proposed for Urban is not a watershed or water sources area that needs to be protected.

- b. This land is essentially barren a'a and pahoehoe lava. Its scenic qualities are generally limited to the shoreline area, and it is expected that these qualities will be preserved. The scenic qualities of the inland area will be enhanced with the establishment of golf course greens and other landscaping. Archaeological surveys and testing have been performed in the proposed project area. Based on study findings, significant historic sites in the resort will undergo further study as recommended in the archaeological studies or be preserved and integrated into the overall resort plan. As areas are prepared for development, the State Historic Sites Section of DLNR and the Hawaii County Planning Department will be consulted regarding the necessity for additional archaeological work. Communications between Kaupulehu Developments and these two governmental agencies have been established and general consultation is underway.
- c. The Conservation District land under consideration for the Urban District is located adjacent to Urban District land which contains the Kona Village Resort. The Kaupulehu site is not a wilderness area. The shoreline area would be accessible to the public for recreational and other uses.

A 123-acre portion of land is proposed to be converted from the Urban to the Conservation District, thus providing open space and preserving areas of archaeological interest.

- d. During a botanical study conducted for Kaupulehu Developments, an endemic plant (*Sesbania* spp.), which is proposed for addition to the Federal and State Endangered Species Lists, was found on Kaupulehu Developments makai land in the Conservation District. The area of the discovery is not part of land which is part of the boundary amendment petition.

None of the plant or animal species observed during the botanical or animal and bird survey are officially listed as rare or endangered.

Eight anchialine ponds or wetland areas are located within the proposed boundary change area. All are planned to be preserved under the current master plan. Some ponds could be used to establish a bird sanctuary in conjunction with the U.S. Fish and Wildlife Service.

- e. Converting the Conservation District land to the Urban District will not cause floods or soil erosion. The land is now barren of soil; soil will be brought in as the area is developed, but landscaping will be promptly established to avoid wind or water erosion. The only area subject to flooding is the shoreline. This area is expected to be maintained in open space. If any development is planned within the flood zone, it will follow the county flood control regulations which are based on Federal flood insurance program provisions.
- f. The Conservation District land under consideration for the Urban District is barren aa and pahoehoe lava, not forest land.
- g. Retaining the existing open space of the lava in its natural condition would not enhance the present or potential value of abutting or surrounding communities. Allowing the proposed urban uses around the greens of the golf course would enhance the value of the surrounding development. The natural and scenic resources of the land, largely in the shoreline area, will be incorporated into the proposed development. The golf holes in this area will be carefully designed to maintain Waiakuhi Pond and endemic flora and preserve interesting lava formations for visual effect.

- h. Conversion of petition lands to the Urban District and subsequent development will result in improved public access to the shoreline for recreational purposes. The natural and historic sites of interest will become more accessible for enjoyment and educational purposes.
- i. The land under consideration is suitable for urban uses and activities.
- j. The hotel and condominium uses proposed for this land are not permitted uses in a Conservation District. The requested changes from Urban District to Conservation District (123 acres) and from Conservation District to Urban District (575 acres) will not be detrimental to a multiple use conservation concept.

The proposed Urban reclassification is consistent within the general policy provisions of Section 205-2, Hawaii Revised Statutes, and with the standards for the Urban District, as set forth in State Land Use Commission Regulation 2-2 because it:

- (1) allows further resort development in a County-designated intermediate resort area and provides a new center of trading and employment;
- (2) proposes a development that is economically feasible;
- (3) involves land which is or will be proximate to basic services;
- (4) involves land which is reasonably free from danger of floods, unstable soil conditions, and other adverse environmental effects; and
- (5) involves land which is contiguous to an existing Urban District.

#### 1.2.2 Interim Statewide Land Use Guidance Policy

The interim statewide land use guidance policy was repealed by Act 230 of the State Legislature in its 1985 session. However, SLUC district regulations have not yet been amended accordingly, and the specific interim policies contained in those regulations may still need to be addressed. Following is a discussion of the proposed action's consistency with the relevant policies.

- (1) Land use amendments shall be approved only as reasonably necessary to accommodate growth and development, provided there are no significant adverse effects upon agriculture, natural, environmental, recreational, scenic, historic, or other resources of the area.

**Discussion:** As discussed previously, the land use amendment being sought is reasonably necessary to accommodate the quality growth and development proposed by Kaupulehu Developments. This environmental impact statement discloses the impacts that might result from the development of the proposed Kaupulehu Resort and the expansion of Kona Village Resort and details the mitigation measures that would be taken to avoid or minimize these effects. With the mitigation measures proposed there would be no significant adverse effects.

- (2) Lands to be reclassified as an Urban District shall have adequate public services and facilities or as can be so provided at reasonable cost to the petitioner.

**Discussion:** The projected demand from the project for additional public services and facilities as a result of development has been taken into account. Since the developers will provide the project's infrastructure (much of which is considered a public service/facility, such as a wastewater treatment plant, water system, etc.); it is not expected to foster extensive public expenditures.

- (3) Maximum use shall be made of existing services and facilities, and scattered urban development shall be avoided.
- (4) Urban districts shall be contiguous to an existing urban district or shall constitute all or a part of a self-contained urban center.

**Discussion:** Kaupulehu Developments proposes an Urban designation of land which is contiguous to existing Urban District land. It reflects an integrated plan, rather than scattered development and has been designed as a self-contained destination resort. Kona Village Resort is an established visitor destination; the current project entails expansion of its facilities.

- (5) Preference will be given to amendment petitions which will provide permanent employment, or needed housing accessible to existing or proposed employment centers, or assist in providing a balanced housing supply for all economic and social groups.

**Discussion:** The Kaupulehu Resort development will add to the economic stability of the area and allow for high quality development and permanent employment opportunities. Kaupulehu Developments is continuing to discuss housing requirements with the appropriate County and State agencies.

- (6) In establishing the boundaries of the districts in each county, the Commission shall give consideration to the general plan of the County.

**Discussion:** The relationship of the proposed Kaupulehu Developments plan to the Hawaii County General Plan is addressed in Section 6 of this chapter.

- (7) Insofar as practicable conservation lands shall not be reclassified as urban lands.

**Discussion:** Considering the discussions in Section 1.2.1 relating to the types of land to be designated Conservation, it does not appear that there is any compelling reason for retaining in Conservation the petition lands requested for Urban redesignation.

- (8) The Commission is encouraged to reclassify urban lands which are incompatible with the interim statewide land use guidance policy or are not developed in a timely manner.

**Discussion:** The Kaupulehu Developments plan for the land it is requesting be redesignated Urban is compatible with the interim statewide land use guidance policy and will be developed in a timely manner. Kaupulehu Developments is also proposing to convert land presently in the Urban District to the Conservation District because it is not intended to be used for development purposes.

**1.2.3 Special Requirements for Petitions for Urban Classification**

The State Land Use Commission's rules call for specific information to be provided with petitions for reclassification of land to the Urban District. This document is being submitted as required under Chapter 343, HRS in order to meet the special requirements to convert 575 acres from the Conservation to the Urban District.

**1.3 PROJECT SCHEDULE AND RELATIONSHIP TO INCREMENTAL DISTRICTING REGULATIONS**

Detailed design work on Kaupulehu Resort will start immediately upon receipt of all the necessary land use approvals. Within the five-year period after SLUC approval, it is planned that virtually all of the infrastructure improvements for the newly designated urban land will be substantially in place.



## **2. HAWAII STATE PLAN**

The Hawaii State Plan (Hawaii, State of, Department of Planning and Economic Development, 1978) consists of a series of broad goals, objectives and policies which are to act as the long-range guidelines for the growth and development of the State. In general, the proposed action is consistent with the overall intent of the State Plan. Discussed below are the specific objectives, policies, and priority actions contained in Part I and Part III of the State Plan which are thought to be the most relevant to the proposed project.

### **PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES**

#### **OBJECTIVE AND POLICIES FOR POPULATION**

(1)(a) **OBJECTIVE:** Guide population growth to be consistent with the achievement of physical, economic, and social objectives of the State Plan.

(2)(b) **POLICY:** Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.

(3)(b) **POLICY:** Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the state.

(4)(b) **POLICY:** Promote increased opportunities for Hawaii's people to pursue their socio-economic aspirations throughout the islands.

**Discussion:** At a time when employment opportunities are decreasing in the agricultural sector of Hawaii's economy, opportunities are increasing in the visitor industry. Permanent operational employment at Kaupulehu Resort is expected to total about 1,060 full-time equivalent jobs upon completion. The additional 50 new units at Kona Village Resort will also lead to increased employment at the established resort. Indirectly, employment throughout the State will also be stimulated by this development.

Adequate services and facilities will be ensured by Kaupulehu Developments and the operator of Kona Village, including: internal roadways, potable water, wastewater disposal, electricity, and other services. State and County tax revenues generated by the resort (property taxes, income taxes, etc.) will contribute toward the cost of providing services to visitors and new residents.

#### **OBJECTIVE AND POLICIES FOR THE ECONOMY - IN GENERAL**

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

(6)(b) **POLICY:** Strive to achieve a sustained level of construction activity responsive to, and consistent with, State growth objectives.

(9)(b) **POLICY:** Encourage labor-intensive activities that are economically satisfying.

(11)(b) **POLICY:** Promote economic activities, especially those which benefit areas with substantial unemployment problems.

- (14) POLICY: Encourage businesses that have favorable financial multiplier effects within Hawaii's economy.

Discussion: As stated above, Kaupulehu Resort development and Kona Village expansion will provide many employment opportunities. It is expected that average operational period salaries will range from \$15,000 to \$21,000 a year (Environment Capital Managers, Inc.). Construction of facilities is expected to occur over a period of many years. Thus, development of the resort facilities will contribute to sustaining the level of construction activity within the State. Both hotel/resort and construction employment have favorable effects on the economy by generating jobs directly and indirectly. Due to the decline of the sugar industry in the West Hawaii region, local unemployment rates have been higher than Statewide rates. Direct and indirect employment related to the proposed development will contribute toward alleviating this problem.

#### OBJECTIVE AND POLICIES FOR THE ECONOMY - VISITOR INDUSTRY

- (a) OBJECTIVE: A visitor industry that constitutes a major component of steady growth for Hawaii's economy.

(3)(b) POLICY: Improve the quality of existing visitor destination areas.

(4)(b) POLICY: Encourage greater cooperation between the public and private sectors in developing and maintaining well-designed and adequately serviced visitor industry and related developments.

(5)(b) POLICY: Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities.

(6)(b) POLICY: Develop the industry in a manner that will provide the greatest number of primary jobs and steady employment for Hawaii's people.

(7)(b) POLICY: Provide opportunities for Hawaii's people to obtain job training and education that will allow for upward mobility within the visitor industry.

(9)(b) POLICY: Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawaii's cultures and values.

Discussion: State and County tax revenues generated by the development will contribute toward the cost of providing services to new residents and visitors. Kaupulehu Resort will be carefully planned and located in a coastal area planned for intermediate resort development. Kaupulehu Developments intends to maintain the high standards set by other resorts in the South Kohala and North Kona area. Kaupulehu Resort will be designed to have a minimal impact on the Kona Village Resort operation. The proposed project will improve the quality of existing visitor destination area by providing needed infrastructure and additional scenic and recreational amenities.

The proposed project will further the policy of providing opportunities for Hawaii's people to obtain job training and will allow for upward mobility within the visitor industry. The proposed development will offer short-term and long-term employment to residents of the State and County of Hawaii and will contribute to sustaining the level of construction activity in the State. Operational employment will provide workers with higher than average total compensation based on wages and gratuities.

Kaupulehu Developments intends to develop a resort that will be compatible with the local Hawaiian character, one which reflects the island atmosphere through its design and service.

OBJECTIVES AND POLICIES FOR THE PHYSICAL ENVIRONMENT - LAND-BASED, SHORELINE, AND MARINE RESOURCES

(1)(a) OBJECTIVE: Prudent use of Hawaii's land-based, shoreline, and marine resources.

(2)(a) OBJECTIVE: Effective protection of Hawaii's unique and fragile environmental resources.

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

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

(8)(b) POLICY: Pursue compatible relationships among activities, facilities, and natural resources, especially within shoreline areas.

Discussion: Kaupulehu Developments understands that the western shore of Hawaii Island has a unique environmental character that needs to be preserved. Development will be separated from the shoreline by an open space area, which includes Waiakuhi Pond and other pond and wetland areas. The high quality coastal waters and diversity of marine biota will be maintained to the greatest extent possible. The shoreline and beach will be made easily accessible to the public. The concept master plan has been designed to incorporate the natural features of the site, preserving some of the more significant natural and archaeological features.

OBJECTIVE AND POLICIES FOR THE PHYSICAL ENVIRONMENT - SCENIC, NATURAL BEAUTY, AND HISTORIC RESOURCES

(1)(a) OBJECTIVE: Enhancement of Hawaii's scenic assets, natural beauty, and multi-cultural/historical resources.

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

(4)(b) POLICY: Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.

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

Discussion: The South Kohala and North Kona region, including the lands of Kaupulehu, is rich in natural and cultural resources. Kaupulehu Developments proposes to maintain archaeological preserves and to preserve significant individual archaeological sites and trails. As mentioned previously, the shoreline area, including the ponds, is not planned to be altered. The low density, landscaped character of the resort will provide a means for the development to accommodate and be complemented by the surrounding environment.

OBJECTIVE AND POLICY FOR THE PHYSICAL ENVIRONMENT - LAND, AIR AND WATER QUALITY

(2)(a) OBJECTIVE: Greater public awareness and appreciation of Hawaii's environmental resources.

(1)(b) POLICY: Foster educational activities that promote a better understanding of Hawaii's limited environmental resources.

Discussion: Increased access to Kaupulehu project lands and to the shoreline will be made available to the general public via the Kaupulehu Resort. The establishment of, and access to, archaeological preserves would support activities that promote a better understanding of Hawaii's heritage. Preserving the ponds and wetlands contained in the shoreline area will serve to further both visitors' and residents' understanding of Hawaii's unique natural heritage.

OBJECTIVE AND POLICIES FOR FACILITY SYSTEMS - SOLID AND LIQUID WASTES

OBJECTIVE: Maintain basic public health and sanitation standards relating to treatment and disposal of solid wastes.

(1)(b) POLICY: Encourage the adequate development of sewer systems that complement planned growth.

(2)(b) POLICY: Encourage reuse and recycling to reduce solid and liquid wastes and develop a conservation ethic.

Discussion: Kaupulehu Developments intends to construct a sewage treatment facility which treats sewage to the secondary level. This will create an effluent which will be safe to use for golf course irrigation while serving to conserve and recycle water. Kona Village Resort will expand its existing sewage treatment facilities to accommodate the 50 new units.

OBJECTIVE AND POLICIES FOR FACILITY SYSTEMS - WATER

OBJECTIVE: Provide adequate water to accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(1)(b) POLICY: Relate growth activities to existing and potential water supply.

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

Discussion: Water for Kaupulehu Resort will be supplied from two wells at the 1,440-foot elevation on Kaupulehu Developments mauka lands. A wastewater treatment plant will be designed so that wastewater can be recycled; effluent mixed with brackish water can be used to irrigate the resort golf course. Kona Village Resort will continue to obtain its water supply from desalinization.

OBJECTIVE AND POLICIES FOR SOCIO-CULTURAL ADVANCEMENT - LEISURE

OBJECTIVE: Adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

(4)(b) POLICY: Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values.

(5)(b) POLICY: Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.

Discussion: Kaupulehu Developments intends to promote the recreational and educational potential of historical and natural resources on its lands. Public access to features including archaeological sites within designated preserves and shoreline resources will be enhanced.

#### OBJECTIVE AND POLICY FOR SOCIO-CULTURAL ADVANCEMENT - CULTURE

OBJECTIVE: The enhancement of cultural identities, traditions, values, customs, and arts of Hawaii's people.

(1)(b) POLICY: Foster increased knowledge and understanding of Hawaii's ethnic and cultural heritage and the history of Hawaii.

Discussion: The sites of cultural interest at Kaupulehu Resort are predominantly of Hawaiian origin. Significant sites will be preserved and interpreted for the public and resort guests.

### **PART III. PRIORITY DIRECTIONS**

#### ECONOMIC IMPLEMENTING ACTIONS

(1)(a) PRIORITY ACTION: Stimulate the economy to provide needed jobs for Hawaii's people without stimulating unnecessary in-migration.

(2)(b) PRIORITY ACTION: Protect the economic health and quality of the visitor industry.

(3)(b) PRIORITY ACTION: Maintain or enhance the quality of existing and future hotels and resort destination areas which conform with regional carrying capacities and state policies providing for adequate shoreline setbacks and beach access.

(4)(b) PRIORITY ACTION: Provide incentives to encourage existing hotel owners to upgrade, repair and maintain visitor facilities.

(5)(b) PRIORITY ACTION: Preserve and enhance Hawaii's significant natural environment and scenic, historic, and cultural sites.

(6)(b) PRIORITY ACTION: Develop and maintain career opportunities in the visitor industry for Hawaii's people, with emphasis on managerial positions.

(9)(b) PRIORITY ACTION: Maintain and enhance visitor satisfaction.

(10)(b) PRIORITY ACTION: Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.

(13)(d) PRIORITY ACTION: Encourage the expansion of the statewide agricultural base through the promotion of products for export and local consumption.

(1)(f) PRIORITY ACTION: Promote a consistent and stable level of construction activity.

Discussion: The Kaupulehu Resort development and Kona Village Resort expansion will provide a steady level of construction employment over a period of several years, lead to the establishment of permanent full-time and part-time operational jobs, and stimulate employment growth in other sectors of Hawaii's economy. It is estimated that many employees will be Hawaii Island residents, and that most of the remaining employees will be from other islands. Opportunities will exist for training and promotion from within.

The expansion of the Kona Village Resort and the development of the Kaupulehu Resort will serve to promote many of the State Plan's priority directions related to the visitor industry. Kona Village will be upgrading its existing resort to meet a growing demand for this type of facility. The Kaupulehu Resort is expected to improve and enhance visitor satisfaction in the West Hawaii region. Both projects will encourage a favorable resort investment climate for Hawaii Island. In addition, implementation of the proposed project will expand the services and capacity of the entire West Hawaii coastal resort region and effect a synergism among the high quality and luxury resorts within the region.

Development of Kaupulehu Resort and Kona Village Resort expansion will conform with relevant State and County land use regulations, as well as other regulations pertinent to the proposed development.

Local agricultural products, including fish, meat, vegetables, and fruits, will be purchased for consumption at the resorts, contributing to the maintenance and expansion of the agricultural base.

#### POPULATION GROWTH AND DISTRIBUTION IMPLEMENTING ACTIONS

(2)(a) PRIORITY ACTION: Encourage hiring of Hawaii's people by firms doing business in the state.

(2)(b) PRIORITY ACTION: Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographical area.

Discussion: Kaupulehu Developments' policy is to hire from the locally available labor supply for long-term employment at the resort. The proposed project will be constructed according to a phased schedule as demand warrants and resources allow.

#### HAWAII'S LAND RESOURCES

(a) PRIORITY ACTION: Preserve and improve shoreline open spaces and scenic resources.

Discussion: The concept master plan includes the provision of public access to the shoreline from Queen Kaahumanu Highway, lateral access along Kaupulehu Resort's shoreline, and parking facilities. An open space area between the shoreline and resort facilities will provide a buffer.

### **3. STATE FUNCTIONAL PLANS**

State functional plans are intended to provide more detail to the Hawaii State Plan in 12 specific areas of concern: agriculture, conservation lands, education, higher education, energy, health, historic preservation, housing, recreation, tourism, transportation, and water resources development. As defined in the Hawaii State Plan (Section 2), a functional plan sets forth "the policies, programs and projects designed to implement the objectives of a specific field of activity when such activity or program is proposed, administered, or funded by an agency of the State."

The relevant State functional plans were examined to determine the relationship of the proposed Kaupulehu Resort plan and Kona Village Resort expansion to each. All of the plans had been adopted by 1985; they function as guidelines only and are not to be interpreted as law or statutory mandate.

#### **3.1 STATE AGRICULTURE FUNCTIONAL PLAN**

An objective of the State Agriculture Functional Plan (Hawaii, State of, Department of Agriculture, 1984) is to achieve the productive use of lands most suitable and needed for agriculture. Most of the land proposed for the project by Kaupulehu Developments consists of basalt lava that has not weathered to any appreciable extent. It has little or no soil/vegetation cover and has little agricultural potential. A small site on the mauka Kaupulehu land, which is in the Agricultural District, is currently being used for water exploration and withdrawal and would continue to be used for this purpose. No change in the use of this area is requested. By implementing the proposed project, the market for local agricultural products will grow.

#### **3.2 STATE ENERGY FUNCTIONAL PLAN**

The State Energy Functional Plan (Hawaii, State of, Department of Planning and Economic Development, June 1984) has as an objective the promotion of energy-efficient design. This relates both to overall land use planning and to specific building design and equipment selection decisions.

There are no detailed building designs yet for Kaupulehu Resort facilities and the new units at Kona Village Resort. However, it is intended that all future plans conform with County of Hawaii energy conservation regulations.

#### **3.3 STATE HEALTH FUNCTIONAL PLAN**

The State Health Functional Plan (Hawaii, State of, Department of Health, June 1984:5) "focuses primarily on public health programs under the jurisdiction of the State Health Department." Several of the implementing actions relate to operating Department of Health (DOH) permit/approval programs with which the proposed project must comply. These include: operating the environmental impact statement process; reviewing private wastewater treatment systems; administering permit programs for discharges to the air, all surface and groundwater, and for treatment and disposal of solid wastes; reviewing plans for new sources of drinking water; and reviewing plans for air conditioning and mechanical ventilation systems for buildings that are used by the public. These topics (wastewater, air quality, water quality, potable water systems, solid waste, and approvals needed) are discussed in terms of the proposed

project in various sections of the EIS. The implementing actions also express other areas of concern to DOH, such as reuse of treated effluent, noise, and medical services, that are covered in this EIS as well.

### 3.4 STATE HISTORIC PRESERVATION FUNCTIONAL PLAN

Essentially all of the policies and implementing actions in the State Historic Preservation Functional Plan (Hawaii, State of, Department of Land and Natural Resources, June 1984) are directed at state agencies, DLNR in particular. The archaeological resources on the proposed Kaupulehu Resort and Kona Village Resort expansion sites have been surveyed. Within Kaupulehu Resort the significant archaeological areas and important sites will be preserved and maintained for the benefit of island residents and visitors. There are currently three proposed archaeological preserves on the Kaupulehu Developments makai property. Preservation/interpretive plans will be worked out with the responsible State and County agencies.

The preservation efforts and interpretive signs/materials which will be established at the Kaupulehu Resort help fulfill Objective E of this functional plan which calls for "activities which support and foster increased knowledge and understanding of . . . the history of Hawaii".

### 3.5 STATE HOUSING FUNCTIONAL PLAN

This State functional plan summarizes the results of the Hawaii Housing Authority study (Hawaii, State of, Department of Social Services and Housing, June 1984) "to formulate a comprehensive plan for the development, operation, and management of housing within the State". Most of the policies and implementing actions apply to the government sector.

A(2)(c) IMPLEMENTING ACTION: Encourage the use of opportunities and incentives in the State Land Use redistricting process to provide lands or homes for affordable or assisted housing development.

Discussion: Kaupulehu Developments will continue to work with appropriate governmental agencies and private entities to provide necessary housing for those employees requiring assistance.

B(1)(a) IMPLEMENTING ACTION: Assess and delineate lands suitable for future housing development.

Discussion: The Kaupulehu Resort site is suitable for resort housing, hotel units and other related facilities by virtue of its physical shorefront setting and its accessibility to public facilities and services.

B(1)(c) IMPLEMENTING ACTION: Encourage and assist in the development of rental housing for employees of large businesses and industries outside of urban areas.

Discussion: Kaupulehu Developments will continue to consult with the Hawaii County Housing Agency, the Hawaii Housing Authority, and concerned private developers to meet the housing requirements for employees.



### 3.6 STATE RECREATION FUNCTIONAL PLAN

The State Recreation Functional Plan (Hawaii, State of, Department of Land and Natural Resources, June 1984) has as Policy D(2) "the securing of public accesses to resources with recreational value." Public access to the shoreline will be provided by Kaupulehu Developments. Although specific access ways will be later determined by the County of Hawaii, mauka makai access from Queen Kaahumanu Highway and lateral shoreline access are planned.

Policy E(3) of the State Recreation Functional Plan aims to "coordinate visitor and resident recreation interests to achieve compatible recreation usage." Section 7 of Chapter IV addresses the potential impacts of the Kaupulehu Resort on recreational usage on the subject lands and in the region.

### 3.7 STATE TOURISM FUNCTIONAL PLAN

The Hawaii State Department of Planning and Economic Development (June 1984) authored this functional plan and considers it a "guide to help coordinate the various sectors of government and private industry toward achieving statewide objectives of the Hawaii State Plan." The role of government in tourism is seen not only as protecting the economic health of the industry, but also as "advancing the social goals of the community." The policies and implementing actions which are most relevant to the private sector, and particularly to the proposed project, are those concerning physical development.

(B)(1) POLICY: Ensure that visitor industry activities are in keeping with the economic and physical needs and aspirations of Hawaii's people.

B(1)(a) IMPLEMENTING ACTION: Encourage the development of an orderly mix of visitor accommodations including full-service hotels, condominium apartments, and some single-family homes, in order to meet the lodging desires of the broad spectrum of our visitor guests.

Discussion: The concept master plan for Kaupulehu Resort provides for a self-contained visitor destination area of high quality, similar to other resort developments in the neighboring South Kohala coastal area. It will provide an orderly mix of visitor accommodations with resulting benefits to Hawaii's economy. The expansion of Kona Village Resort will provide more units in an alternate retreat atmosphere.

B(2) POLICY: Improve the quality of existing visitor destination areas.

Discussion: The low density, high quality nature of Kaupulehu Resort will improve the quality of an existing visitor destination area through the provision of additional high quality visitor facilities, infrastructure, and scenic and recreational amenities.

B(3) POLICY: Encourage greater cooperation between the public and private sectors in developing and maintaining well-designed and adequately serviced visitor industry and related developments.

B(3)(a) IMPLEMENTING ACTION: Assure that adequate infrastructure and amenities, such as roads, water, drainage and parks, are provided through a reasonable distribution of financial responsibilities between governmental and private parties.

**Discussion:** Kaupulehu Resort will be a well designed and adequately serviced development. Infrastructure and amenities including roads, water, drainage, and sewage disposal facilities will be provided without the use of public funds. State and County tax revenues generated by the development will contribute toward the cost of providing various public services to new residents and visitors. As part of the proposed actions, Kaupulehu Developments proposes to establish and maintain shoreline access and archaeological preserves. Extensive capital improvements have already been made in the Kona/Kohala area, and public plans have been directing growth here since the late fifties.

B(3)(d) **IMPLEMENTING ACTION:** Encourage the clustering of hotels and resort condominium developments to provide open space and promote energy conservation.

**Discussion:** The clustering of hotel and condominium uses at Kaupulehu Resort will allow for energy conservation by using major infrastructure for groups of compatible uses. Through clustering, the proposed concept master plan for the resort will allow for more concentrated open space as well as scenic views.

B(4) **POLICY:** Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities.

B(4)(b) **IMPLEMENTING ACTION:** Ensure that new hotel and condominium projects be set back from the shoreline for access which facilitates and permits use of those areas.

B(4)(d) **IMPLEMENTING ACTION:** Plan development of resorts in a coordinated manner to minimize loss of public recreational opportunities in designated visitor destination areas.

B(4)(e) **IMPLEMENTING ACTION:** Resort development should take place within designated visitor destination areas.

**Discussion:** The proposed Kaupulehu Resort is within a designated visitor destination area. It will be carefully planned and sensitive to existing adjacent communities and activities. The resort lands border the Kona Village Resort, and the developers of both resorts are cooperating to assure compatible uses and to facilitate future development. Three parcels for archaeological preserves have been delineated in the plans on the makai property; combined with the golf courses and other open space, these areas will act as a buffer between the proposed resort and the existing Kona Village Resort. The proposed concept master plan for Kaupulehu Resort facilitates public access to and along the shoreline. Few, if any, public recreational opportunities would be lost; public use of the shoreline is likely to increase with planned access improvements.

B(4)(c) **IMPLEMENTING ACTION:** Ensure the construction, as necessary in connection with both new hotel and large resort condominium projects, of affordable dwelling units adequate to accommodate employee households.

**Discussion:** Assistance for affordable employee housing will be provided, as required by the appropriate agencies.

D(3) **POLICY:** Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawaii's cultures and values.

D(3)(a) **IMPLEMENTING ACTION:** Provide relevant information to visitors to foster their understanding of Hawaii's uniqueness in order to minimize damage of natural, historic, and archaeological resources, promote their personal safety and protection, and foster an appreciation of the contribution of Hawaii's residents to the enjoyment of the visitor's experience in Hawaii.

D(3)(b) **IMPLEMENTING ACTION:** Provide relevant interpretation of, and public access to, sites of archaeological significance whenever feasible, and establish a program to explain Hawaii's history and values to visitors and residents.

**Discussion:** Kaupulehu Developments will foster visitor understanding of Hawaii's uniqueness in order to minimize damage of natural, historic, and archaeological resources, to promote their personal safety and protection, and to instill an appreciation of local residents as contributors to a pleasant visitor experience. The applicant also intends to provide interpretive programs and public access to significant archaeological sites. Before plans to develop the project site are finalized, the State and County will be consulted regarding an appropriate plan for the management of cultural resources.

### 3.8 STATE WATER RESOURCES DEVELOPMENT FUNCTIONAL PLAN

This functional plan, prepared by the Hawaii State Department of Land and Natural Resources (June 1984) "primarily affects State operations . . . it also involves some actions of . . . the private sector. It points out where . . . private industry coordination will be needed and . . . can help achieve water resources objectives".

The plan presents general objectives and policies for the management of potable water supply, floodplains, agricultural water, and estuarine environments that could be considered relevant to this project. These topics are discussed in various sections of Chapter IV in this report.

#### **4. HAWAII COASTAL ZONE MANAGEMENT PROGRAM**

The Hawaii Coastal Zone Management Act (Act 188, SLH 1977), which became Chapter 205A, Hawaii Revised Statutes, established State policies for any action affecting the coastal zone. The act established specific objectives and policies in seven broad categories. The relationship of the proposed Kaupulehu Resort concept master plan and the Kona Village expansion to the areas of statutory concern is discussed below.

##### **4.1 RECREATIONAL RESOURCES**

Coastal recreational resources will be made more accessible to the public following project development. An open space area to be established and maintained by Kaupulehu Developments will separate the Kaupulehu Resort hotel, beach club, and shoreline condominiums from the shoreline area. Mauka/makai public access from Queen Kaahumanu Highway to the shoreline will be provided, facilitating public access to shoreline activities such as swimming, fishing, and other recreational pursuits.

##### **4.2 HISTORIC RESOURCES**

Kaupulehu Developments intends to fully identify significant archaeological resources. Archaeological surveys of the project areas have been undertaken for this purpose. Specific significant sites and potentially significant sites have been identified and recommended for preservation or further study prior to development. These sites will be preserved to the greatest extent possible and, where desirable, restored. Kaupulehu Developments intends to modify its master plan as required to accommodate the recommendations. Details of sites to be preserved and studied will be developed in conjunction with the State Historic Sites Section of DLNR and the Hawaii County Planning Department. Other aspects of the proposed project's relationship to archaeological resources are discussed in Chapter IV, Section 1.12.

##### **4.3 SCENIC AND OPEN SPACE RESOURCES**

Extensive landscaping and the open space corridors of the golf holes, the archaeological preserves, and the shoreline area will enhance the spacious character of the resort and scenic views will be maintained.

##### **4.4 COASTAL ECOSYSTEMS**

The ecosystems of the nearshore waters and the shoreline area are not expected to be adversely affected by the proposed development. Potential adverse impacts will be avoided or minimized. Valuable ecosystems will be preserved wherever feasible.

##### **4.5 ECONOMIC USES**

The Hawaii County General Plan acknowledges that resort development of the project land is an appropriate use, as indicated by the actions of both State and County agencies (e.g., by the granting of various permits). The policies under this heading state that reasonable growth in areas designated for visitor industry facilities (which

are recognized as coastal dependent developments) is to be permitted with the assurance that adverse impacts are minimized. Both public and private facilities and improvements will be provided to implement the existing intermediate resort designation on the County of Hawaii General Plan. These improvements will enhance the South Kohala-North Kona region as a visitor destination area and will thus benefit the State's economy.

#### **4.6 COASTAL HAZARDS**

The Kaupulehu shoreline is subject to potential hazards from storm waves and tsunamis. Development along the coast will conform to the requirements of the Federal Flood Insurance Program and will incorporate measures to protect against these hazards. Erosion will be controlled to avoid or minimize any adverse impacts on coastal waters. Structures are planned to be separated from the shoreline by open space, thereby further reducing the risk of damage from coastal hazard.

#### **4.7 MANAGING DEVELOPMENT**

This environmental impact statement is a tool for communicating the impacts of Kaupulehu Resort and Kona Village expansion at an early stage of planning. It is intended to facilitate participation in the planning and review process. The proposed plan will require securing several permits before it can be implemented. There will thus be numerous opportunities for the Hawaii Coastal Zone Management Program network authorities to place conditions on the project which will assure the proper management of coastal zone resources.

## 5. COUNTY SPECIAL MANAGEMENT AREA

The entire proposed resort acreage falls within the "Special Management Area" (SMA) and is therefore subject to the SMA Rules and Regulations of the County of Hawaii by authority of Chapter 205A, HRS. Following is a discussion of the relationship of the Kaupulehu resort concept master plan to the SMA guidelines in the Hawaii County Planning Commission's Rule No. 9. The following brief comments note the extent to which the project is believed to be consistent with them. The objectives and policies of the Hawaii State Coastal Zone Management Act are also discussed in the County's SMA Rule. These have been discussed in the section above.

**Guideline A.1.** This guideline seeks to minimize alterations to any body of water.

**Comment:** It is expected that anchialine ponds or wetlands will not be altered or filled. (See discussion in Section 1.8 of Chapter IV.)

**Guidelines A.2 and 3.** These guidelines seek to minimize reductions in the availability and/or access to beaches and other recreational areas and shoreline areas due to development.

**Comment:** The proposed project will improve the availability of shoreline recreational resources by increasing access to them.

**Guideline A.4.** This guideline concerns the visual impacts of the proposed development.

**Comment:** Kaupulehu Resort facilities will be separated from Queen Kaahumanu Highway by golf holes and the relocated Kona Village Resort entrance road. Most of the Kaupulehu Resort facilities and the additional Kona Village Resort units will be at a lower elevation than the highway. Structures closer to the highway will be low-rise and softened by landscaping which will contrast with the adjacent lava-dominated environment. Development will not significantly detract from the line of sight between the highway and the sea.

**Guideline A.5.** This guideline aims at minimizing development that adversely affects water, scenic, or wildlife resources, or that adversely affects existing or potential agricultural uses of the land.

**Comment:** The water, scenic, and wildlife resources of the Kaupulehu Resort and Kona Village Resort expansion sites are anticipated to be easily incorporated into the development and adverse impact on them avoided.

**Guidelines B.1,2 and 3.** These guidelines state that no development shall be approved unless it has no significant adverse environmental effects and is found consistent with Chapter 205A, HRS, the Hawaii County General Plan, the Hawaii County Zoning and Subdivision Codes, and other applicable ordinances.

**Comment:** This EIS analyzes the potential of the project to create adverse effects and outlines the mitigation measures that will be taken to avoid them or minimize them to insignificant levels. The plan's consistency with Chapter 205A, HRS and with

the Hawaii County General Plan is discussed, respectively, in Section 4 above, and Section 6 following. Applications for zoning amendments and subdivision will be submitted to the County upon approval of the redistricting request. These and all applicable ordinances will be complied with.

**Guidelines C.1 and 2.** These guidelines seek to ensure access to beaches, recreation areas, and natural reserves, and to ensure that adequate recreation and wildlife preserves are maintained.

**Comment:** Access will be improved and an open shoreline area will be provided under the concept master plan. Waiakuhi pond and other ponds and wetland areas, as well as wildlife resources are expected to be preserved and maintained.

**Guideline C.3.** This guideline concerns solid and liquid waste management.

**Comment:** These issues are discussed in Sections 6.6 and 6.7 of Chapter IV.

**Guideline C.4.** This guideline seeks to minimize adverse impacts resulting from alterations to existing landforms and vegetation.

**Comment:** No specific grading plans for development sites have been prepared, but the proposed project will allow low density development that utilizes existing landforms. The golf courses are planned to utilize interesting land forms as visual features. Most of the development area consists of barren lava with sparse vegetative cover in spots. Soil will be imported for the golf courses and landscaping.

**Guideline C.5.** This guideline seeks to minimize adverse environmental or ecological impacts due to the project.

**Comment:** Kaupulehu Developments is committed to minimizing adverse impacts. Moreover, the multi-level review and permit process that the plan must undergo before it is implemented will ensure that appropriate mitigation measures are made conditions of development.

**Guideline C.6.** This guideline states that the proposed project must be consistent with the General Plan.

**Comment:** As outlined in the following section, the revised master plan is consistent with the Hawaii County General Plan.

## 6. HAWAII COUNTY GENERAL PLAN

The Hawaii County General Plan contains both a set of policies and land use maps showing the location of desired land uses for the entire island. The latter are referred to as "Land Use Pattern Allocation Guide Maps" (LUPAG maps). The General Plan was revised in 1978, and the land use designation for the area of proposed Kaupulehu resort development was upgraded from "retreat" to "intermediate" resort. The current maximum number of visitor units in "intermediate resort" is 1,500, and this standard will be observed by the applicant. (The 1,500 units are the combined total for Kaupulehu Resort and Kona Village Resort.) According to the General Plan standards, an intermediate resort area is a self contained resort destination area providing basic and support facilities for the needs of the development.

The General Plan states that for the LUPAG maps "the boundaries indicated are long-range guides to general location" (1971:77). On the following page the same idea is reiterated:

The land use pattern is a broad, flexible design intended to guide the direction and quality of future developments in a coordinated and rational manner. The General Plan Land Use Pattern Allocation Map indicates the general location of various land uses in relation to each other (emphases added).

LUPAG maps are the graphic expressions of the policies of the General Plan, particularly those relating to land use. The LUPAG map for the region currently designates the Kaupulehu area as "resort," "open," and "conservation." The proposed project is consistent with the "intermediate resort" designation for the project site. The resort unit limit in the General Plan will not be exceeded under the proposed plan.

Basic infrastructure will be provided by Kaupulehu Developments, including sewer, water, and road systems. The proposed project will provide for public access to the shoreline and the archaeological preserves for recreational, educational, and other purposes.

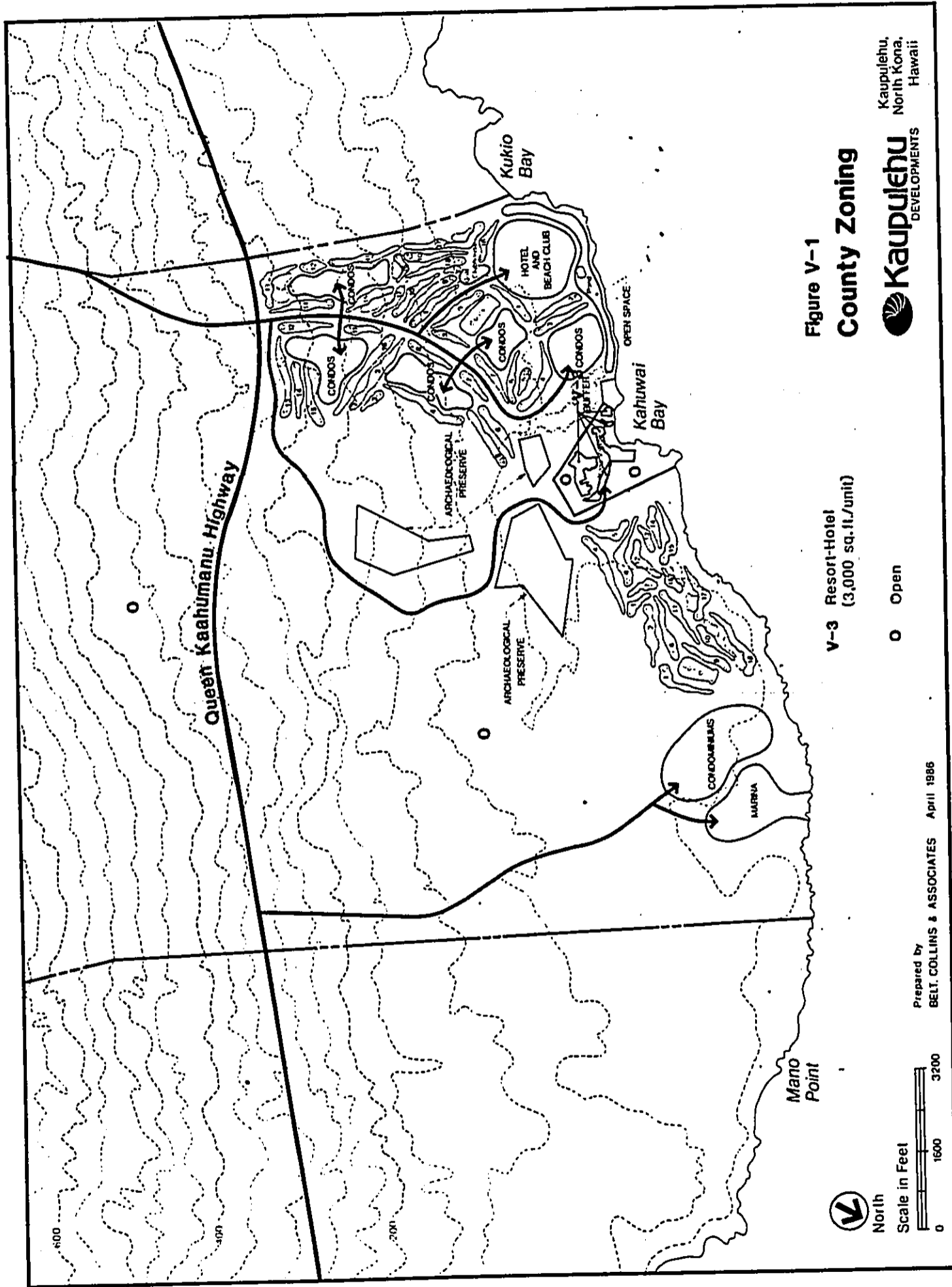
## 7. HAWAII COUNTY ZONING

The existing Kona Village Resort site is zoned Resort-Hotel (V-3) and Open. Current County zoning on all of TMK 7-2-03:1 is Open (see Figure V-1). The remainder of the project site is also zoned Open. Golf courses and recreational uses are permitted in Open districts by Hawaii County. Resort uses are permitted in Resort-Hotel districts by the County.

The well site is in the Unplanned District of the mauka lands. This designation applies to areas not subjected to sufficient studies to adopt a specific district classification.

Changes in the County zoning of the property will be necessary as part of the implementation of the proposed resort-residential community. The appropriate zoning districts for land use in an area designated Intermediate Resort on the Hawaii County General Plan are V, Resort-Hotel District; RM, Multiple-Family Residential District; and O, Open, as well as other districts. If the SLUC grants the additional Urban designation, a rezoning application will be filed with the Hawaii County Planning Department.





## 8. KONA REGIONAL PLAN

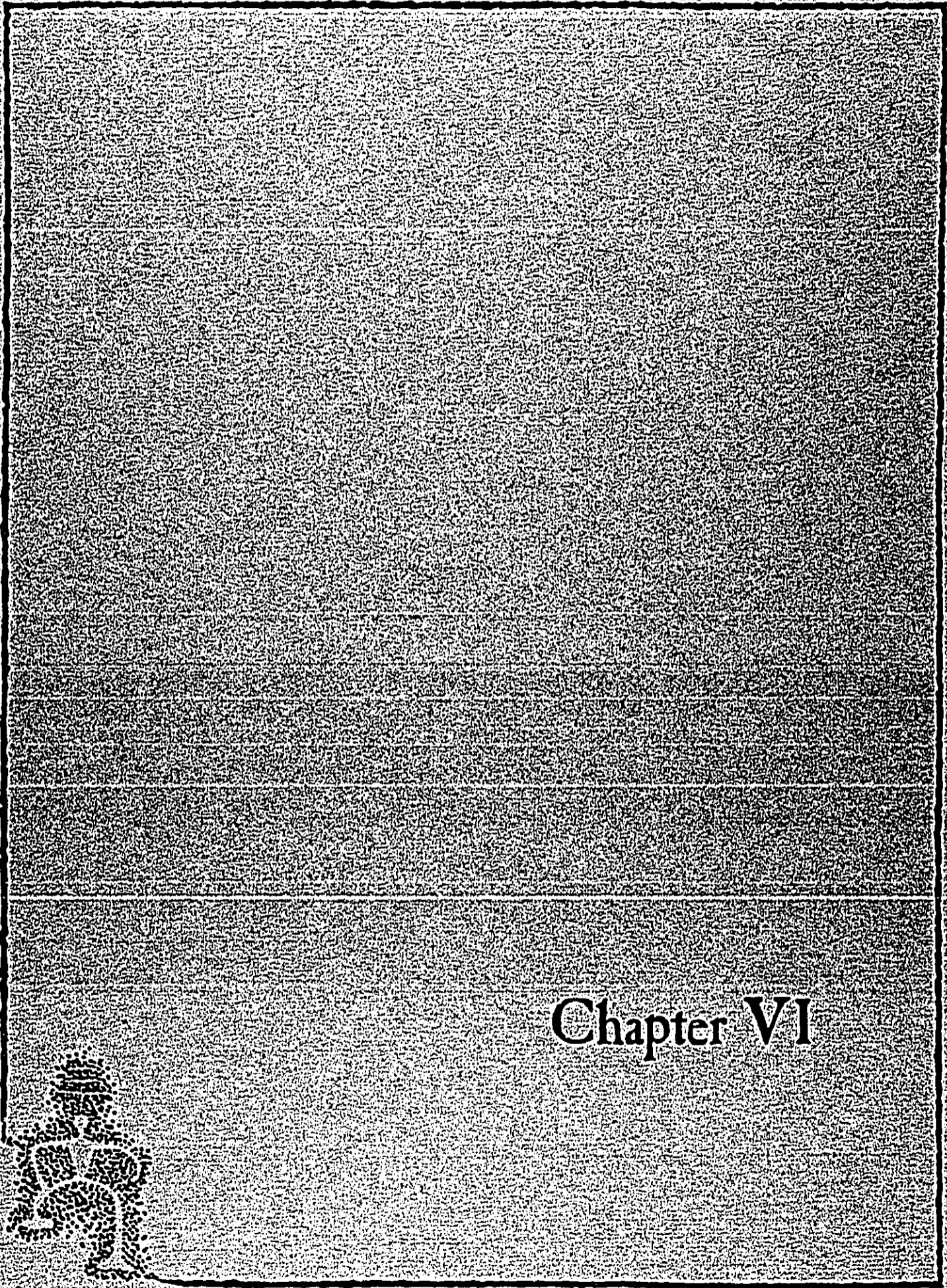
The Kona Regional Plan, adopted by the County Planning Commission in April 1984, was prepared for the vicinity of North and South Kona. The plan seeks to analyze and coordinate the community-wide needs of the Kona area and serves as a more detailed guide to implementing the broad goals and objectives of the County of Hawaii General Plan. Implementation of the Kona Regional Plan is designed to be a continuing partnership between public and private sectors.

The Kona Regional Plan expects that the economics of the Kohala and Kona Districts will become more and more interdependent, especially as both are based largely on the tourism industry. Hence, the Kona Regional Plan urges land use planning of these areas be coordinated.

Priority development areas have been ranked in order to provide the public and private sectors with a general sense of priority in pursuing the various actions called for in this plan. This ranking is not to be considered a rigid regulation, but rather indicate the sense of direction for development activities. One of the Kona Regional Plan's priority development areas is the makai Kaupulehu land, which is to be developed as demand warrants.

The Kona Regional Plan recommends that development of the Kona area be extremely sensitive to cultural resources, and that a possible solution to promoting their wise use could be land exchanges (1983; p. 189). Kaupulehu Developments intends to establish archaeological preserves as part of the proposed resort development. Some land currently designated as Urban District is planned to be converted to Conservation District in order to help effectuate the preservation of cultural resources. An intensive archaeological survey and testing of several sites has been conducted to identify those that have a high preservation value. These sites will be maintained for the use and enjoyment of visitors and residents. Shoreline resources will be preserved and maintained.

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Chapter VI



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# Chapter VI

## Chapter VI

### RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

It is intended that the proposed project conform to standards set by the State and County of Hawaii. Because the project site primarily consists of barren lava, future options for alternate uses of the land are seriously limited. The proposed plans for Kaupulehu Resort development and Kona Village expansion are expected to foreclose future options or to narrow the range of uses of the environment.

As evidenced by this report, development of the proposed project does not appear to pose any significant risks to health and safety. It is obviously in the interest of the developers to provide a healthful, safe and enjoyable experience at the resorts.

The accesses, open areas, and archaeological preserves proposed in the concept plan for Kaupulehu Resort allow for increased use of the area's resources, and represent a long-term gain for the public. Over the long run, a man-made environment will largely replace the natural terrain of lava fields. However, numerous open spaces, especially the golf course corridors, the shoreline and the proposed archaeological preserves, will maintain the openness of the site, and landscaping will enhance the visual character of the project.

Other benefits to be derived from the development of Kaupulehu Resort and the expansion of Kona Village Resort are the enhancement of long-term economic viability of the resorts and the long-term employment and other economic benefits which they will bring to the region. Detailed plans for the development sites have not yet been prepared, but no significant long-term losses of resources are anticipated. Natural or cultural resources recommended for preservation will be incorporated into the overall development plans.

Growth in visitor and resident population will follow project development. The effects of this growth have been weighed and the benefits found to offset the potential adverse impacts.

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Chapter VII



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## Chapter VII

## Chapter VII

### IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Urbanization resulting from the development of the Kaupulehu Resort site and Kona Village expansion site will change the natural setting of the sparsely vegetated lava landscape by converting the land to accommodate golf courses, condominium units, hotel facilities, and a beach club complex. In this process, most of the dryland vegetation will be replaced by the golf courses and other landscaping and buildings. At the same time, development will avoid destruction of other more valued resources such as ponds, wetlands, native vegetation and archaeological sites. The one candidate endangered plant species found on Kaupulehu makai lands, Sesbania arborea, is outside the development area and will remain undisturbed. Archaeological sites, including those grouped within planned archaeological preserves, will be incorporated into the overall development scheme. An archaeological survey and test excavations have been performed and the developer intends to follow the resulting recommendations regarding the preservation of significant sites. Some sites that have received archaeological clearance may be destroyed. However, those deemed of significant cultural, interpretive or research value will be preserved or undergo further work as recommended.

Water for resort use is an important resource commitment, given that the project is located in a dry area of the island of Hawaii which is noted for its lack of readily accessible potable water source. The importation of soil for the golf courses and development sites will be needed. This will result in the relocation, not the depletion, of the island's soil resource.

The proposed project does not call for substantial commitment of government supplied services and facilities.



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# Chapter VIII

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# Chapter VIII

## Chapter VIII

### OFFSETTING CONSIDERATIONS OF GOVERNMENTAL POLICIES

Some minor adverse impacts will result due to implementation of the proposed project. However, these will be more than offset by the benefits derived from the project. No significant adverse effects are expected to result from the development of Kaupulehu Resort and the expansion of Kona Village Resort. State and County plans have encouraged quality resort development along the West Hawaii coast. Most of the public infrastructure needed to support such development is now established. The additional acreage being requested for Urban District land is necessary to allow for sufficient designated land to implement an economically viable destination resort of high quality (Kaupulehu Resort) and to ensure the viability of an established visitor destination (Kona Village Resort).

Analysis of the public revenues and public expenditures that the project will generate indicates that the benefit/cost ratio is favorable (4 to 1 ratio). While this analysis did not quantify environmental costs, the adverse environmental impacts of the proposed project are not major.

According to current plans, only the number of units that are allowed under existing government approvals will be developed. The existing lava dominated landscape will be transformed into a resort environment, but the important resources of the land, including Waiakuhi Pond and other ponds and wetlands, the shoreline, endemic biota, and significant archaeological sites, will be preserved, thus conforming to various State and County policies that encourage protection and preservation of such resources.

Some archaeological sites not recommended for preservation are likely to be lost. Further archaeological work, including salvage excavations, will be performed if deemed appropriate by the DLNR and the Hawaii County Planning Department. The archaeological work and the establishment of archaeological preserves and interpretive information will fulfill the implementing action of State Functional Plans which call for access to archaeological resources in order to help foster both visitors' and residents' understanding of Hawaiian history.

The project development plan is consistent with government policies calling for increased access to the shoreline and increased recreational opportunities.

The concept plan is consistent with all relevant government plans and policies, as discussed in Chapter V. The proposed development will fulfill the goals of the State Plan, which call for economic growth that maintains a desired physical environment and meets the needs of Hawaii's people.

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Chapter IX

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# Chapter IX



## Chapter IX

### UNRESOLVED ISSUES AND NECESSARY APPROVALS AND PERMITS

#### 1. UNRESOLVED ISSUES

The State Land Use District Boundary Amendment request which this environmental impact statement supports is one of several approvals which must be obtained before the proposed project can be implemented. A complete list of necessary approvals follows this section. This document identifies in conceptual terms the issues that must be addressed before construction can begin or be carried to completion; many of the details have yet to be finalized. The most important of these issues are identified below. None constitute areas of real controversy at present; rather, it is simply too early in the development process for a final course of action to be settled upon. It is believed that all of them can be resolved without undue difficulty.

- (1) Availability of Employee Housing. There are currently no plans to establish employee housing on the proposed project site. It is believed that the private housing market is capable of satisfying most of the demand for housing from employees who will be in-migrants to the region. However, it is recognized that some housing assistance may be necessary. Kaupulehu Developments has established contact with and will continue to work with the Hawaii Housing Authority, the County Housing Agency, and other interested parties to explore assisted housing options. The developer will comply with any governmental conditions necessary for project approval.
- (2) Impact on the Kona Village Resort. The Kaupulehu Resort site is immediately adjacent to the existing Kona Village Resort, which is an exclusive and remote luxury establishment. Although the proposed Kaupulehu Resort will not infringe on the Kona Village Resort directly, the fact that it will be located close to the existing resort may affect the sense of isolation that is desired by its guests. A case in point is the Kona Village Resort access road which will need to be relocated from its existing location to a new location off the proposed Kaupulehu Resort entrance road. Kaupulehu Developments intends to create a buffer which will contribute to maintaining the Kona Village Resort's remote feeling. Other potential problems, particularly potential disturbances during the construction period, will be short-term or mitigated.
- (3) Location of Off-Site Population Growth Facilities. The project plan described in this document conceptually locates all proposed on-site development. However, the location of the off-site growth which will undoubtedly occur in response to implementation of the project cannot be determined at this time. As growth trends become more clearcut, public facilities needed to serve the expanding population will need to be developed.
- (4) Transportation Improvements. As development at Kaupulehu and surrounding resort projects continues and traffic volumes increase, existing roadways will tend to become congested. Eventually, improvements to Queen Kaahumanu Highway will be necessary. The need for improvements to Queen Kaahumanu Highway is a function of projected regional growth, including but not restricted to the proposed project. The exact design of these improvements and when they will be necessary cannot be accurately predicted at present.

- (5) Historic/Archaeological Site Preservation. Kaupulehu Developments will follow recommendations to undertake further archaeological work on or preserve significant historic remains present within the project site. It is possible that other archaeological sites will be uncovered during site preparation of specific development sites. Should any be discovered, all work will cease and the appropriate governmental agencies notified. Work will not resume until approval has been obtained. Any subsequent archaeological work required is currently unknown.

## 2. NECESSARY APPROVALS AND PERMITS

The State Land Use District Boundary amendment is the first of several approvals required by the proposed project previous to the implementation of the concept master plan. The following list is of essential approvals which must be obtained for the project to proceed. In the course of developing certain parcels, other permits may be necessary, such as Planned Unit Development permits or Use Permits, depending on the final site design.

<u>APPROVALS NEEDED</u>	<u>APPROVING AGENCY OR BODY</u>
<u>HAWAII COUNTY:</u>	
Special Management Area Use Permit	Planning Department/Planning Commission
Rezoning	Planning Department/Planning Commission/County Council
Plan Approval	Planning Department
Subdivision Approval	Planning Department
Building Permit	Department of Public Works
Grubbing, Grading, Excavation, and Stockpiling Permit	Department of Public Works
Outdoor Lighting Permit	Department of Public Works
Conformance with County Flood Control Ordinance	Departments of Planning & Public Works
Sign Permit	Department of Public Works
Water System Expansion Approval	Department of Water Supply

**STATE:**

State Land Use Boundary Amendment

Historic Sites Review

Drinking Water System Approval

State Land Use Commission

Department of Land & Natural  
Resources

Department of Health



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# Chapter X

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# Chapter X



## CHAPTER X

### CONSULTED PARTIES AND THOSE WHO PARTICIPATED IN THE PREPARATION OF THE DEIS

#### 1. CONSULTED PARTIES

The notice of availability of the Environmental Impact Statement Preparation Notice (EISPN) for Kaupulehu Developments proposed resort project was published in the OEOC Bulletin by the Office of Environmental Quality Control on December 8, 1985. The agencies, organizations, and individuals listed below were sent copies of the EIS Preparation Notice with a copy of the Environmental Assessment and were asked to comment on the project. Everyone believed to have an interest in the project or who requested consulted party status was included in the mailing. Those who responded to the request for comments are marked with an asterisk and copies of the correspondence with them are reproduced in Chapter XI. Those marked with a "+" indicated by telephone that although they would not be providing comments on the EISPN, they would like to review the Draft Environmental Impact Statement.

#### Federal Agencies

- \* U.S. Army Corps of Engineers, Pacific Ocean Division
- \* U.S. Department of Agriculture, Soil Conservation Service
- U.S. Department of the Interior
- \* Fish and Wildlife Service
- \* Geological Survey, Water Resources Division
- + U.S. Environmental Protection Agency, Region IX-San Francisco
- \* U.S. Department of Transportation, Federal Aviation Administration

#### State Agencies

- \* Department of Accounting and General Services
- \* Department of Agriculture
- \* Department of Budget and Finance
- \* Department of Defense
- \* Department of Education
- Department of Hawaiian Home Lands
- \* Department of Health
- \* Department of Labor and Industrial Relations
- \* Department of Land and Natural Resources
- \* Department of Planning and Economic Development
- \* Department of Social Services and Housing
- \* Department of Taxation
- \* Department of Transportation
- \* Office of Environmental Quality Control
- Office of Hawaiian Affairs

**University of Hawaii - Manoa**

- + Environmental Center
- \* Water Resources Research Center

**Congressional Representatives**

- The Honorable Daniel K. Inouye
- \* The Honorable Spark M. Matsunaga
- The Honorable Daniel K. Akaka
- \* The Honorable Cecil Heftel

**State Legislators**

Senator Richard Henderson  
Senator Richard M. Matsuura  
Senator Malama Solomon  
Representative Virginia Isbell  
Representative Andrew Levin  
Representative Robert Lindsey  
Representative Wayne Metcalf  
Representative Harvey Tajiri  
Representative Dwight Takamine

**Hawaii County**

- Mayor - Dante K. Carpenter
- \* Department of Parks and Recreation
- \* Department of Public Works
- \* Department of Water Supply
- Department of Research and Development
- \* Fire Department
- Office of Housing and Community Development
- Safety Coordinator
- Civil Defense Agency
- Finance Department
- Hawaii Redevelopment Agency
- \* Planning Department
- \* Police Department

**Hawaii County Council**

James L. K. Dahlberg  
Frank De Luz, III  
Takashi Domingo  
Robert Herkes  
Lorraine Jitchaku  
Russell Kokubun  
Merle K. Lai  
Spencer Kalani Schutte  
Stephen K. Yamashiro

**Public Utilities**

- \* Hawaii Electric Light Company
- \* Hawaiian Telephone  
Gasco Inc., Hawaii Division

**Community Organizations and Other Groups/Individuals**

- \* Conservation Council for Hawaii  
Hawaii Hotel Association
- \* Hawaii Leeward Planning Conference
- \* Kona/Kohala Chamber of Commerce  
Kona Outdoor Circle  
Life of the Land
- \* Mauna Lani Resort
- \* Moku Loa Group, Hawaii Chapter Sierra Club
- \* Na Ala Hele  
West Hawaii Committee

**2. ORGANIZATIONS AND INDIVIDUALS WHO ASSISTED IN THE PREPARATION OF THIS DEIS**

This Draft Environmental Impact Statement was prepared for Kaupulehu Developments by Belt, Collins & Associates with input provided by subconsultants. The following organizations and persons were involved:

**Belt, Collins & Associates**

Anne L. Mapes	Project Manager and Principal Author
Pamela Gring	Contributor/Planner
Glen T. Koyama	Contributor/Planner
Edward H. Iida	Contributor/Civil Engineer
Thomas Nance	Contributor/Hydrologist
Karon Uyechi	Graphic Designer

**Subconsultants**

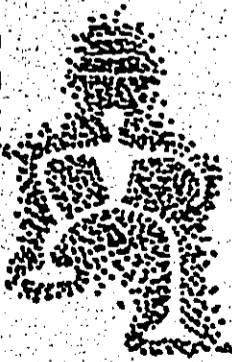
B. P. Bishop Museum	Archaeological Reconnaissance
Paul H. Rosendahl, Ph.D., Inc.	Archaeological Survey
OI Consultants, Inc.	Anchialine Pond Survey
Steven Dollar	Marine Survey
Ming Chew Associates	Market Demand Analysis
ECMI	Revenue-Cost and Impact Analysis
Winona Char	Botanical Survey
James W. Morrow	Air Quality Impact Assessment
Y. Ebisu & Associates	Noise Impact Assessment
Philip Bruner	Bird and Animal Survey

RECEIVED AS FOLLOWS

# Chapter XI

RECEIVED AS FOLLOWS

# Chapter XI



## CHAPTER XI

### COMMENTS AND RESPONSES DURING THE COMMENT PERIOD

The agencies and individuals listed in Chapter X: were all sent copies of the Environmental Impact Statement Preparation Notice (EISPN) with the Environmental Assessment (EA) and a transmittal letter requesting comments. The EISPN and the transmittal letter sent to these organizations and individuals are reproduced in the following pages along with their comments and our responses to them.

Standard Transmittal Letter Requesting Comments  
XI-3

Environmental Impact Statement Preparation Notice  
XI-4 through 6

#### **AGENCIES, ORGANIZATIONS, AND INDIVIDUALS RESPONDING TO THE STANDARD TRANSMITTAL LETTER**

##### FEDERAL AGENCIES

Department of Agriculture, Soil Conservation Service  
Department of the Army, U.S. Army Engineer District, Honolulu  
Department of the Interior  
    Fish and Wildlife Service  
    Geological Survey, Water Resources Division  
Department of Transportation

##### STATE AGENCIES

Department of Accounting and General Services, Division of Public Works  
Department of Agriculture  
Department of Budget and Finance  
Department of Defense  
Department of Education  
Department of Health  
Department of Labor and Industrial Relations  
Department of Land and Natural Resources  
Department of Planning and Economic Development  
Department of Social Services and Housing, Hawaii Housing Authority  
Department of Taxation  
Department of Transportation  
Office of Environmental Quality Control  
University of Hawaii at Manoa  
    Water Resources Research Center

##### CONGRESSMEN

Representative Cecil Heftel  
Senator Spark Matsunaga



**COUNTY OF HAWAII**

Department of Parks & Recreation  
Department of Public Works  
Department of Water Supply  
Fire Department  
Planning Department  
Police Department

**UTILITIES**

Hawaii Electric Light Company, Inc.  
Hawaiian Telephone

**ORGANIZATIONS**

Conservation Council for Hawaii  
Hawaii Leeward Planning Conference  
Kona/Kohala Chamber of Commerce  
Mauna Lani Resort  
Sierra Club, Hawaii Chapter  
Na Ala Hele

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

November 21, 1985  
85-2085

**Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii**

Kaupulehu Developments, a joint venture of Cambridge Pacific, Inc. and Barnwell Hawaiian Properties, Inc., is proposing to expand the existing resort on the makai Kaupulehu land into a self-contained intermediate resort/residential community. On September 25, 1985, the applicant petitioned the State Land Use Commission to amend the State Land Use District Boundaries in two ways. First, by placing 575 acres presently within the Conservation District in the Urban District; and second, by returning 123 acres now within the Urban District to the Conservation District.

On October 17, 1985, the Commissioners unanimously found that the proposed action may have significant environmental effects and determined that the applicant shall prepare an Environmental Impact Statement (EIS) in accordance with Chapter 343, Hawaii Revised Statutes (HRS). An Environmental Impact Statement Preparation Notice (EISPN) announcing this determination was published in the November 8, 1985 issue of the Office of Environmental Quality Control Bulletin. A copy of the EISPN and the environmental assessment are enclosed.

We request that you/your organization assist us in preparing the EIS by providing comments on the proposed project as it relates to your jurisdiction and responsibility, special knowledge, or interest. You could help us address those issues that are of greatest concern by indicating in writing the specific questions, issues, and topics you believe are important, as well as the reasons why they are important. The more specific you can be, the greater the likelihood that we will be able to respond satisfactorily.

The EIS Regulations stipulate that a written response to requests for comments be made within 30 days of their receipt, and we hope you will respond within this time period. It is expected that the EIS will be available in March 1986. At that time, the document will be circulated for public review and comment.

Thank you for your cooperation. If you have any questions, please call me at 521-5361.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:lf  
Enclosures

Honolulu 1676 Coral Street, Honolulu, Hawaii 96813 Telephone (808) 521-5361, Telex 01111174 M424  
Singapore 160 Orchard Road #12-01, International Building, Singapore-19745 Telephone 235 6870, Telex RS 54464 RLISIN  
Auckland Level 2, First Floor, 19 Commerce Street, Neutral Bay, Sydney, NSW 2091 Telephone 948 1108

CHAPTER 343, HAWAII REVISED STATUTES  
 ENVIRONMENTAL IMPACT STATEMENT  
 PREPARATION NOTICE

KAUPULEHU DEVELOPMENTS

Project Location: Kaupulehu, North Kona District, County of Hawaii  
 TMK 7-2-03:1, Third Division

Applicant: Kaupulehu Developments

Accepting Agency: Land Use Commission, State of Hawaii

Proposed Actions: Redistricting 575 acres of land from the Conservation District to the Urban District; return of 123 acres presently located within the Urban District to the Conservation District

Determination: EIS Required

I. Description of the Proposed Project

Kaupulehu Developments is proposing to expand the existing resort on the makai Kaupulehu land into a self-contained intermediate resort/residential community. The shorefront property would be developed in conformance with the Hawaii County General Plan Intermediate Resort designation for the area.

The development concept for the intermediate resort is a low density project integrating a hotel and beach club, beach and golf condominiums, and a full range of facilities and amenities, including two championship golf courses. Proposed are a 600-900 room hotel with a beach club; 50-150 residential beach condominiums; 350-450 golf course condominium units; and two 18-hole championship golf courses.

The applicant is requesting an additional 575 acres to be placed in the State Urban District and the return of 123 acres now within the Urban District to the Conservation District.

II. Description of the Affected Environment

The land of Kaupulehu Developments comprises about 11,000 acres within the ahupuaa of Kaupulehu on the west coast of Hawaii Island, North Kona District.

Makai Kaupulehu is characterized by aa and pahoehoe lavas with little or no soil cover. The climate is hot and arid averaging only 7 to 8 inches of rainfall annually. No major drainage channels are located on the property.

Vegetation on the makai property is scarce except for the landscaping at Kona Village Resort. The Kona coast is a known habitat for the endangered Hawaiian hoary bat.

An archaeological reconnaissance survey conducted by the B.P. Bishop Museum in September 1984, located and recorded 151 new sites and relocated 44 previously located sites. Several areas have been designated for further archaeological survey.

III. Assessment Process

An action involving land in the conservation district is one of the five classes of action which subject an applicant to an EIS requirement. On September 23, 1985 Kaupulehu Developments petitioned the Land Use Commission to amend the State Land Use District Boundaries in two ways. First, by placing 575 acres presently within the Conservation District in the Urban District; and second, by returning 123 acres now within the Urban District to the Conservation District.

On October 17, 1985, the Commissioners unanimously found that the proposed action may have significant environmental effects and determined that the preparation of an Environmental Impact Statement is required.

IV. Potential Impacts

The potential exists for significant effects, including the following:

- o alterations to existing landforms;

State Agencies  
 Department of Accounting and General Services  
 Department of Agriculture  
 Department of Budget and Finance  
 Department of Defense  
 Department of Education  
 Department of Hawaiian Home Lands  
 Department of Health  
 Department of Labor and Industrial Relations  
 Department of Land and Natural Resources  
 Department of Planning and Economic Development  
 Department of Social Services and Housing  
 Department of Taxation  
 Department of Transportation  
 Office of Environmental Quality Control  
 Office of the Governor  
 Office of Hawaiian Affairs

University of Hawaii-Manoa  
 Environmental Center  
 Water Resources Research Center

Congressional Representatives

The Honorable Daniel K. Inouye  
 The Honorable Spark M. Matsunaga  
 The Honorable Daniel K. Akaka  
 The Honorable Cecil Hefzel

State Legislators

Senator Richard Henderson  
 Senator Richard M. Matsunaga  
 Senator Malama Solomon  
 Representative Virginia Isbell

Hawaii County

Mayor Dante K. Carpenter  
 Department of Parks and Recreation  
 Department of Public Works  
 Department of Research and Development  
 Department of Water Supply  
 Fire Department  
 Office of Housing and Community Development  
 Safety Coordinator  
 Civil Defense Agency  
 Finance Department  
 Hawaii Redevelopment Agency  
 Planning Department  
 Police Department

- o change in the visual character of the area;
- o change in species composition of flora and fauna;
- o impact on marine ecosystem;
- o improved public access to the shoreline;
- o impact on archaeological sites;
- o short term increase in air pollutants due to construction activity;
- o long term increase in air pollution due to increased traffic and fuel combustion necessary to meet the electrical demand of the resort;
- o short term increase in noise levels due to project construction;
- o long term increase in noise levels due to increased traffic;
- o increased short-term and long-term employment;
- o increased demand for housing; and
- o increased government revenues and expenditures

V. Determination and Supporting Reasons

The proposed development has the potential to have significant impacts on the environment because of the extent of lands proposed to be reclassified from Conservation to Urban (575 acres), because the project involves lands adjacent to the shoreline, and because numerous archaeological sites are located within the project boundaries.

In conformance with Subsection 1.22, Classes of Action, and Subsection 1.31, Significance Criteria and Procedures, of the State Environmental Impact Statement Regulations, the Land Use Commission of the State of Hawaii has determined that the applicant shall prepare an Environmental Impact Statement in accordance with Chapter 343, Hawaii Revised Statutes (HRS).

VI. Parties to be Consulted in the Preparation of the EIS

The agencies and organizations listed below shall be sent copies of the EIS Preparation Notice (EISPN) and asked to comment on the project.

Federal Agencies

U.S. Army Corps of Engineers, Pacific Ocean Division  
 U.S. Department of Agriculture, Soil Conservation Service  
 U.S. Department of the Interior  
 Fish and Wildlife Service  
 Geological Survey, Water Resources Division  
 U.S. Environmental Protection Agency, Region IX - San Francisco

Hawaii County Council

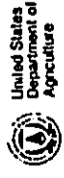
James L.K. Dahlberg  
Frank De Luz, III  
Takashi Domingo  
Robert Herkes  
Lorraine Jitchaku  
Russell Kokubun  
Merle K. Lai  
Spencer Kalani Schutte  
Stephen K. Yamashiro

Public Utilities

Hawaii Electric Light Company  
Hawaiian Telephone  
Gasco Inc., Hawaii Division

Community Organizations and Other Public Interest Groups

Hawaii Hotel Association  
Hawaii Leeward Planning Conference  
Kona Coast Chamber of Commerce  
Kona Outdoor Circle  
Life of the Land  
Moku Loa Group, Hawaii Chapter Sierra Club  
Na Ala Hele  
West Hawaii Committee



Soil Conservation Service

P.O. Box 50004  
Honolulu, HI  
96850

**RECEIVED**  
DEC 19 1985

**BELT, COLLINS  
& ASSOCIATES**  
Engineering - Planning  
Landscape Architecture

December 20, 1985  
85-2221

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Mr. Francis C. H. Lum  
State Conservationist  
U.S. Department of Agriculture  
Soil Conservation Service  
P.O. Box 50004  
Honolulu, Hawaii 96850

Dear Ms. Brown:

Subject: Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

XI-7

We have no comments to make on subject notice.

Sincerely,

*Francis C. H. Lum*  
FRANCIS C. H. LUM  
State Conservationist

cc: Gary Kam, DC, SCS, Kealahou FO

Dear Mr. Lum:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 17, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. Although you had no comments to make, the time you and your staff spent reviewing the document is appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986 and notice of its availability will be announced in the OEQC Bulletin. Your continued participation in the review process is requested.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:if

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 1401 Kalia Street, Honolulu, Hawaii 96813, Telephone: (808) 521-5161, Telex: H111174 B1177  
Singapore: 4045 Wilfrid Road, #12-01, International Banking Corporation, Singapore, 211600, Telex: 83-5404-11K ININ  
New York: 100 West 33rd Street, New York, NY 10018, Telephone: (212) 850-1100

The Soil Conservation Service is an agency of the Department of Agriculture





DEPARTMENT OF THE ARMY  
U. S. ARMY ENGINEER DISTRICT, HONOLULU  
FT SHAFTER, HAWAII 96856  
December 23, 1985

RECEIVED  
DEC 27 1985

ELLI, COLLINS & ASSOCIATES

Ms. Nancy Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Thank you for the opportunity to review and comment on the EIS Preparation Notice for Resort Development, Kaupulehu, North Kona, Hawaii. The following comments are offered:

a. The proposed marina on the north end of the property would require a DA permit. In addition, the presence of anchialine ponds has been noted adjacent to Kukio Bay in the vicinity of the proposed hotel and beach club during recent Operations Branch site investigations. It is recommended that the developer conduct a thorough survey of the property for presence and location of these ponds. In addition, any proposal to fill such ponds or Waiakuhi Pond and its adjacent wetlands would require a Department of the Army permit.

b. The project site is shown in the Concept Master Plan (Encl 1) which was provided in the Environmental Assessment (EA). According to the most recently published Flood Insurance Rate Maps (FIRM's), prepared by the Federal Insurance Administration for the County of Hawaii, shoreline portions of the project, extending approximately 0-500 feet inland or within the coastal high hazard area with Zone V15 designation (Encl 2), limits farther inland, Zone A4 designated areas delineate limits of coastal inundation without high velocity wave action. The base flood elevations range from 4-9 feet mean sea level. The remaining portion of the project site are within zone C, area of minimal flooding. An explanation of zone designations is provided in enclosure 3.

c. Section 1.2 "Storm Waves and Tsunamis", p. 3. It should be noted that the zone designation mentioned (Zone 11), differs from that found in the FIRM's (Zone V15 and A4). To our knowledge, the 1982 FIRM's used in this

-2-

evaluation are the most up-to-date flood hazard maps available. If you have questions regarding this matter, please contact our Flood Plain Management Section at 438-9865.

d. Page 2-4, Section 2.5. Although the Waiakuhi pond is mentioned several times in the report, there is no description nor interpretation of its significance anywhere.

e. Page 2-4, Section 2.5 and Page E-3, Section 5.4. The EA indicated that the Waiakuhi Ponds and any significant archaeological remains would be preserved and incorporated in the design and landscaping of the hotel grounds. This statement as well as the vague mitigation measures mentioned on page 5-3 would appear to indicate that:

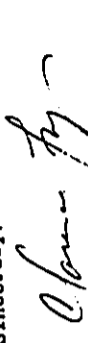
1. a prehistoric property and also a wetland could be adversely affected; and
2. extensive cultural properties could be adversely affected.

Therefore, a detailed Cultural Management Plan may be appropriate in order to schedule and perform archaeological investigations for both the EIS and construction phases.

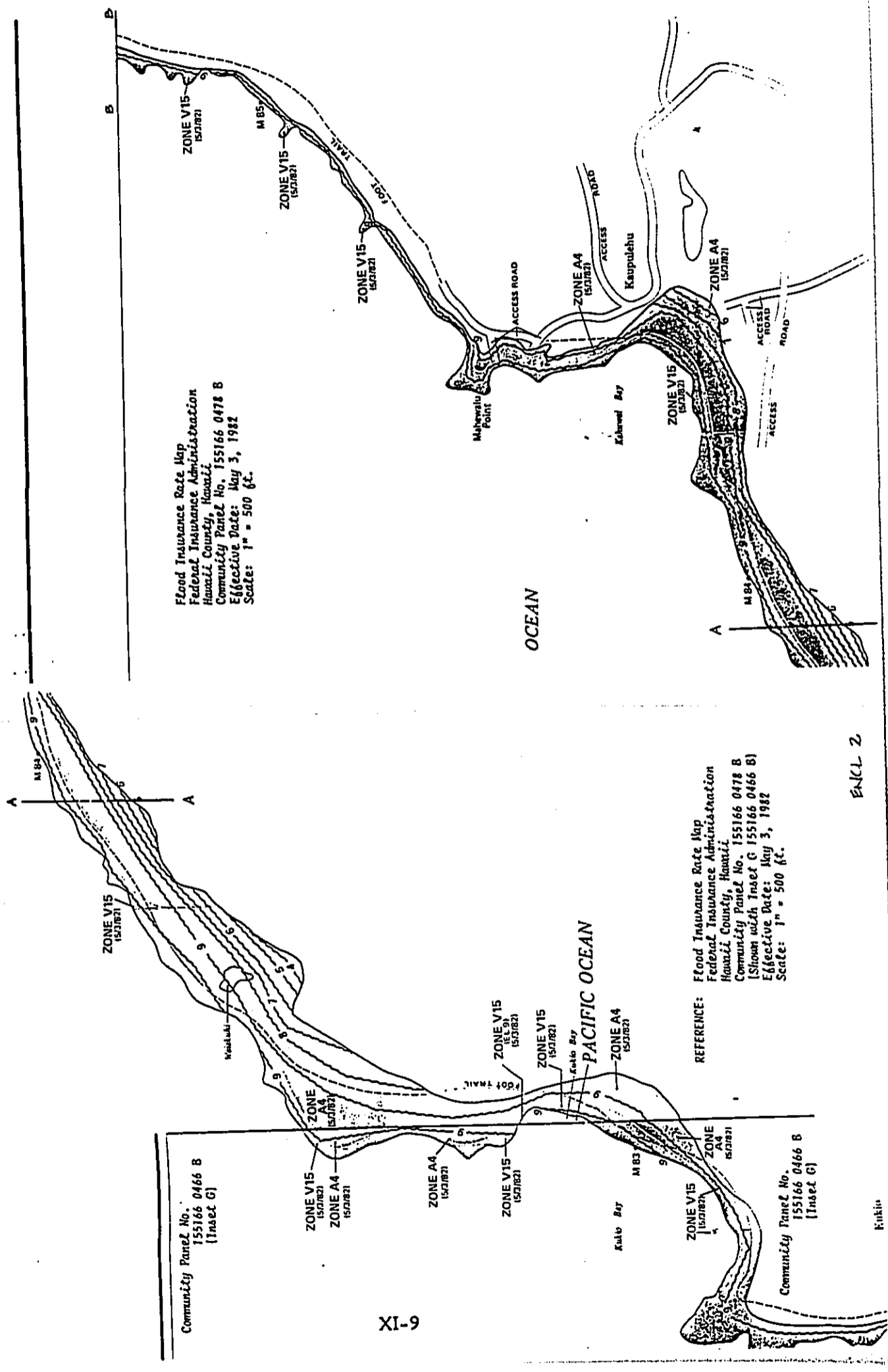
f. Page 3-6, Section 3.5. The basis of why the archaeological sites are not unique should be given. A copy of the 1984 Bishop Museum survey would be helpful since no information appears in the EA about the types of archaeological sites and the areas surveyed.

g. Page 5-5. The statement that - without the proposed development, research on archaeological sites or improved shoreline access would not occur - seems presumptuous. Improved shoreline access and research on archaeological sites involve numerous factors and are not necessarily dependent on development.

Sincerely,

  
Kisuk Cheung  
Chief, Engineering Division

Enclosures



Flood Insurance Rate Map  
 Federal Insurance Administration  
 Hawaii County, Hawaii  
 Community Panel No. 155166 0478 B  
 Effective Date: May 3, 1982  
 Scale: 1" = 500 ft.

Community Panel No.  
 155166 0466 B  
 (Inset G)

ZONE V15  
 (15/1/82)  
 ZONE A4  
 (15/1/82)

ZONE A4  
 (15/1/82)  
 ZONE V15  
 (15/1/82)

ZONE V15  
 (15/1/82)  
 ZONE V15  
 (15/1/82)  
 ZONE A4  
 (15/1/82)

Kalo Bay  
 M 83

ZONE V15  
 (15/1/82)  
 ZONE A4  
 (15/1/82)

Community Panel No.  
 155166 0466 B  
 (Inset G)

REFERENCE:  
 Flood Insurance Rate Map  
 Federal Insurance Administration  
 Hawaii County, Hawaii  
 Community Panel No. 155166 0478 B  
 (Shown with Inset G: 155166 0466 B)  
 Effective Date: May 3, 1982  
 Scale: 1" = 500 ft.



FLOOD INSURANCE RATE MAP (FIRM)  
FEDERAL INSURANCE ADMINISTRATION

\*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base elevations and hazard factors are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas between the 100-year flood and 500-year flood where the average depth of flooding is less than one square foot per acre; or areas between the 100-year flood and 500-year flood where the average depth of flooding is less than one square foot per acre; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of underseepage, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity force action; base flood elevations and flood hazard factors not determined.
V1-V20	Areas of 100-year coastal flood with velocity force action; base flood elevations and flood hazard factors determined.

ENCL 3

KEY TO MAP

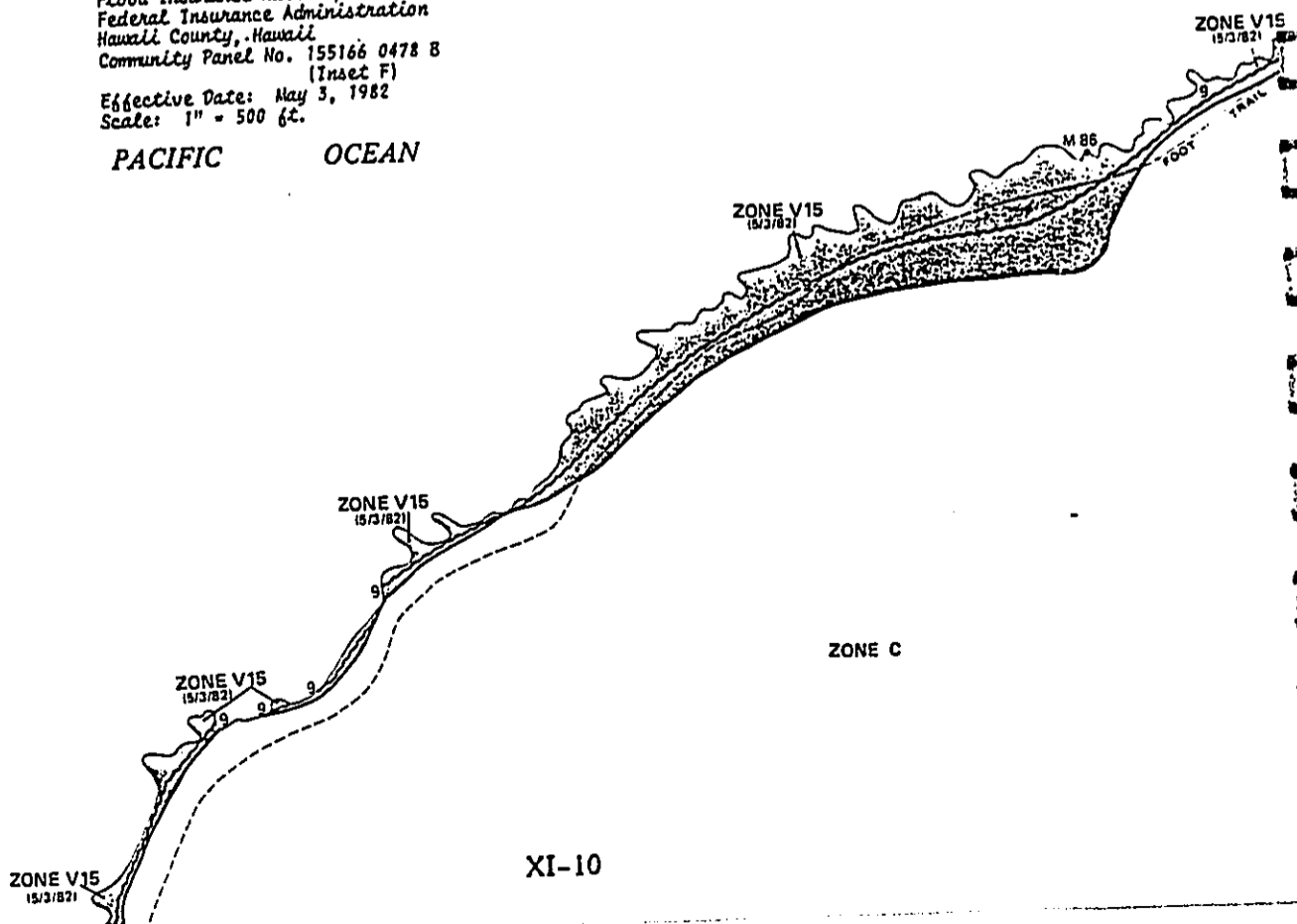
100-Year Flood Boundary	ZONE B
100-Year Flood Boundary	ZONE B
Zone Designations With Date of Issuance e.g. 12/27/74	ZONE B
100-Year Flood Boundary	513
100-Year Flood Boundary	513
Base Flood Elevation Line With Elevation in Feet**	IEL 0871
Base Flood Elevation in Feet Where Uniform Within Zone**	RI17, X
Elevation Reference Mark	• M1.5
River Mile	
**referenced to the National Geodetic Vertical Datum of 1929	

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.  
This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.  
For adjoining map panels, see separately printed Index To Map Panel.

INSET F

Flood Insurance Rate Map  
Federal Insurance Administration  
Hawaii County, Hawaii  
Community Panel No. 155166 0478 B  
(Inset F)  
Effective Date: May 3, 1982  
Scale: 1" = 500 ft.



BEIT COLLINS  
& ASSOCIATES  
Engineering • Planning  
Landscape Architecture

January 15, 1986  
86-112

Mr. Kisuk Cheung  
Chief, Engineering Division  
Department of the Army  
U.S. Army Engineer District, Honolulu  
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 23, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The information you provided will be helpful to us in the preparation of the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:jf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu office and Silver, Honolulu, Hawaii 96813. Telephone: (808) 521-5361. Telex: 010117100124  
Washington, D.C. office: 1100 North 17th Street, Suite 1000, Arlington, VA 22209. Telephone: (703) 525-1100  
Portland, Oregon office: 1000 NE Oregon Street, Suite 1000, Portland, OR 97232. Telephone: (503) 255-1100



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
100 ALA MOANA BOULEVARD  
P.O. BOX 50187  
HONOLULU, HAWAII 96810

RECEIVED

DEC 20 1985

MILLER & ASSOCIATES  
ES  
Room 6307

DEC 27 1985

Belt, Collins, and Associates  
Attn: Nancy E. Brown  
606 Coral Street  
Honolulu, Hawaii 96813

Re: Environmental Impact Statement Preparation Notice,  
Resort Development, Kaupulehu, North Kona, Hawaii

The U.S. Fish and Wildlife Service has reviewed the referenced document and offers the following comments for your consideration.

It appears that several anchialine ponds and an anchialine pond/wetland are present in the affected area (Aquatic Survey of the Kona Coast Ponds, Hawaii Island, 1974. J.A. Maciolek and R.E. Brock and Draft Anchialine Pond Survey of the Northwest Coast of Hawaii Island, 1985. OI Consultants, Inc.). The Environmental Impact Statement (EIS) should include a map showing the location of anchialine ponds and wetlands in the affected area; a discussion of the macro-biota found in these habitats, including endangered water birds, migratory shorebirds, anchialine organisms, and wetland flora; and a discussion of potential primary and secondary impacts to these habitats from the proposed project.

With the exception of Lanai and Molokai, Hawaii Island has the smallest acreage of wetland habitat of the major Hawaiian Islands (Water Birds of Hawaii Island, 1985. P.W.C. Paton and J. M. Scott, Elepsio, Vol. 45, No. 8.). The Service is particularly interested in the preservation and enhancement of Waikahi Pond for endangered Hawaiian water birds. Our office is willing to work with you and the developers in developing a design to enhance the endangered water bird value of Waikahi Pond. This design concept would include creating open water areas and visual buffers for water birds.

Page 2-2 Figure 5, Concept Master Plan, shows a marina at the north end of the property. However, the Preparation Notice does not include a discussion of potential impacts of a marina on nearshore marine resources or water quality. The EIS should include potential designs of the proposed marina and potential impacts of the proposed marina on nearshore marine resources.

Page 3-4 mentions that the ohai (*Sesbania* sp.), a Category I candidate endangered species, was found near the water tank inland of the Kona Village Resort. It is our understanding that the developer plans to configure the golf course to avoid the water tank area and avoid the plant. This configuration should be discussed in the EIS.

We appreciate the opportunity to comment.

Sincerely yours,

*Peter A. Steins*

Ernest Kosaka  
Project Leader  
Office of Environmental Services

cc: NMFS - WPPD  
DLNR  
EPA, San Francisco



**BELT, COLLINS  
& ASSOCIATES**  
Engineering - Planning  
Landscape Architecture

January 15, 1986  
86-121

Mr. Ernest Kosaka  
Project Leader  
Office of Environmental Services  
Fish and Wildlife Service  
U.S. Department of the Interior  
P.O. Box 50167  
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 27, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments will be helpful to us in the preparation of the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu International Airport, Honolulu, Hawaii 96814, Telephone: (808) 531-5001, Telex: 101111 ZI HAWAII  
Singapore 441111 Road #12, The International Building, Singapore 0511, Telephone: 2551620, Telex: RS 42041 R KNS



United States Department of the Interior

RECEIVED  
DEC 9 1985

GEOLOGICAL SURVEY  
Water Resources Division  
P.O. Box 50166  
Honolulu, Hawaii 96850

BEIT COLLINS  
& ASSOCIATES  
ENGINEERING • PLANNING  
LANDSCAPE ARCHITECTURE

December 20, 1985  
85-2206

Ms. Nancy E. Brown  
Beit, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

The subject environmental assessment has been reviewed by personnel from the Hawaii District Office of the U.S. Geological Survey, Water Resources Division. Our principal concerns were the hydrology and geology sections of the assessment. We have no comments to make at this time.

We appreciate the opportunity to review the Environmental Impact Statement preparation notice.

Sincerely,

*Stanley F. Kapustka*  
Stanley F. Kapustka  
District Chief

Mr. Stanley F. Kapustka  
District Chief  
U.S. Department of the Interior  
Geological Survey  
Water Resources Division  
P.O. Box 50166  
Honolulu, Hawaii 96850

Dear Mr. Kapustka:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 6, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. Although you had no comments to make, the time you and your staff spent reviewing the document is appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 406 Coral Street, Honolulu, Hawaii 96813 Telephone (808) 531-5161 Telex DE1114748074  
Singapore 160 Orchard Road, #17-06, International Building, Singapore 19737 Telephone 21564870 Telex RS 50464 INCISIN  
Suva 14-17, First Floor 19, Fanning Street, Suva, Fiji Telephone 322-1111 Telex 804 187

433-3902  
js-

December 2, 1985

**BELT, COLLINS  
& ASSOCIATES**  
ENGINEERS • PLANNERS  
LANDSCAPE ARCHITECTS

**RECEIVED**

NOV 25 1985

EIS, CEQAS & PERMITS

**AIRPORTS DISTRICT OFFICE**  
BOX 50244  
HONOLULU, HI 96850-0001  
Telephone: (808) 546-7129

 **U.S. Department  
of Transportation**  
Federal Aviation  
Administration

November 22, 1985

**Belt, Collins & Associates**  
606 Coral Street  
Honolulu, Hawaii 96813

Gentlemen:

This is in regard to the proposed EIS for the State Land Use District Boundary Petition for Kaupulehu Development, Kaupulehu, North Kona District, Hawaii. Since the resort is near the Keahole Airport, the potential noise exposure from aircraft over flights should be assessed.

Sincerely,

*David J. Welhouse*

**David J. Welhouse**  
Planning Engineer

**Henry A. Sumida**  
Airports District Office Manager

**Mr. David J. Welhouse, Planning Engineer**  
U.S. Department of Transportation  
Federal Aviation Administration  
Airports District Office  
Box 50244  
Honolulu, HI 96850-0001

Dear Mr. Welhouse:

Subject: Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your interest in the Environmental Impact Statement (EIS) we are preparing for the Kaupulehu Resort Development. The EIS Preparation Notice and the Environmental Assessment are enclosed.

A noise consultant will help us prepare the EIS and we will make sure your concern regarding potential noise exposure from aircraft arriving and departing from Keahole Airport is addressed.

We expect the Draft EIS to be available for public review in March 1986 and we will send a copy to you. If you have other concerns or questions, please call me at 521-5361.

Sincerely,

*Nancy E. Brown*

**Nancy E. Brown**

Enclosure

Honolulu: 606 Coral Street, Honolulu, Hawaii 96813, Telephone: (808) 521-5351, Telex: BELT11 719074  
Singapore: 360 Orchard Road, #12-08, International Building, Singapore 0713, Telephone: 235-6400, Telex: RS 50464 RLUSIN  
Auckland: Level 2, First Floor, 19 Governor Street, Neutral Bay, Sydney, NSW 2089, Telephone: 908 1188

GEORGE R. ARIYOSHI  
GOVERNOR



STATE OF HAWAII  
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES  
DIVISION OF PUBLIC WORKS  
P. O. BOX 119 HONOLULU, HAWAII 96810

HIDEO MURAKAMI  
COMPTROLLER  
MIKE N. TOMINAGA  
DEPUTY COMPTROLLER

LETTER NO. (P)1854.5

BELT, COLLINS  
& ASSOCIATES  
ENGINEERS - PLANNING  
LANDSCAPE ARCHITECTS

December 20, 1985

85-2214

DEC - 6 1985

Mr. Teuane Tominaga  
State Public Works Engineer  
Department of Accounting & General Services  
Division of Public Works  
State of Hawaii  
P.O. Box 119  
Honolulu, Hawaii 96810

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Subject: Environmental Impact Statement  
Preparation Notice  
Resort Development, Kaupulehu, North Kona

We have reviewed the subject document and have no  
comments to offer.

Very truly yours,

*Teuane Tominaga*  
TEUANE TOMINAGA  
State Public Works Engineer

CT:jk

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 6, 1985--Letter No. (P) 1854.5--  
acknowledging receipt of the Environmental Impact Statement Preparation Notice and  
Environmental Assessment for Kaupulehu Developments' proposed project. Although you  
had no comments to make, the time you and your staff spent reviewing the document is  
appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office  
of Environmental Quality Control (OEQC) in March 1986 and notice of its availability will be  
announced in the OEQC Bulletin. Your continued participation in the review process is  
requested.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 1615 Coral Street, Honolulu, Hawaii 96813, Tel: 808-531-2800  
Honolulu 1615 Coral Street, Honolulu, Hawaii 96813, Tel: 808-531-2800  
Honolulu 1615 Coral Street, Honolulu, Hawaii 96813, Tel: 808-531-2800

GEORGE R. ARIYOSHI  
GOVERNOR



RECEIVED  
DEC 16 1985

JACK K. SUWA  
CHAIRPERSON, BOARD OF AGRICULTURE  
BILT, COLLINS & ASSOCIATES  
SUZANNE D. PETERSON  
DEPUTY TO THE CHAIRPERSON

BILT, COLLINS  
& ASSOCIATES  
Engineering, Planning  
Landscape Architects

State of Hawaii  
DEPARTMENT OF AGRICULTURE  
1428 So. King Street  
Honolulu, Hawaii 96814-2512  
December 12, 1985

Mailing Address:  
P. O. Box 22159  
Honolulu, Hawaii 96822-0159

December 20, 1985  
85-2213

Ms. Nancy E. Brown  
Belt Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Environmental Impact Statement (EIS) Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

The Department of Agriculture has reviewed the subject document and has the following comments to offer.

The entire project site is within the State Conservation or Urban District boundaries. Only the well site which is described as being at "...the 1,400-foot elevation on the mauka portion of the property" (document, page 5-2) involves lands within the Agricultural District.

The Draft EIS should address the anticipated water usage of the resort for both potable water as well as irrigation water for the golf courses. Any adverse impacts to agriculture in the region caused by groundwater withdrawal should be described.

Thank you for the opportunity to comment.

Sincerely,

*Jack K. Suwa*  
JACK K. SUWA  
Chairman, Board of Agriculture

Mr. Jack K. Suwa  
Chairman, Board of Agriculture  
Department of Agriculture  
State of Hawaii  
P.O. Box 22159  
Honolulu, Hawaii 96822-0159

Dear Mr. Suwa:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 12, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The Draft Environmental Impact Statement (DEIS) will discuss the anticipated potable water use for the development and irrigation water use for the golf courses. Potential adverse impacts to agriculture in the region caused by the increased withdrawal of groundwater will also be addressed.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:lf

cc: Alexander Kimzler, Kaupulehu Developments

Honolulu 1405 Federal Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex: 081311 ZENB424  
Singapore 4011 Robinson Road, #1218b, International Building, Singapore 0721, Telex: 331548ZU, Khas: 85 54844 IK ISIN  
Nishi-Ariyoshi, 1st Floor, 19 Chitose Street, Nishi-Ariyoshi, Nishi-Ku, Kyoto 600, Japan, Telephone: 075 311 106



GEORGE R. ANTOSHS  
Director

HAWAIIAN PUBLIC UTILITIES COMMISSION  
OFFICE OF THE PUBLIC UTILITIES COMMISSION  
OFFICE OF THE PUBLIC UTILITIES COMMISSION



STATE OF HAWAII  
DEPARTMENT OF BUDGET AND FINANCE  
STATE CAPITOL  
P.O. BOX 190  
HONOLULU, HAWAII 96813-0190

JENSEN S. L. HEE  
DIRECTOR

DEPT. OF BUDGET AND FINANCE  
STATE CAPITOL

DIVISIONS:  
BUDGET, PLANNING AND MANAGEMENT  
FISCAL AND ECONOMIC DATA COLLECTION  
FINANCE

BELT, COLLINS  
& ASSOCIATES  
LANDSCAPE ARCHITECTURE

December 20, 1985  
85-2205

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

This is in response to your letter of November 21, 1985 regarding an Environmental Impact Statement for the Resort Development at Kaupulehu, North Kona, Hawaii.

This office has no specific jurisdiction or responsibility over any area related to the proposed project and the environmental impact, and therefore has no comment to make.

Thank you for the opportunity to comment on the proposal.

Very truly yours,

*Jensen S. L. Hee*  
JENSEN S. L. HEE

Mr. Jensen S. L. Hee, Director  
Department of Budget and Finance  
State of Hawaii  
P.O. Box 150  
Honolulu, Hawaii 96810-0150

Dear Mr. Hee:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 11, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. Although you had no comments to make, the time spent by you and your staff reviewing the document is appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986 and notice of its availability will be announced in the OEQC Bulletin. Your continued participation in the review process is requested.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NED:if

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu: 606 Coral Street, Honolulu, Hawaii 96813. Telephone: (808) 521-5101. Telex: 381111 JENHEE  
Singapore: 301 Orchard Road, #12-01, International Building, Singapore 238 0871. Telex: 35 66871 JEN  
Auckland: Level 2, First Street, 19 Victoria Street, Auckland, New Zealand. Telex: 35 66871 JEN

December 20, 1985  
85-2208

**BELT, COLLINS  
& ASSOCIATES**  
Engineers, Planners  
Landscape Architects

ALEXIS T. LUM  
Major General  
Adjutant General  
State of Hawaii  
DANIEL E. C. JAY  
Major General  
Adjutant General  
State of Hawaii

DEC 11 1985



STATE OF HAWAII  
DEPARTMENT OF DEFENSE  
OFFICE OF THE ADJUTANT GENERAL  
240 DUKONO FIELD ROAD, HONOLULU, HAWAII 96813

GEORGE R. ANTONIO  
Major General

HIENG

Belt, Collins & Associates  
ATTN: Nancy E. Brown  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for providing us the opportunity to review the above subject project.

We have completed our review and have no comments to offer at this time.

Yours truly,

*Jerry M. Matsuda*

Jerry M. Matsuda  
Major, Hawaii Air  
National Guard  
Contr & Engr Officer

Mr. Jerry M. Matsuda  
Major, Hawaii Air National Guard  
Department of Defense  
Office of the Adjutant General  
State of Hawaii  
3949 Diamond Head Road  
Honolulu, Hawaii 96816

Dear Mr. Matsuda:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 11, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. Although you had no comments to make, the time you and your staff spent reviewing the document is appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986 and notice of its availability will be announced in the OEQC Bulletin. Your continued participation in the review process is requested.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:if

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 606 Coral Street, Honolulu, Hawaii 96813 Telephone (808) 521-5361, Telex: BELH17400A  
Singapore, 360 Orchard Road, #12-06, International Building, Singapore 0221 Telephone: 2356670, Telex: RS 50464 BCESIN  
Aurillac Street 2, First Floor, 19 Convent Street, Hermitage Hotel, Singapore 0481168

GEORGE A. AIRBORN  
Governor



Francis M. Hatanaka

RECEIVED  
DEC 19 1985

BELT, COLLINS & ASSOCIATES

STATE OF HAWAII  
DEPARTMENT OF EDUCATION

P. O. BOX 2206  
HONOLULU, HAWAII 96804

December 13, 1985

OFFICE OF THE SUPERINTENDENT

Belt, Collins, & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Attn: Ms Nancy E. Brown

Dear Ms Brown:

SUBJECT: EIS Preparation Notice  
Kaupulehu, North Kona, Hawaii

Our review of the subject development indicates that no significant enrollment impact is anticipated should the project be developed as planned.

Schools serving the area are Kealahou Elementary-Intermediate, K-8, and Kona Waena High, 9-12.

Should there be any questions, please contact Mr. Howard Lau at 737-4743.

Sincerely,

Francis M. Hatanaka  
Superintendent

FMH:jl

cc V. Honda, OOS  
K. Mizuba, Hawaii Dist.

AN EQUAL OPPORTUNITY EMPLOYER

BELT, COLLINS  
& ASSOCIATES  
ENGINEERS • PLANNERS  
LANDSCAPE ARCHITECTS

Mr. Francis M. Hatanaka  
Superintendent  
Department of Education  
State of Hawaii  
P.O. Box 2360  
Honolulu, Hawaii 96804

Dear Mr. Hatanaka:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 17, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. Your comments will be included in the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

Nancy E. Brown

NEB:ll

cc: Alexander Kinzler, Kaupulehu Developments

December 20, 1985  
85-2220

Honolulu 406 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 531-5101, Telex: H111174NM74  
Singapore 401 Orchard Road #2706, International Building, Singapore 0921, Telephone 2151600, Telex: H155144 DK 151N  
Australia Level 2 Ford House 19 Lawrence Street, Neutral Bay, Sydney, NSW, 2059, Telephone 9481100

RECEIVED

JAN 17 1985

DR. COLLINS & ASSOCIATES, L.L.C. HONOLULU, HAWAII



STATE OF HAWAII DEPARTMENT OF HEALTH

P. O. BOX 3274 HONOLULU, HAWAII 96811

IN REPLY, PLEASE REFER TO: EPH60

December 31, 1985

Ms. Nancy E. Brown  
Beit Collins & Associates  
606 Coral St.  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Subject: Request for Comments on Environmental Impact Statement Preparation  
Notice for Resort Development, Kaupulehu, N. Kona, Hawaii

Thank you for allowing us to review and comment on the subject EIS preparation notice. We provide the following comments:

Receiving Water Quality

- a. Municipal drinking water and wastewater treatment systems or their equivalents are recommended as the most appropriate alternatives because of the magnitude of the proposed project. The projected concern is the maintenance of the water quality of the receiving waters.
- b. Nearshore waters. Due to the highly porous nature of the project site, proper maintenance of the landscape fertilization and golf course irrigation (with sewage effluent) will be necessary to minimize the percolation of nutrients into the nearshore waters.
- c. Waiakahi Pond. Section II-54-05, Water Quality Standards defines "anchialine pool" as:  
"Standing waters that vary in salinity and basin limits and are not surface connected to the ocean except in rare circumstances. These pools are natural brackish water exposures which are near coastlines in recent lavas and, rarely, in fossil reefs and which have tidal fluctuations. They are usually small, shallow pools of low salinity (1,000 to 10,000 ppm) with distinctive biota but usually no fishes."  
If Waiakahi Pond is an anchialine pool, the "Basic Water Quality Criteria," Section II-54-04 would be applicable.

Reuse of Treated Sewage Effluent

Although there are distinct advantages in the reuse of wastewaters, certain public health concerns still exist. Reclaimed water is a potentially hazardous substance, since prevailing wastewater treatment processes are generally incapable of removing all of the biological and chemical contaminants that are present in the wastewater. The principal

Ms. Nancy E. Brown  
December 31, 1985  
Page 2

hazard from the use of reclaimed water appears to be the increased exposure of the public to pathogens. The primary area of concern is the direct public contact with wastewater.

In order to minimize public contact with the wastewater, it will be necessary to establish various environmental controls.

- a. Increase public awareness by posting signs, for casual users (golfers, joggers, etc.).
- b. Education of golf course and landscape maintenance workers on the proper handling of treated wastewater.
- d. Elimination of potential cross connectin of potable drinking water sources with wastewater (i.e., hose bibs on the wastewater system should not be accessible by the general public).
- d. Establishment of reliable operation and maintenance of the wastewater reuse system.
- e. Establishment of buffer zones between conflicting uses (i.e., sufficient spacing of residential developments from spray irrigation systems).

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

Sincerely,

*James K. Ikeda*  
JAMES K. IKEDA  
Deputy Director for  
Environmental Health

cc: DHS-A, Hawaii

**BELT, COLLINS  
& ASSOCIATES**  
Engineering - Planning  
Landscape Architecture

January 15, 1986  
86-119

Mr. James K. Ikeda  
Deputy Director for Environmental Health  
Department of Health  
State of Hawaii  
P.O. Box 3378  
Honolulu, Hawaii 96801

Dear Mr. Ikeda:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of January 2, 1986 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments will be helpful to us in preparing the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:ll

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 1000 Ala Moana Street, Honolulu, Hawaii 96813 Telephone: (808) 551-2400  
New York 10017 11th Street, New York, NY 10019 Telephone: (212) 697-1100  
Washington, DC 20004 11th Street, Washington, DC 20004 Telephone: (202) 638-1100

GEORGE W. ARIYOSHI  
GOVERNOR



STATE OF HAWAII  
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS  
825 MILILANI STREET  
HONOLULU, HAWAII 96813

December 20, 1985

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

This is in response to your letter of November 21, 1985 regarding the environmental impact statement preparation notice for the Kaupulehu Resort Development in North Kona, Hawaii.

We feel that a project as large as Kaupulehu Development will require a substantial number of workers during the construction period as well as the operational period. You may want to address the availability of the labor supply necessary to fill the jobs that will be created.

Thank you for providing us the opportunity to review the environmental impact statement preparation notice. If you need more information or have any questions, please call me at 548-3150 or Frederick Pang, Chief, Research and Statistics Office at 548-7639.

Sincerely,

*Joshua C. Apsalud*  
Joshua C. Apsalud  
Director of Labor and Industrial Relations

RECEIVED  
DEC 27 1985

BELT, COLLINS & ASSOCIATES  
ROBERT C. GILKEY  
DEPUTY DIRECTOR

BELT COLLINS  
& ASSOCIATES  
ENGINEERS - ARCHITECTS  
LANDSCAPE ARCHITECTURE

January 15, 1986  
86-111

Mr. Joshua C. Apsalud, Director  
Department of Labor and Industrial Relations  
State of Hawaii  
825 Mililani Street  
Honolulu, Hawaii 96813

Dear Mr. Apsalud:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 20, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The Draft Environmental Impact Statement (DEIS) will address the number of workers required during construction and operation and the availability of the labor supply.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:if

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu: 1601 Kalia Street, Honolulu, Hawaii 96813. Telephone: (808) 521-5261. Telex: H011017240174  
Singapore: 201 Orchard Road #1701, International Building, Singapore 0721. Telephone: 235-6971. Telex: RN 50164 R R IND  
Seattle: 1000 4th Avenue, 10th Floor, Seattle, WA 98101. Telephone: 206-464-1000

RECEIVED  
DEC 19 1985



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
P. O. BOX 651  
HONOLULU, HAWAII 96809

SUSUMU OHNO, CHAIRMAN  
BOARD OF LAND AND NATURAL RESOURCES  
EDGAR A. WALKER  
DIRECTOR OF THE DEPARTMENT  
DIVISIONS:  
AGRICULTURE DEVELOPMENT  
ADULT EDUCATION  
ADULT RESOURCES  
COMMERCE AND  
INDUSTRY DEVELOPMENT  
CONSUMER PROTECTION  
CONTRACTS AND LEASING  
LAND MANAGEMENT  
SITE PLANNING  
WATER AND LAND DEVELOPMENT

DEC 19 1985 REF. NO.: CPO-2157-85  
DOC. NO.: 0129C

Ms. Nancy E. Brown  
Belt, Collins and Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

SUBJECT: EIS Preparation Notice, Resort Development,  
Kaupulehu, North Kona, Hawaii

Thank you for your letter of November 21, 1985 in which you  
have requested comments from the Department of Land and Natural  
resources on your pending EIS for the Kaupulehu Development. Your  
EIS should address the following concerns:

1. Page 2-6 of your environmental assessment gives the range of the project's development. A similar range of projected water demand, based upon estimates of specific users, e.g., golf course, condominium, hotel, etc., should be included. Location(s) of the water source and transmission routes should be mapped with estimated volumes.
2. The location, volume and method of sewage disposal should be outlined. The potential effects of sewage on the offshore waters and groundwater must be addressed.
3. Soil erosion, especially transported material for the golf courses, and mitigative measures should be addressed.
4. The EIS should contain sufficient information on historic sites to adequately conduct an assessment of
  - (a) The nature of historic sites;
  - (b) The significance of these sites;

Nancy Brown  
Belt, Collins and Assoc.  
Page 2

- (c) The impacts of the proposed developments to these sites; and,
  - (d) Any mitigative measures to reduce any adverse impacts to any significant sites.
5. Mapped locations of public access to the ocean should be included.
  6. A statement of Waiakuhi Pond's macrofauna and the pond's potential value to migratory shorebirds should be included.

Thank you for this opportunity to comment on the proposed  
Kaupulehu Development.

Very truly yours,

SUSUMU OHNO, Chairperson  
Board of Land and Natural Resources

BELT, COLLINS  
& ASSOCIATES  
Planning • Planning  
Landscape Architecture

January 15, 1986  
86-122

Mr. Susumu Ono, Chairperson  
Department of Land and Natural Resources  
State of Hawaii  
P.O. Box 621  
Honolulu, Hawaii 96809

Dear Mr. Ono:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 19, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The Draft Environmental Impact Statement (DEIS) will address the concerns stated in your letter, including information on water supply and demand, the planned method of sewage disposal, soil erosion potential and mitigative measures, information on historic sites, shoreline access and a discussion of Walakahi Pond.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:ff

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu District and State of Hawaii  
Maplewood, 1441 Kalia Road #11, Honolulu, Hawaii 96813  
Telephone: (808) 551-2100  
Fax: (808) 551-2101  
Telex: 860000  
Cable: 860000





DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

HAWAIIAN BLDG. 250 SOUTH KING ST. HONOLULU, HAWAII  
MAIL ROOMS: PO BOX 2011 HONOLULU, HAWAII 96813

RECEIVED  
JAN 7 1986

GEORGE B. AITON  
KENT M. LEITH  
MURRAY E. KOWAL  
AND ASSOCIATES  
PLANNING & ASSOCIATED ARCHITECTS  
1110 KALANIAN'OLEHI DR.  
HONOLULU, HAWAII 96813

RECEIVED  
JAN 7 1986  
MURRAY E. KOWAL  
AND ASSOCIATES  
PLANNING & ASSOCIATED ARCHITECTS  
1110 KALANIAN'OLEHI DR.  
HONOLULU, HAWAII 96813

Ref. No. P-3248

January 2, 1986

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

SUBJECT: Preparation Notice, Environmental Impact Statement (EIS/NI),  
Resort Development, Kaupulehu, North Kona, Hawaii

We have reviewed the subject EIS/NI and Environmental Assessment (EA)  
and offer the following comments.

Background Information

The Land Use Commission (LUC) classified approximately 318 acres  
within the Urban District at Kaupulehu in 1974. The Kona Village Resort was  
built on approximately 65 acres. In 1981 a petition (Docket No. A81-524) was  
submitted to the LUC requesting an additional 65 acres from the Conservation  
District to the north of the original 318 acres. To offset this  
65-acre conversion to Urban, the petition also requested that 65 acres of the  
318-acre Urban District be reclassified from Urban to Conservation. The LUC  
approved the request per Decision and Order dated August 12, 1982.

The petition proposed to develop a 65-acre site detached and to the  
north of the existing Kaupulehu Urban District in order to maintain the  
integrity and isolated atmosphere of the existing Kona Village Resort. The  
proposed development included a low-rise hotel condominium complex of  
approximately 350 one and two-bedroom units in 18-unit clusters. Also  
proposed was a central building to house the common facilities such as  
registration area, restaurants, commercial space and management offices.  
Recreational amenities included a swimming pool and tennis courts.

The current petition (Docket No. A85-597) proposes a self-contained,  
intermediate resort/residential community, which would add approximately 575  
acres to the existing Urban District. The current petition also proposes to  
return approximately 123 acres from the Urban District to the Conservation  
District. The plans include a 600 to 900 room hotel with a beach club; 50 to  
150 residential beach condominiums; 350 to 450 golf course condominium units  
and two 18-hole golf courses.

Ms. Nancy E. Brown  
Page 2  
January 2, 1986

Recreational Resources

The proposed project abuts the shoreline (which includes a white sand beach) and Class AA open coastal waters. The EA states that access to the shoreline will be provided (p. 5-4), but it does not discuss how shore access will be provided nor the specific facilities to be provided (such as parking and comfort station facilities). Additionally, the project proposes to develop a recreational beach club facility, but does not discuss public use of the facility.

An existing adjacent development, Kona Village, is a very exclusive resort development which does not provide public access to the site nor the shoreline. A guard station on the only access road screens traffic to the resort. The EIS should discuss how the proposed project, which includes proposed development to the immediate south and north of Kona Village, will affect lateral access along the coastline and describe in more specific terms how access will be provided.

Historic Resources

Previously completed archaeological studies of the area have identified numerous archaeological sites. In response, the project proposes further extensive surveys which will recommend mitigation measures and has already planned for the establishment of archaeological preserves at three sites (identified on the conceptual master plan). The EIS should discuss the findings and recommendations of the proposed extensive surveys, and public access to significant archaeological finds. The preserves are located along the access route to Kona Village which, as previously discussed, is not accessible to the public. It is unclear if public access to the preserves will be provided.

Scenic and Open Space Resources

The physical dimensions of the 600-900 unit hotel are not described in the EA. The development of a large, tall structure at the shoreline may pose potentially adverse scenic and aesthetic impacts. These impacts and possible mitigation measures should be further discussed in the EIS.

Coastal Hazards

The project's shoreline areas are located within the coastal high hazard area and are susceptible to tsunami inundation (Zone V-15). Development within this area should be consistent with the National Flood Insurance Program.

Ms. Nancy E. Brown  
Page 3  
January 2, 1986

#### Ecosystems

The EA indicates that one O'hai tree, a candidate endangered species, had been found, but it does not describe plans for the tree (pulling it out, relocation, leaving it there). The EIS should discuss this further.

The project site is described as porous lava with little or no ground cover. The EA states that most rainfall percolates into the ground to the underlying (brackish) groundwater body and moves seaward to be discharged at the coast. Since the project proposes to import soil for the golf courses and to utilize effluent from a secondary sewage treatment plant (we note that the EA does not specify whether this plant would be a new plant or an expansion of the plant used by Kona Village) for irrigation, the EIS should further discuss the potential impacts upon coastal water quality and offshore ecosystems due to these effects, as well as mitigation measures to address adverse impacts.

#### Impacts on Other Resort Areas

According to the State Tourism Plan Technical Reference Document dated October 1981, Kaupulehu is a "Designated Visitor Destination Area" and is also designated as an "Intermediate Resort Area" by the County of Hawaii. Due to the significant increase in magnitude of the current petition (Docket No. A85-597), the EIS should address the impact that the proposed development of the Kaupulehu environs would have on the "Designated Visitor Destination Areas" of North Kona (Kailua, Keauhou-Kahaluu, Mohokou-Kaloko) and South Kona (Anaeboomalu, Kawahae-Hapuna, Ruako-Honokaae Bay). Between North and South Kona, the proliferation of hotels along the shoreline and associated resort condominium projects could have a detrimental effect on the luxury South Kona resort areas of Waikoloa, Mauna Lani, and Mauna Kea. The social, visual, resource and market impacts should be thoroughly addressed in the EIS.

More specifically, the EIS should also address the impact the proposed Kaupulehu expansion would have on the existing Kona Village Resort with an internationally known image and reputation of a quality resort which allows the guests to achieve the unique rural village atmosphere and the feeling of remoteness in a "Polynesian hide-away" setting.

#### Cumulative Impacts

Cumulative impacts of the concept master plan are inadequately addressed. The concept master plan (Figure 5, p. 2-2) indicates a golf course, condominiums, and a marina north of Kona Village. The EA focuses discussion on the development proposed south of Kona Village. While it mentions the marina and the adjacent condominiums, it does not describe these in detail nor the associated potential impacts. The EA does not describe the golf course at all. Additionally, the EA implies that further development in the mauka area of the Kaupulehu a'upuaa (Kaupulehu Mauka) will occur, but

Ms. Nancy E. Brown  
Page 4  
January 2, 1986

scarcely describes this. It states that a new well developed for the Kaupulehu mauka properties will be used to service the mauka development, but only implies that the proposed sewage system will be similarly designed to service both areas. The concept master plan does not indicate the location of the sewer treatment plant; hence, it is assumed that it will be located off-site, perhaps in the Kaupulehu mauka development or as an expansion of the Kona Village facility.

The EIS should also further discuss social impacts, such as the number of new jobs created, increased pressure on public services such as schools, and the provision of police and fire services.

We request clarification as to the number of condominium units to be built. On page 2-4, the EA states that 350-450 condominium units would be situated on approximately 60 acres within the golf courses, but on page 2-6, Table 3 indicates 300-450 units for that area.

#### Relationship to Public Policies

The EA has examined the relationship of the proposed project to the Hawaii State Plan and has identified and reviewed pertinent objectives and policies related to the visitor industry in Chapter IV of the report. This review should not be limited to objectives and policies for the economy-visitor industry (Section 226-8, HRS). For example, relevant objectives and policies for the physical environment, Section 226-11 through 226-13, HRS should be reviewed as well as relevant objectives and policies for facility systems, Sections 226-14 through 226-16, HRS. There are also Priority Guidelines which may relate to the proposed project.

We would appreciate the opportunity to review the Environmental Impact Statement when it is prepared.

Very truly yours,

*Kent M. Keith*

Kent M. Keith

cc: Office of Environmental Quality Control  
Land Use Commission

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

January 15, 1986  
86-120

Mr. Kent M. Keith, Director  
Department of Planning & Economic Development  
State of Hawaii  
P.O. Box 2339  
Honolulu, Hawaii 96704

Dear Mr. Keith:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of January 2, 1986 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments will be helpful to us in preparing the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 4000 Coast Street Honolulu Hawaii 96818 Telephone (808) 531-5300 Telex 101111240077  
Singapore 111, Bras Basah Road #12 The International Building Singapore 228903 Telex 350433444  
Singapore 111, Bras Basah Road #12 The International Building Singapore 228903 Telex 350433444

December 20, 1985  
85-2204

**BELT, COLLINS  
& ASSOCIATES**  
Engineering - Planning  
Landscape Architecture

RUSSELL N. FUKUMOTO  
EXECUTIVE DIRECTOR

BY REPLY REFER

TO:  
85:DEV/6544



**STATE OF HAWAII**  
DEPARTMENT OF SOCIAL SERVICES AND HOUSING  
HAWAII HOUSING AUTHORITY  
P. O. BOX 17907  
HONOLULU, HAWAII 96817

December 4, 1985

GEORGE R. LANTIERO  
DIRECTOR

Mr. Russell N. Fukumoto  
Executive Director  
Department of Social Services and Housing  
Hawaii Housing Authority  
State of Hawaii  
P.O. Box 17907  
Honolulu, Hawaii 96817

Belt Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Attention Nancy E. Brown

Gentlemen:

Subject: Environmental Impact Statement Preparation  
Notice - Resort Development, Kaupulehu,  
North Kona, Hawaii

The Authority has reviewed subject EIS Preparation Notice  
and offer the following comments for your consideration:

1. This proposed project does not address the need for employee housing. The State Housing Plan encourages the development of rental housing for employees of large businesses outside of urban areas.
2. Affordable housing for the moderate-gap group families is much needed in the Kohala-Kailua-Kona area.

Therefore, we recommend that both these matters be addressed in the EIS.

Thank you for the opportunity to comment.

Sincerely,

*Russell N. Fukumoto*  
Russell N. Fukumoto  
Executive Director

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 4, 1985 (Reference No. 85:DEV/6544) acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments will help us focus the relevant sections of the Draft Environmental Impact Statement (DEIS) on your Department's specific concerns. The document will address the need for additional housing in the project area as a result of Kaupulehu Developments' proposed project. Your concern for affordable housing for the moderate-gap group families in the Kohala-Kailua-Kona area will be addressed in general terms.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:if

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu: 1001 Coral Street, Honolulu, Hawaii 96813. Telephone: (808) 531-5101. Telex: 101111 ZHAWZ  
Singapore: 100 Orchard Road, #1210, International Building, Singapore 0711. Telephone: 2354281. Telex: RS 50343 BK TNIN  
Honolulu Fax: 1001 Coral Street, Honolulu, Hawaii 96813. Telephone: (808) 531-5101.

GEORGE R. ARTIOSH  
DIRECTOR



STATE OF HAWAII  
DEPARTMENT OF TAXATION  
P.O. BOX 239  
HONOLULU, HAWAII 96808

RECEIVED  
HERBERT M. DIAS  
DIRECTOR  
DEPARTMENT OF TAXATION  
DEC 21 1985  
BELT, COLLINS & ASSOCIATES  
ENGINEERING • PLANNING  
LANDSCAPE ARCHITECTURE

BELT, COLLINS  
& ASSOCIATES  
ENGINEERING • PLANNING  
LANDSCAPE ARCHITECTURE

December 20, 1985  
85-2202

December 13, 1985

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

This is in response to your letter of November 21, 1985, and the enclosed data relating to Kaupulehu Developments.

Our comments are restricted to item IV, "Potential Impacts", as it relates to increased government revenues. It appears that the tax revenues resulting from the business of operating a luxury hotel and beach club would be significant. Such income would be subject to both the general excise tax and the net income tax. The wages of the employees of the organization would be subject to the net income tax imposed on individual taxpayers.

There seems to be no other provisions that would come within the provisions of the Chapters of the Hawaii Revised Statutes administered by the Department of Taxation.

I trust that this information will be of some assistance in the preparation of your Environmental Impact Statement.

Very truly yours,

*Herbert M. Dias*  
HERBERT M. DIAS  
Director of Taxation

Mr. Herbert M. Dias  
Director of Taxation  
Department of Taxation  
State of Hawaii  
P.O. Box 259  
Honolulu, Hawaii 96809

Dear Mr. Dias:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 13, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comment relating to increased government tax revenues both from general excise tax and net income tax resulting from the operation of the hotel and beach club will be incorporated into the discussion of Potential Impacts in the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu, 1605 Third Street, Honolulu, Hawaii 96813. Telephone: (808) 531-5100. Telex: 1011111 ZANUSA  
Nagasaki, 1-11-1 Honcho, 812-001, International Building, Sakuragaoka 2-15-1070, Tokyo 105  
Nagoya, 1-1-1 Honcho, 460-0001, Sakuragaoka 2-15-1070, Tokyo 105  
San Francisco, 1000 Market Street, San Francisco, CA 94102

GEORGE B. ARYOSH  
Governor



STATE OF HAWAII  
DEPARTMENT OF TRANSPORTATION  
165 KUAHOLOA STREET  
HONOLULU, HAWAII 96813

WAYNE J. YAMASAKI  
DIRECTOR

DEPUTY DIRECTORS  
JONATHAN K. SHIMADA, PhD  
WALTER T. MO  
CHERYL D. SOON  
ADAM D. VINCENT

WIRE/TELETYPE TO

STP 8.10990

December 6, 1985

Ms. Nancy E. Brown  
Belt, Collins and Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

For your information, the environmental assessment that accompanied the subject preparation notice was previously reviewed by our agency. The environmental assessment was also part of the petition submitted for a land use boundary change before the Land Use Commission.

Since our comments have remained valid, we are enclosing a copy of our memorandum to the Department of Planning and Economic Development which contained our concerns regarding the proposed Kaupulehu development.

At this time, we would like to request that our agency be consulted (as applicable) during the preparation of the environmental impact statement.

Very truly yours,

*Wayne J. Yamasaki*  
Wayne J. Yamasaki  
Director of Transportation

Enclosure

2125  
STP 8.10929

November 4, 1985

MEMORANDUM

TO: The Honorable Kent H. Keith, Director  
Department of Planning and Economic Development

FROM: Director of Transportation

SUBJECT: PETITION A65-597 FOR AN AMENDMENT TO THE  
STATE LAND USE BOUNDARY, KAUPULEHU,  
N. KONA, HAWAII, TRK: 7-2-03: 1,2,3

We have several areas of concerns regarding the petition for land use change to allow the Kaupulehu Development in North Kona, Hawaii:

These are:

1. It is recommended that the public shoreline access be addressed in more detail.
2. A traffic impact analysis should be included in the environmental assessment.
3. The proposed entry road and Queen Kaahumanu Highway should be a channelized intersection with acceleration, deceleration and turning storage lanes. This is to be constructed by the developer/applicant at no cost to the state.
4. The electrical facilities within the Queen Kaahumanu Highway right-of-way shall be underground. No overhead electrical facilities will be permitted.

These concerns should be resolved prior to granting a boundary change.

*Jonathan K. Shimada*  
Wayne J. Yamasaki

BELT, COLLINS  
& ASSOCIATES  
Interior • Exterior  
Landscape Architecture

December 20, 1985  
85-2216

Mr. Wayne J. Yamasaki  
Director of Transportation  
Department of Transportation  
State of Hawaii  
869 Punchbowl Street  
Honolulu, Hawaii 96813

Dear Mr. Yamasaki:

Environmental Impact Statement  
Resort Developments, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 6, 1985 (Reference No. STP 8.10990) relating your comments on Kaupulehu Developments' proposed project.

Your comments will help us focus on your Department's specific concerns. The Draft Environmental Impact Statement (DEIS) will address public shoreline access and a traffic analysis will be conducted.

The developer will construct, at no cost to the state, a channelized intersection with acceleration, deceleration and turning storage lanes. All electrical facilities within the Queen Kaahumanu Highway right-of-way will be placed underground.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:II

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 1001 East Street Honolulu Hawaii 96813 Telephone: (808) 531-5400 Telex: 101111 ZI 0117  
Newspaper: 1411 Richard Road #117th International Building, Singapore 10111 Telephone: 715 4870 Telex: RS 501018 ININ

GEORGE B. ANTONIO  
DIRECTOR



STATE OF HAWAII  
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

505 HALEKUAHOLE STREET  
ROOM 301  
HONOLULU, HAWAII 96813

December 9, 1985

LETITIA N. UYEHARA  
DIRECTOR  
TELEPHONE NO.  
544-9411

Ms. Nancy E. Brown  
December 9, 1985  
Page 2

- 2) Figure 5 shows a pond surrounded by open space. if anchialine ponds exist in the area the impacts to them should be discussed.
- 3) Due to the large number of units proposed, traffic impacts should be evaluated.

Thank you for providing us this opportunity to review your preparation notice.

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Subject: Comments on Kaupulehu Resort Development  
Preparation Notice

We have reviewed the preparation notice for the proposed Kaupulehu Resort Development and offer the following comments:

- 1) The draft EIS should discuss the marina and its associated condominiums even though those lands are zoned urban. Section 1:42(e) of the Environmental Impact Statement rules entitled "Content Requirements" states:

The EIS shall, at a minimum, contain the following information:

- e. The probable impact of the proposed action on the environment. Consideration of all phases of the action and consideration of all consequences on the environment; secondary or indirect, as well as primary or direct shall be included. The interrelationships and cumulative environmental impacts of the proposed action and other related projects shall be discussed in the EIS.....

Sincerely,

*Letitia N. Uyehara*  
Letitia N. Uyehara



**BELT, COLLINS  
& ASSOCIATES**  
ENGINEERING - PLANNING  
LANDSCAPE ARCHITECTURE

December 20, 1985  
85-2215

Ms. Letitia N. Uyehara, Director  
Office of Environmental Quality Control  
State of Hawaii  
550 Halekauwila Street, Room 301  
Honolulu, Hawaii 96813

Dear Ms. Uyehara:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 9, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments proposed project.

Your comments will help us focus on your Office's specific concerns. Regarding your comment that the Environmental Impact Statement should discuss the marina and its associated condominiums even though those lands are in the State Urban District, we will address their impacts in a very general manner because development of that site is beyond a 20-year time frame. Regarding your second comment, present development plans do not call for alteration of the pond. A description of the pond will be provided in the Draft Environmental Impact Statement (DEIS) and potential impacts to the pond will be discussed. We do plan to conduct a traffic impact study, as suggested in your third comment.

We expect to file the DEIS with your Office in March 1986 and you and your staff will, of course, have an opportunity to comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:if

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 1881 Leialoi Street, Honolulu, Hawaii 96813 Telephone: (808) 531-5301 Telex: 0010101 ZH0017  
Singapore, 401 Orchard Road #1218 International Building Singapore 0711 Telex: 93514821 Index 85-201-1 DE MIN



**University of Hawaii at Manoa**

Water Resources Research Center  
Holmes Hall 200 • 2540 Dole Street  
Honolulu, Hawaii 96822

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

January 15, 1986  
86-116

30 December 1985

Ms. Nancy E. Brown  
Belt, Collins and Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

**SUBJECT** Environmental Impact Statement Preparation Notice,  
Resort Development, Kaupulehu, North Kona, Hawaii

We have reviewed the subject EISP and offer the following comment. The commitment of freshwater resources for the development should be included in the "Summary" under "IV Potential Impacts" on p. 2.

Thank you for the opportunity to comment. This material was reviewed by WRRC personnel.

Sincerely,

*Edwin T. Murabayashi*  
Edwin T. Murabayashi  
EIS Coordinator

ETH:Jm

Mr. Edwin T. Murabayashi  
Water Resources Research Center  
University of Hawaii at Manoa  
Holmes Hall 283  
2540 Dole Street  
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 30, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The Draft Environmental Impact Statement (DEIS) will discuss the commitment of freshwater resources for the development.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your office for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:ll

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 1001 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 955-5111, Telex 0810117418174  
San Jose: 4410 (Hamilton) Road, #12100, International Building, San Jose, CA 95128-1200  
Fax: (408) 955-5111

COMMITTEE ON  
WAYS AND MEANS  
SUBCOMMITTEE  
ON  
TAXES  
OVERSIGHT

CECIL "CEC" HEFTEL  
111 DISTRICT, HAWAII

**Congress of the United States**  
**House of Representatives**  
**Washington, DC 20515**  
December 20, 1985

1034 LINDSEY STREET, HONOLULU, HAWAII 96813  
TELEPHONE: (808) 531-2128  
FACSIMILE: (808) 531-2128  
DISTRICT OFFICE:  
300 ALA MOANA BOULEVARD  
ROOM 4104  
HONOLULU, HAWAII 96850  
TELEPHONE: (808) 514-4397

**BELT, COLLINS  
& ASSOCIATES**  
ENGINEERS, PLANNERS  
LANDSCAPE ARCHITECTS

January 15, 1986  
86-113

Congressman Cecil Heftel  
Room 4104  
300 Ala Moana Boulevard  
Honolulu, Hawaii 96850

Dear Congressman Heftel:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 20, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Although you had no comments to make, the time you and your staff spent reviewing the document is appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986 and notice of its availability will be announced in the OEQC Bulletin. Your continued participation in the review process is requested.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

**RECEIVED**  
DEC 20 1985

BELT, COLLINS & ASSOCIATES

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813-5135

Dear Nancy:

Thank you for sending me a copy of your Environmental Impact Statement Preparation Notice for resort development on the big Island.

I appreciate your asking my assistance in commenting on your EIS proposal, but I am not in a position to critically assess your material. As you know, the purpose of an environmental impact statement is to anticipate what the effect of the project will be on the environment and how you will mitigate these intrusions. It is not in my purview as a congressman to engage in such a study.

Again, I appreciate knowing of your endeavors and hope you will feel free to keep in touch. With best wishes and aloha,

Sincerely,

*Cecil Heftel*  
Cecil Heftel  
Member of Congress

CH/1m

Honolulu District Office, Honolulu, Hawaii 96813, Telephone: (808) 531-2128, Telex: H11117ZBNDZ  
Secretary: Kathleen Heftel, Room 4104, International Building, Suite 400, Honolulu, Hawaii 96850, Telex: 855004 IR IN IN

RECEIVED  
DEC 12 1985

CHIEF DEPUTY  
DEMOCRATIC WHIP  
SENATOR  
COMMITTEE ON FINANCE  
COMMITTEE ON ENERGY AND  
NATURAL RESOURCES  
COMMITTEE ON LABOR AND  
HUMAN RESOURCES  
COMMITTEE ON  
VETERANS' AFFAIRS

United States Senators & Associates  
WASHINGTON, D.C. 20510  
December 6, 1985

SPARK M. MATSUNAGA  
HAWAII  
WASHINGTON OFFICE  
125 MATT BARDING  
WASHINGTON D.C. 20510  
HONOLULU OFFICE  
3101 PRINCE LUIPO BARDING  
HONOLULU HAWAII 96810

Ms. Nancy E. Brown  
Beit, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Re: Kaupulehu Development

This is just to acknowledge receipt of  
your recent communication addressed to  
Senator Spark Matsunaga.

Please be assured that the Senator  
will be responding to you at the earliest  
possible moment.

Yours truly,

Cheryl Matano (Ms.)  
Administrative Assistant  
to Senator Matsunaga

Dante K. Carpenter  
Mayor

Eugene N. Tiwanak  
Managing Director



DEPARTMENT OF PARKS & RECREATION  
COUNTY OF HAWAII

Patricia G. Engelhard  
Director

Ronald Okamura  
Deputy Director

BELT, COLLINS  
& ASSOCIATES  
Engineering, Planning  
Landscape Architecture

December 20, 1985  
85-2203

December 10, 1985

Ms. Nancy Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Subject: Kaupulehu Resort Development  
North Kona, Hawaii  
EIS Preparation Notice

Thank you for the opportunity to review the EIS  
preparation notice.

In preparing the EIS report, we believe that the issue  
of public shoreline access should be more specifically  
addressed, such as the establishment of public access  
policies and standards.

We look forward to reviewing the finalized report.

*Patricia Engelhard*  
Patricia Engelhard  
Director

PE:CH:a1

Ms. Patricia G. Engelhard, Director  
Department of Parks & Recreation  
County of Hawaii  
25 Aupuni Street  
Hilo, Hawaii 96720

Dear Ms. Engelhard:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 10, 1985 acknowledging receipt of the  
Environmental Impact Statement Preparation Notice and Environmental Assessment for  
Kaupulehu Developments' proposed project.

Your comments will help us focus on your Department's specific concerns. The  
Draft Environmental Impact Statement (DEIS) will address the issue of public shoreline  
access.

We expect to file the DEIS with the Office of Environmental Quality Control  
(OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NED:jf

cc: Alexander Kinzler, Kaupulehu Developments





**DEPARTMENT OF PUBLIC WORKS**  
COUNTY OF HAWAII - 25 ALUPAHI STREET - HILLO, HAWAII 96720 - TELEPHONE (808) 941-8331

OWNER & CONTRACTOR  
NANCY E. BROWN  
Chief Engineer  
NANCY E. BROWN  
Deputy Chief Engineer

**BELT, COLLINS  
& ASSOCIATES**  
Engineering - Planning  
Landscape Architecture

December 9, 1985

BELT COLLINS & ASSOCIATES  
ATTN: MS NANCY E. BROWN  
606 CORAL STREET  
HONOLULU HI 96813

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE  
Resort Development, Kaupulehu, North Kona, Hawaii

We acknowledge receipt of your November 21, 1985 letter (your reference No. 85-2045) transmitting the Preparation Notice for the project. Our Department comments have been transmitted to the Planning Department, which will in turn consolidate all Hawaii County Department comments and will then submit them to your office.

December 20, 1985  
85-2210

Mr. Hugh Y. Ono  
Chief Engineer  
Department of Public Works  
County of Hawaii  
25 Alupahi Street  
Hilo, Hawaii 96720

Dear Mr. Ono:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 9, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. We await the consolidated submittal from the Hawaii County Planning Department which will include your Department's comments.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,  
*Nancy E. Brown*  
Nancy E. Brown

NEB:if  
cc: Alexander Kinzler, Kaupulehu Developments

*HUGH Y. ONO*  
HUGH Y. ONO  
Chief Engineer  
cc: Planning Director  
BKY:csd

Honolulu: 606 Coral Street, Honolulu, Hawaii 96813, Telephone: (808) 571-5351, Telex: BELLH 714007A  
Singapore: 360 Orchard Road, #17-08, Intercontinental Building, Singapore 239607, Telephone: 233-6870, Telex: RS 50464 BCLISN  
Aurika: 14th Fl., 14th Fl., 19 Convent Street, Neutral Bay, Sydney NSW, 1585, Australia - 9011 181



RECEIVED  
DEC 20 1985

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII  
35 AUPUNI STREET • HILO, HAWAII 98720

January 15, 1986  
86-117

December 23, 1985

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

EIS PREPARATION NOTICE  
RESORT DEVELOPMENT  
KAUPULEHU, NORTH KOHA  
FILE: BA-7-004-0033

The Department has no water system in the area.

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

Dear Mr. Sewake:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Koha, Hawaii

Thank you for your letter of December 23, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

We understand there is no County water supply system in the area.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:if

cc: Alexander Kinzler, Kaupulehu Developments

QA

711/1/86  
HAWAIIAN WATER SUPPLY SYSTEMS  
COUNTY OF HAWAII  
DEPARTMENT OF WATER SUPPLY  
35 AUPUNI STREET  
HILO, HAWAII 98720

DANTE K. CARPENTER  
Mayor

December 5, 1985

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Subject: Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for the opportunity to comment on the proposed resort development planned for Kaupulehu, North Kona, Hawaii.

The Hawaii County Fire Department harbors no objections toward this proposed development provided Fire, Building, and Water regulations or codes are complied with fully.

Presently, fire protection and rescue services to the area are provided via the Kailua Fire Station located approximately 13 miles distant from the project site. Eleven personnel are usually on duty daily, manning one 1500 gpm pumper, one 1500 gpm ladder pumper, one 1000 gpm tanker pumper, and one intensive care ambulance. Private fire protection may also be provided by the volunteer fire company located on the Kona Village property.

Sincerely,

*Francis E. Smith*  
FRANCIS E. SMITH  
FIRE CHIEF

FES/mo

RECEIVED

DEC 9 1985

FRANCIS E. SMITH  
FIRE CHIEF

DOM COLOMBA  
DEPUTY FIRE CHIEF



HAWAII COUNTY FIRE DEPARTMENT  
466 KINOOLE STREET  
HILO, HAWAII 96720

BELT COLLINS  
& ASSOCIATES  
Engineers - Planning  
Landscape Architects

December 20, 1985

85-2212

Mr. Francis E. Smith  
Fire Chief  
Hawaii County Fire Department  
466 Kinoolie Street  
Hilo, Hawaii 96720

Dear Mr. Smith:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 5, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The information you provided on fire protection and rescue services will be incorporated into the Draft Environmental Impact Statement (DEIS). The proposed project will be in compliance with all applicable fire, building, and water regulations or codes.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:IF

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu: 1015 Commercial Street, Honolulu, Hawaii 96813, Telephone: (808) 521-5161, Telex: 101117 ZANZU  
Singapore: 101 Orchard Road, #1210, International Building, Singapore 238870, Telex: 85 50444 IK ININ  
Australia: Level 7, East Tower 191 Collins Street, Neutral Bay, Sydney NSW, 1589, Telephone: 9881188





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DEC 21 1985

BEIT, COLLINS & ASSOCIATES

PLANNING DEPARTMENT

25 AUPUN STREET • HILO, HAWAII 96720  
(808) 961-6286

DANTE E. CARPENTER  
Mayor

ALBERT LONO LYMAN  
Director

ILIMA A. PIHANALA  
Deputy Director

COUNTY OF  
HAWAII

December 20, 1985

Ms. Nancy E. Brown  
Beit, Collins and Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

EIS Preparation Notice  
Kaupulehu Developments/Land Use Boundary Amendment

Thank you for the opportunity to provide comments on the subject preparation notice.

We have reviewed the Environmental Assessment and submit comments from both our department as well as the County Department of Public Works:

1. As part of the background section, information on the nature and length of the lease agreement between the applicant and Bishop Estate should be included.
2. We were of the understanding that the Urban Designation north of Kona Village was to be reverted back to a Conservation District. Since there is a change in plans and since the concept master plan indicates a marina, condominiums, and a golf course to the north of Kona Village, the EIS should also describe these portions even if they are not part of the present boundary amendment. The EIS should describe the phasing and necessary land use designation changes or permits that would be required.
3. Will Kaupulehu Developments be the actual developer or will it enter into agreements with others for the development of specific parcels and projects?

Ms. Nancy E. Brown  
Page 2  
December 20, 1985

4. We suggest that all studies conducted for the proposed resort/residential community be included as appendices or technical documents to the EIS. These would include the botanical, fauna, marine, and archaeological survey reports and any market study which has been conducted.

5. Table 5 on page 2-9 lists the necessary permits required and a tentative schedule for this project. Please be advised that the zoning decision must occur prior to the SMA decision and that the order of listing should be reversed.

6. We note that the hoary bat and the donkey are also on the endangered species list.

7. The EIS should include a full discussion on the current status of the water supply, any necessary improvements which need to be made to the source and system, and the anticipated demand which may be generated by the proposed project.

8. The statements on page 3-8 and page 5-5 as they relate to public shoreline access are not entirely correct. While there is no public shoreline access "on the ground," nevertheless a condition of a previous SMA permit required that access be provided. Such an access could still be required even if the proposed development does not occur. The EIS should discuss both mauka-makai and lateral shoreline accesses including alternate or proposed locations of these accesses.

9. The EIS should include discussions on housing as it relates to the General Plan standards for resort designations, the direct and indirect demand that is likely to be generated by the proposed development, and how Kaupulehu Developments intends to help satisfy this anticipated demand.

10. The Kona Regional Plan, although adopted by the Planning Commission, has still not been adopted by the County Council. We note also that the regional plan does recommend incremental expansion of the resort area at Kaupulehu as demand warrants. Therefore, the discussion should include information on potential demand for both hotel and condominium units.

11. On page 4-4 in the discussion on County zoning, a statement is made that the Conservation District is also zoned Open. Please be advised that although an Open zone is shown, the County's zoning has no effect in Conservation Districts. Thus, the Open zone is effective only in the Urban district portions of TMK: 7-3-03:1.

1985 DEC 21 10 00 AM '85

DEPARTMENT OF PUBLIC WORKS  
COUNTY OF HAWAII  
HILO, HAWAII

DATE December 9, 1985

*Memorandum*

TO : Planning Department  
FROM : Chief Engineer  
SUBJECT: EISPK FOR RESORT DEVELOPMENT  
Kaupulehu, N. Kona, Hawaii

The roadways should be kept under private ownership and maintenance.

*[Signature]*  
HUGH ONO  
Chief Engineer  
DIR:CSO

Ms. Nancy E. Brown  
Page 3  
December 20, 1985

12. Discussions on the biological, social, and economic impacts need to be more fully substantiated in the EIS.
13. Where will the new HELCO substation be located? Service extended across Queen Ka'ahumanu Highway should be underground.
14. On page 6-1, under the "no project alternative" we raise the question as to whether such an alternative has benefit if it preserves the atmosphere and value of the existing Kona Village resort.

We enclose a copy of the Department of Public Works comments for your consideration also.

Should you have any questions or wish to discuss this further, please do not hesitate to contact Virginia Goldstein of my staff.

Sincerely,

*[Signature]*  
ALBERT LONO LYMAN  
Planning Director

VKG/ALL:lv  
Enc.

cc: Mayor's Office  
Department of Public Works

**BELT, COLLINS  
& ASSOCIATES**  
Landscape Architecture

January 15, 1986  
86-115

Mr. Albert Lono Lyman, Director  
Planning Department  
County of Hawaii  
25 Aupuni Street  
Hilo, Hawaii 96720

Dear Mr. Lyman:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 20, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments and the comment from the Department of Public Works will be helpful to us in preparing the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu 686 (local Street, Honolulu, Hawaii 96811, Telephone (808) 521-5161, Telex 101111 740073  
Singapore 6411 (local Road #1218, International Booking Singapore 021) Telephone 215 6201 Telex 85 906-1 DE ININ  
London 6111 (local Road #1218, International Booking London 021) Telephone 215 6201 Telex 85 906-1 DE ININ



**POLICE DEPARTMENT**  
 COUNTY OF HAWAII  
 349 KAPIOLANI STREET  
 HILO, HAWAII 96720

**BELT, COLLINS & ASSOCIATES**  
 Engineers, Planners  
 Landscape Architects



**GUY A. PAUL**  
 CHIEF OF POLICE  
 WAYNE G. CARRILLO  
 DEPUTY CHIEF

December 20, 1985  
 85-2211

OUR REFERENCE  
 YOUR REFERENCE

December 11, 1985

Ms. Nancy E. Brown  
 Belt, Collins & Associates  
 606 Coral Street  
 Honolulu, HI 96813

RE: Environmental Impact Statement Preparation Notice  
 Resort Development, Kaupulehu, North Kona, Hawaii  
 Tax Map Key 7-2-03:1, 3rd Division

The EISP and the environmental assessment were reviewed by our Department; and from the police standpoint, we foresee no adverse effect from the requested land use.

*Guy A. Paul*  
**GUY A. PAUL**  
 CHIEF OF POLICE

GWT:gs

Mr. Guy A. Paul  
 Chief of Police  
 Police Department  
 County of Hawaii  
 349 Kapiolani Street  
 Hilo, Hawaii 96720

Dear Mr. Paul:

Environmental Impact Statement  
 Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 11, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comment that you foresee no adverse effect on police service due to the proposed land use, will be incorporated into the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986 and notice of its availability will be announced in the OEQC Bulletin. Your continued participation in the review process is requested.

Sincerely,

*Nancy E. Brown*  
 Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu: 406 Coral Street, Honolulu, Hawaii 96813, Telephone: (808) 521-5161, Telex: H011174 HAWAII  
 Singapore: 341 Orchard Road, #12-06, International Building, Singapore 19721, Telephone: 235 4270, Telex: RS 54444 HAWAII  
 Australia: Level 2, First Floor, 19 Catherine Street, North Sydney, New South Wales, Australia, Telephone: (02) 941 1001

HAWAII ELECTRIC LIGHT COMPANY, INC. • PO BOX 1027 • HILO, HI 96721-102

H-W/G

**BEIT, COLLINS  
& ASSOCIATES**  
ENGINEERS • PLANNERS  
LANDSCAPE ARCHITECTS

December 12, 1985

December 20, 1985  
85-2209



Ms. Nancy E. Brown  
Beit, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Mr. Alva K. Nakamura, Manager  
Engineering Department  
Hawaii Electric Light Company, Inc.  
P.O. Box 1027  
Hilo, Hawaii 96721-1027

Dear Ms. Brown:

Subject: Kaupulehu Resort Environmental Impact Statement

In response to your letter of November 21, 1985, the following are our comments:

- Page 3-7 Electricity for the Kona Village Resort is provided by two 500 KW generators in lieu of 500 KV generators.
  - Page 5-4 Service will be extended to the proposed development from the new substation to be constructed by HELCO, which will be located mauka of the Queen Kaahumanu Highway.
- Kaupulehu Development may have to pay the full cost for the new substation if Kona Village Resort refuses to share the cost.

HELCO will require the approximate load for the hotel, beach club, condominiums and all the other facilities to determine transformer size and generation support requirements.

We will require at least a year's lead time to obtain the electrical equipment.

If you have any questions, please call Hal Kamigaki at 961-4824.

Very truly yours,

*Alva K. Nakamura*  
for Alva K. Nakamura, Manager  
Engineering Department

AKH:HK:md

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 12, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The statement on page 3-7 that electricity for the Kona Village Resort is provided by two 500 KV generators will be corrected in the Draft Environmental Impact Statement (DEIS) to read two 500 KW generators. The DEIS will also clarify that Kaupulehu Developments may have to pay the full cost for the new substation to be constructed by HELCO.

Kaupulehu Developments will work with your staff to establish the approximate load for the resort development so transformer size and generation support requirements can be determined.

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your Department for review and comment.

Sincerely,

*Nancy E. Brown*  
Nancy E. Brown

NEB:ll

cc: Alexander Kinzler, Kaupulehu Developments

A Hawaiian Electric Industries Company

Honolulu (District) Office: 1500 Ala Moana Blvd., Honolulu, HI 96813  
Newspaper: 941 Ditch Road #17, International Building, Honolulu, HI 96813  
Mailing Office: 1000 Ala Moana Blvd., Honolulu, HI 96813



RECEIVED

DEC 26 1985

BELT, COLLINS & ASSOCIATES  
Engineering - Planning  
Landscape Architecture

HAWAIIAN TELEPHONE  
GTE

January 15, 1986  
86-118

Derrick M. Uyeda  
Island Manager

December 23, 1985

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Ms. Brown:

Environmental Impact Statement Preparation Notice  
Resort Development, Kaupulehu, North Kona, Hawaii

In response to your letter of November 21, 1985, regarding the above subject, Hawaiian Tel has no major environmental concerns either for or against the proposed development.

We now serve the adjacent Kona Village Resort with a poleline and telephone cable, and anticipate no adverse environmental impact to reinforce this existing cable to provide new services to the proposed development. Aside from extending the poleline at the project site, all other work should have little or no impact on the surrounding area.

Please feel free to contact my West Hawaii District Manager, Edward Stevens, at 329-4295, if you need further assistance.

Sincerely,

*Derrick M. Uyeda*

Derrick M. Uyeda  
Island Manager - Hawaii

cc: E. Stevens  
T. Yoshioka  
G. Yadao

Mr. Derrick M. Uyeda  
Island Manager-Hawaii  
Hawaiian Telephone Company  
P.O. Box 4249  
Hilo, Hawaii 96720

Dear Mr. Uyeda:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 23, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The information you provided will be helpful to us in preparing the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to your office for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:lj

cc: Alexander Kinzler, Kaupulehu Developments

Hawaiian Telephone Company, Honolulu, Hawaii  
1000 Ala Moana Blvd., Suite 1000, Honolulu, HI 96813  
Telephone: (808) 531-5000, Telex: 011111740171  
Fax: (808) 531-5000, Cable: 3354487  
Hawaiian Telephone Company, Hilo, Hawaii  
1000 Ala Moana Blvd., Suite 1000, Hilo, HI 96720  
Telephone: (808) 935-1111, Telex: 011111740171

433-3902  
D

# CONSERVATION COUNCIL for HAWAII

STATE BOARD AND OAHU CHAPTER • P.O. BOX 2923 • HONOLULU, HI 96802 • (808) 527-7777  
FAX (808) 527-5109

BELL, COLLINS  
& ASSOCIATES  
Interior • Exterior  
Landscape Architecture

RECEIVED  
NOV 25 1985

November 21, 1985

Bell, Collins & Associates  
606 Coral St.  
Honolulu, HI 96813

BELL, COLLINS & ASSOCIATES

December 2, 1985

Mr. Rick Scudder, President  
Conservation Council for Hawaii  
P.O. Box 2923  
Honolulu, Hawaii 96802

Dear Mr. Scudder:

Subject: Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your interest in the Environmental Impact Statement (EIS) we are preparing for the Kaupulehu Resort Development. The EIS Preparation Notice and the Environmental Assessment are enclosed.

We expect the Draft EIS to be available for public review in March 1986 and we will send a copy to you. If you have other concerns or questions, please call me at 521-5361.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

Enclosure

Dear Sir:

We request to be a consulted party in the preparation of the EIS for the proposed Kaupulehu Development in North Kona. Please send us a copy the EIS Preparation Notice/Environmental Assessment for our review and comment.

Thank you for your attention on this.

Sincerely,

*Rick Scudder*

Rick Scudder,  
President

Member of the National Wildlife Federation • 1111 Kalia Road, Honolulu, HI 96813 • (808) 527-7777  
for information on membership, environmental health and education

Honolulu 606 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex: H111174 BM74  
Singapore 301 Orchard Road, #11-06, International Building, Singapore 0221, Telephone 235 6870, Telex: MS 50444 IM ISIN  
Australia 171-173 Victoria Street, Sydney, New South Wales 2002, Telephone 961 1001



APOA, INC.  
BANK OF HAWAII  
BANK OF HAWAII REAL ESTATE DIV. INC.  
BANK OF HAWAII REALTY CO., INC.  
BANK OF HAWAII REALTY CO., INC.  
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BANK OF HAWAII REALTY CO., INC.

REVISED  
DEC 6 - 1985



BEIT, COLLINS & ASSOCIATES  
P.O. BOX 635 • KAIIUA-KONA, HAWAII 96745-0635

HAWAII LEEWARD PLANNING CONFERENCE

BEIT COLLINS  
& ASSOCIATES  
Engineers • Planners  
Landscape Architects

LAWYERS: T. J. BOYD, JR., INC.  
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Nancy E. Brown  
Beit, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Ms. Brown:

We have reviewed the [environmental] assessment for the resort development at Kaupulehu developments. We are comfortable with the [environmental] assessment as prepared and feel the assessment adequately addresses the main [environmental] issues.

Sincerely,  
*Nancy E. Brown*  
Nancy E. Brown  
President

HPL:sjs

December 20, 1985  
85-2207

Mr. H. Peter L'Orange, President  
Hawaii Leeward Planning Conference  
P.O. Box 635  
Kaiaua-Kona, Hawaii 96745-0635

Dear Mr. L'Orange:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 4, 1985 acknowledging receipt of the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project. Although you had no comments to make, the time you and your staff spent reviewing the document is appreciated.

We expect to file the Draft Environmental Impact Statement (DEIS) with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to you for review and comment.

Sincerely,  
*Nancy E. Brown*  
Nancy E. Brown

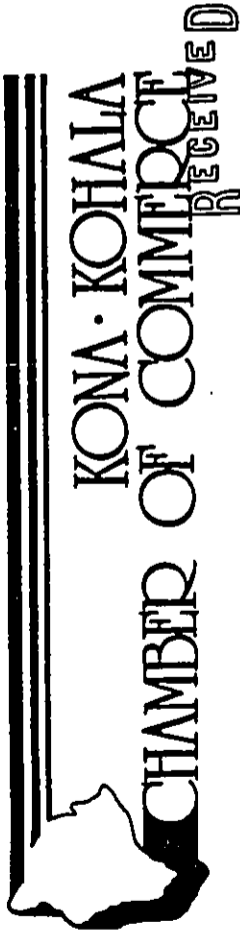
NEB:jf

cc: Alexander Kinzler, Kaupulehu Developments

Honolulu: 606 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex BE111H 743049  
Singapore: 360 Orchard Road, #12-06, International Building, Singapore 0923, Telephone 235-6800, Telex- RS 50464 BCSIN  
Australia: Level 2, First Floor 19 Conventer Street, Neutral Bay, New South Wales 1585, Telephone (02) 991-1101

OFFICE: BANK OF HAWAII BUILDING, KAIIUA, KONA • PHONE: 329-3214





December 26, 1985

BELT, COLLINS & ASSOCIATES

Nancy E. Brown  
BELT, COLLINS & ASSOCIATES  
606 Coral Street,  
Honolulu, HI 96813

Dear Nancy:

Thank you for including the Kona-Kohala Chamber of Commerce on your list of parties receiving the EISPN for planned resort development at Kaupulehu, North Kona, by Kaupulehu Developments. As BELT COLLINS is well aware, there is a great deal happening in our area in terms of development along the Kona-Kohala Coast. The Kona-Kohala Chamber of Commerce is a pro-business organization very much interested in the economic development of our region; we are at the same time mindful of the unique character of our region and the need to sensitively balance development and growth against community needs and concerns. Because the EISPN and request for comment arrived at our office amidst the Christmas seasonal rush, we are unable to refer the matter to committee for evaluation, and of course cannot in timely fashion brief and poll our members on the plans. Instead, I will reply in my capacity as Executive Director. In addition, I am immediately making available copies of the material to a select few of our board of directors who might have the greatest interest in commenting. I will also maintain on file in our office these materials; a notice will appear in our January newsletter to all members advising them of the plans and how they might review and comment.

I hope that this approach will provide you with sufficient input to do a comprehensive job of preparing your EIS.

#### OVERVIEW OF CONCERNS

My chief concern at this writing is that the Kaupulehu Development proceed with its plans in a manner that will generate the most community support for the project while eliciting the least resistance and vocal objection. You should be aware that two major developments here, developments that many consider crucial to our economic growth, have come under fire from anti-development, anti-growth elements. This small but very vocal group of dissidents is well schooled in the legal, media, emotional, and other aspects of interfering with development and have shown great skill in elongating the development process and erecting enough time-consuming barricades to affect the economic desirability of a given project. Hemmeter Investment's planned \$360 million Hyatt Regency at Waikoloa and

Nancy Brown, Page 2

Mauna Kea Properties, Inc.'s planned South Kohala Resort (another \$300 million) together promise on the order of 4,000 new jobs for our region. These jobs are much needed, the tax benefits to the County of Hawaii are much needed, and in general both projects enjoy a widespread support throughout the community.

However, the handful opposed to the projects have managed to make both projects the centerpieces of controversy; if there is a single greatest negative environmental impact from these two projects, it has been the negative effects on our small community and the discord and polarization that has occurred.

Therefore my single largest concern for the Kaupulehu project you propose is a social concern. Please get your ducks lined up in a row; please address every possible concern. Almost more important than whether or not your project is built, is whether or not our small community can go through any more protracted, emotional, divisive development battlegrounds.

That caveat having been expressed, allow me to comment more specifically on the various aspects of your plans as put forth in the Environmental Assessment dated September 1985.

XI-50

#### INTRODUCTION

The Applicant, Kaupulehu Developments is a joint venture of Cambridge Pacific, Inc. and Barnwell Hawaiian Properties, Inc. with principal business address 2828 Paa Street, Suite 2085, Honolulu, HI, 96819. There has been some complaining locally that resort developments such as you propose siphon off profit dollars that then disappear to the mainland. It will be important to stress that the developer is a local business, and to stress that the primary monetary benefits of the development will accrue to the State and County of Hawaii and its citizens.

Property ownership. The subject property is owned by the Kamehameha Schools/Bishop Estate and leased to Kaupulehu Developments. It is critically important, therefore, that a principal end beneficiary of the development of the land will be children of Hawaiian and part-Hawaiian ancestry who are indirectly assisted or directly educated through the Kamehameha Schools/Bishop Estate. A common plea from project opponents is "What about the native Hawaiians?" This project is important in that its enhancement of the value of the underlying land will be of direct benefit to Hawaiian and part-Hawaiian children.

#### DESCRIPTION

Proposed Action and Objective. "Developed in conformance with the Hawaii County General Plan...while adhering to environmentally sensitive design standards." These are two key strengths that the EIS must build on. The general plan is a good one, with widespread support throughout the island. The fact that you are not seeking plan amendments or variance from the site's intended use must be emphasized.

Kona Village ties. It will be important to define the relationship between the planned development and the Kona Village Resort. The Kona Village has long enjoyed community support, but at the same time there is a festering resentment over denial of public beach access. The developer should make quite plain the

75-5737 KUAKINI HIGHWAY, KAILUA-KONA, HAWAII 96740 (808) 329-1758

relationship.

Golf Facilities needed. "The availability of quality golf facilities is crucial..." Be prepared for a healthy barrage of criticism to the effect that the last thing our area needs is more golf courses. There are 27 holes at Keahou, 18 at Mauna Kea, another 18 planned for Mauna Kea, 18 at Mauna Lani, another 18 planned at Mauna Lani, and 36 at Waikoloa. You will need to be able to demonstrate convincingly with your market studies that the golf courses must be included within the total resort plan as a self-contained unit.

Plants. "One candidate endangered species, the tree 'ohai...found." That single tree could be the focus of a great deal of attention by anti-development forces looking for an excuse to stop your project. Why not make plans to propagate the species and incorporate it in your landscaping? Rather than "endangering" a sole plant, you could plan to further the species.

Hoary bat. Not observed is not the same as not there. Be ready to provide evidence.

Class AA waters. The objective of this designation is that the waters remain in their natural pristine state. What will the impact of resort development be on these waters? Can the developers incorporate "Marine Preserve" status or other mitigating measure to ensure that the until-now largely inaccessible shoreline area will survive the arrival of resort visitors, residents, and local users?

Cultural resources. None of the archeological sites are unique, though some may be of interest. A site does not have to be unique or even of interest before some people will clamor for its preservation at all cost. Full documentation of the sites and plans for preservation of as many as possible are highly recommended.

Shoreline Access. "There currently is no public shoreline access." This single short phrase may be the most important in the Environmental Assessment. The Kaupulehu and Kukuio Bay shoreline areas are among the nicest in West Hawaii, and also the least accessible. The Kona Village has a totally exclusionary access policy, as does Huehue Ranch in its administration of access to Kukuio Bay. The developer will need to demonstrate a full plan for providing public access. I suggest that the approach taken by the Waikoloa Resort at Anaeoomalu Bay be given serious study. The resort essentially took a beautiful but inaccessible beach and turned it into an open public facility with access, parking, picnic tables, beach pavilion, showers -- a real showcase. Beach access is the area where Kaupulehu Developments is likely to encounter its most robust opposition and to be most closely scrutinized. It would be in the developers best interest to serve the public interest well with radically improved beach access.

SMA permits. The need for SMA permits will subject the developer to intense public scrutiny. Great attention to detail in all comments received in preparation of the EIS will serve well in the SMA application process, especially if the application should lead to a contested case hearing.

Biological impacts. You will need to stress the positive and pay great attention to addressing the negative. Increased vegetation to increase exotic bird population. Why not include plans for a bird sanctuary and caretaking program? Nutrient loading and fertilization discharge. How certain are you? Be prepared to argue

with a "chemically sensitized" opponent to the use of any and all chemical products that the project design fully mitigates any pollution potential. Shoreline access to negatively affect reef populations. You will need to balance the need to satisfy both fisherman and conservationists. Perhaps a designation for a fishing area bordered by a marine preserve would work; or perhaps simply as a resort policy, access freely granted but no fishing allowed.

Treated effluent discharged. See previous remark on "chemically sensitized."

Employee housing. The need for affordable housing for local residents is a sharp and acute one in West Hawaii. If the developer plans to add to the problem rather than solution, expect opposition. I would suggest that as a critical part of the "total resort community" concept espoused, Kaupulehu Development would do well to plan getting into the low-cost housing business as well. The development of some amount of low-cost housing, whether on adjacent Kaupulehu lands or nearby, might at worst prove a troublesome distraction for the developers; at the same time, it would go a tremendously long way toward solidifying your support and stature here in the community. The employee or "up for grabs" low-cost housing certainly need not be done at a monetary loss. But build some houses that local people including your employees can afford to buy and live in -- the \$400,000 golf course condo is a bit out of reach for most of us.

SUMMARY

The proposed Kaupulehu Developments resort project at Kaupulehu, North Kona holds great promise for the developer and for the community. However, for it to successfully occur the developer must weigh not only all the legitimate community concerns, but the far-out and imagined concerns that anti-development opponents will offer as well. The EIS should reflect a project that not only maximizes the potential of the site for resort development, but as a precious resource for public recreation as well. To be a self-contained resort that is also a functioning part of the total State and County economy also requires examination of the impact of the resort on local jobs and communities, and the ability of developers to meet concurrent needs such as housing.

I look forward to reviewing the completed EIS, and to the future opportunity of presenting full development plans to our membership for their review and comment.

Sincerely,

  
Jeffrey G. Pulham  
EXECUTIVE DIRECTOR

**BELT COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

January 15, 1986  
86-123

Mr. Elliot G. Pulham  
Executive Director  
Kona/Kohala Chamber of Commerce  
75-5737 Kuakini Highway  
Kailua-Kona, Hawaii 96740

Dear Mr. Pulham:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 26, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments and suggestions will be helpful to us in preparing the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to the Kona/Kohala Chamber of Commerce for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:ll

cc: Alexander Kinzler, Kaupulehu Developments

Hawaiian United Bank, Honolulu, Hawaii, North Kona, Hawaii, 96740, Tel. (808) 233-1111, Telex: 811111 HAWAII  
Kailua-Kona, Hawaii, 96740, Tel. (808) 325-1111, Telex: 811111 HAWAII

433-3902  
B

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& ASSOCIATES  
Engineering • Planning  
Landscape Architecture

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DEC 2 1985  
JET, COLLINS & ASSOCIATES

  
**MAUNA LANI RESORT**  
On the Kohala Coast Big Island

November 26, 1985

December 2, 1985

Mr. Roger Harris  
Mauna Lani Resort  
P.O. Box 4959  
Kawaihae, Hawaii 96743-4959

Dear Roger,

Subject: Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your interest in the Environmental Impact Statement (EIS) we are preparing for the Kaupulehu Resort Development. The EIS Preparation Notice and the Environmental Assessment are enclosed.

We expect the Draft EIS to be available for public review in March 1986 and we will send a copy to you. If you have other concerns or questions, please call me at 521-5361.

Sincerely,

*Nancy*

Nancy E. Brown  
Enclosure

Ms. Nancy Brown  
Belt, Collins & Associates  
606 Coral St.  
Honolulu, HI 96813

Dear Nancy:

I wish to be a consulted party on the Kaupulehu Draft EIS.

Thank you.

Very truly yours,

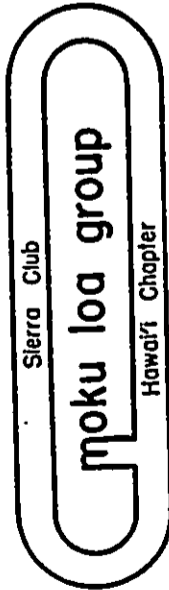
MAUNA LANI RESORT, INC.

*Roger*  
Roger Harris  
Project Planner

RH/wu

Honolulu 406 Coral Street, Honolulu, Hawaii 96813 Telephone (808) 521-5361 Telex BU 11174 BQ474  
Singapore 360 Orchard Road, #17-08, International Building, Singapore 237 Telephone 235 6070 Telex RY 50444 BK YSIN  
Auckland Level 2 First Floor 19 Catherine Street, Auckland 1010 Telephone (09) 811 100

1101 Ewa 4040 - Kawaihae, Hawaii 96743 4959 • Telephone (808) 965 9677 • Telex 751110



BELT COLLINS & ASSOCIATES  
Engineering - Planning  
Landscape Architecture

December 16, 1985  
85-2189

P.O. Box 1137, Hilo, HI 96720

Belt, Collins and Assoc.  
606 Coral Street  
Honolulu, HI 96813  
December 2, 1985

Sierra Club, Moku Loa Group, would like to be a consulted party in the matter of the State Land Use District Boundary Petition for Kaupulehu Development, Kaupulehu, North Kona District.  
We understand that part of the boundary amendment involves 575 acres of conservation land. Our concerns are public access to the shoreline, encroachment of hotels on beaches via variances, impacts on Native Hawaiian archeological sites, and impacts on natural resources including but not limited to anchialine pools.

Thank you,  
*Nelson Ho*  
Nelson Ho  
Conservation Comm. Co Chair.

Mr. Nelson Ho  
Conservation Committee Co-Chairman  
Moku Loa Group  
Sierra Club, Hawaii Chapter  
P.O. Box 1137  
Hilo, Hawaii 96720

Dear Mr. Ho:

Subject: Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 2, 1985 requesting to be a consulted party in the preparation of the Environmental Impact Statement for Kaupulehu Developments' proposed project.

To provide you with more information about the project, a copy of the Environmental Impact Statement Preparation Notice which was published in the November 8, 1985 issue of the Office of Environmental Quality Control (OEQC) Bulletin and a copy of the environmental assessment which accompanied the petition to the Land Use Commission are enclosed. Please call me at 521-5361 if you have any questions on this material.

Your concerns--public access to the shoreline, encroachment of hotels on beaches via variances, impacts on Native Hawaiian archeological sites, and impacts on natural resources including but not limited to anchialine pools-- will be addressed in the Draft Environmental Impact Statement (DEIS).

We expect to file the draft with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to you for your organization's review and comment. Your participation in the EIS process is appreciated.

Sincerely,  
*Nancy E. Brown*  
Nancy E. Brown

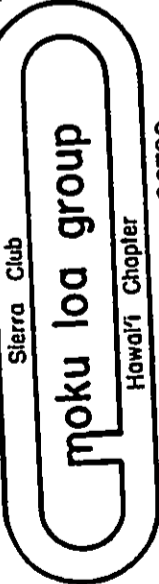
cc: Kaupulehu Developments

Hawaii State Council on Planning and Development  
1000 Ala Moana Blvd., Suite 1000, Honolulu, HI 96813  
Telephone: 535-1270, Telex: 881011, Fax: 535-1270

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JAN 6 1986

BELT, COLLINS & ASSOCIATES



Sierra Club

Hawai'i Chapter

P.O. Box 1137, Hilo, HI 96720

December 30, 1985

Belt, Collins and Assoc.  
606 Coral Street  
Honolulu, Hawaii 96813

The following concerns and comments are expressed in response to the environmental assessment document for resort development at Kaupulehu, North Kona, Hawaii (Dated September 1985).

Environmental Concerns

Hydrology- What are the anticipated # of gallons of water that will be used by the development? How large a drawdown will that represent at the well-head? What potential ground water impacts exist?

Marina- It is mentioned on page 2-1 and outlined on the page 2-2 Master Plan yet no discussion exists for it in the text. Why? Is any excavation needed for that phase? How big will it be? What is its timetable? What permits will be needed? How will the Marina impact marine, reef and shoreline environments?

Anchialine Ponds- Is the Waiakuhī Pond an anchialine ecosystem? Has there been a survey to locate any other possible anchialine ponds on the property? What studies have been done with this pond? What measures would be taken to "preserve" it? Sierra Club would like to see a buffer zone around this pond with no alien vegetation or man-made structures within this zone.

Golf Courses- How many cubic yards of material will be needed for construction? Where is the soil for these golf courses to come from? What is the potential for siltation and dust drift during the construction phases?

Tsunami Hazards- What is the rationale for not discussing Zone VII Coastal High Hazard Areas considerations in the EIS full disclosure document?

Roads- How many miles and acreage of roadways are planned for this development? What alignments will impact the archeological sites?

Cultural Resource Concerns

Archeology- Please append a full description or study on the 151 new archeological sites and the 44 previously known sites, along with location maps. Please denote which of these 195 structures will be destroyed and discuss what efforts will be made to study and document them. If the sites are not "unique to the Leeward Coast", discuss where are the others and what condition they are in. What are the developers basing this opinion of "uniqueness" on? What is the process for determination of what sites will be preserved or destroyed? Please state the relevant State objectives and policies as expressed in the State Coastal Zone Management Program, the Hawaii County Special Management Area Regulations, and the State Functional Plan for Historic Resources that you intend to be "in conformance" with.

King's Highway/Coastal Trail- No mention is made of this historic highway, is it present in any part of the property?

Socio-economic Concerns

Public access- Please detail the access policy and plans. How many parking spaces will be made available for public use? The Club hopes that the policy will not be as "anti-local" or "anti-public" as the restrictive attitude at the Mauna Kea Beach Hotel.

Population Pressures- Please address the potential for uneven "boom and bust" tourism scenarios for the Kona Coast. We ask that a representative wage schedule for hotel workers be included in the EIS to detail its economic opportunities.

Thank you for the opportunity to review and comment on this EA and we look forward to the Draft EIS.

*Nelson Ho*  
Nelson Ho  
for Moku Loa Conservation Comm.  
Hawaii Chapter, Sierra Club

BELT, COLLINS  
& ASSOCIATES  
INTERIOR • PLANNING  
LANDSCAPE ARCHITECTURE

January 15, 1986  
86-114

Mr. Nelson Ho  
Sierra Club, Moku Loa Group  
Hawaii Chapter  
P.O. Box 1137  
Hilo, Hawaii 96720

Dear Mr. Ho:

Environmental Impact Statement  
Restort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 30, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

Your comments will be helpful to us in the preparation of the Draft Environmental Impact Statement (DEIS).

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to you for review and comment.

Sincerely,

*Nancy E. Brown*

Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments

Hawaiian Land and Survey, Honolulu, Hawaii 96811, Telephone: (808) 531-5001, Telex: (H111) 218077  
Singapore: 441 Orchard Road, #1218, International Building, Singapore 05, Telephone: (65) 275-0870, Telex: RY 90141 RININ

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JAN 2 1986

ETI, COLLINS & ASSOCIATES



NA ALA HELE  
P.O. BOX 1572  
KEALAKEKUA, HI 96750

December 30, 1985

Ms. Nancy E. Brown  
Belt, Collins & Associates  
606 Coral St.  
Honolulu, HI 96813

Dear Ms. Brown:

Environmental Impact Statement Preparation Notice  
Ka'upulehu Developments, North Kona, Hawaii

Thank you for requesting that Na Ala Hele submit comments to assist in the EIS preparation. Due to the busy holidays and other time restraints, we are only now responding. We apologize for this delay!

1. Since the SMA Permit of 1976 (#18--see condition 1) to Hualalai Development Corp./Island Copra & Trading Co. Ltd., we have been awaiting a master plan to finally plan and provide for public access to the Ka'upulehu shoreline. We realize that the SMA Permit #18 pertained to the Kona Village Resort and that Ka'upulehu Developments is a separate business entity. However, public access remains a long-standing, unresolved issue involving both resorts.
2. The inland, ancient Hawaiian foottrail connecting Kukui Bay to Kahuwai Bay is not noted in Figure 5 of the Environmental Assessment. This is of major concern, as the trail has been traditionally used for generations, is in prime condition, and is owned in fee simple by the State of Hawaii (per Highways Act of 1892).
3. It is hoped that the Ka'upulehu portion of the "Ala Kahakai Trail System" (see "Na Ala Hele (trails for walking)", published by State Departments of Land and Natural Resources and Planning and Economic Development, March 1973) will be dedicated with the opening of the area to increased commercial and public activity. Mauna Lani Bay Resort made that commitment and could advise you re: how the concept has worked for them.

Thank you for your consideration.

Sincerely,

Deborah Chang Abreu  
President, Na Ala Hele

cc: Mr Vern Yamataka

January 15, 1986  
86-110

BELT, COLLINS  
& ASSOCIATES  
Engineering - Planning  
Landscape Architecture

Ms. Deborah Chang Abreu  
Na Ala Hele  
P.O. Box 1572  
Kealahou, Hawaii 96750

Dear Ms. Chang Abreu:

Environmental Impact Statement  
Resort Development, Kaupulehu, North Kona, Hawaii

Thank you for your letter of December 30, 1985 commenting on the Environmental Impact Statement Preparation Notice and Environmental Assessment for Kaupulehu Developments' proposed project.

The Draft Environmental Impact Statement (DEIS) will discuss public access to the shoreline, the foot trail which connects Kukui Bay to Kahuwai Bay, and the dedication of the Kaupulehu portion of the "Ala Kahakai Trail System."

We expect to file the DEIS with the Office of Environmental Quality Control (OEQC) in March 1986. A copy will be sent to Na Ala Hele for review and comment.

Sincerely,

Nancy E. Brown

NEB:lf

cc: Alexander Kinzler, Kaupulehu Developments  
Vern Yamataka

Honolulu: 606 Coral Street, Honolulu, Hawaii 96813. Telephone: (808) 531-5363. Telex: 101111Z181074  
Singapore: 606 Coral Street, Singapore 022. Telephone: 245-1870. Telex: RS 506641R ISBR  
Honolulu: 606 Coral Street, Honolulu, Hawaii 96813. Telephone: (808) 531-5363. Telex: 101111Z181074



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# Chapter XII

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## Chapter XII

## CHAPTER XII

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# Chapter XIII

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Chapter XIII

## CHAPTER XIII

### CONSULTED PARTIES AND THOSE WHO PARTICIPATED IN THE PREPARATION OF THE DEIS

#### CONSULTED PARTIES

An announcement of the availability of the Draft Environmental Impact Statement (DEIS) for the Kaupulehu Developments proposed resort project was published in the OEOC Bulletin by the Office of the Environmental Quality Control on April 23, 1986. The agencies, organizations, and individuals listed below were sent copies of the DEIS with a request for their comments on the project. Those believed to have an interest in the project or who requested consulted party status were mailed a copy of the report. Parties that replied with a "no comment" statement are marked with an asterisk. Those marked with two asterisks made substantive comments and these letters are reproduced, along with responses to them, in the following pages. Parties who submitted substantive comments after the May 23, 1986 deadline are indicated with a dashed line. Responses to these letters are also included in this chapter.

#### Federal Agencies

- \* U.S. Army Corps of Engineers, Pacific Ocean Division  
U.S. Army, Facilities Engineering
- \*\* U.S. Department of Agriculture, Soil Conservation Service  
U.S. Department of the Interior  
-- Fish and Wildlife Service
- \* Geological Survey, Water Resources Division  
U.S. Environmental Protection Agency, Region IX-San Francisco  
U.S. Department of Transportation
- \* Federal Aviation Administration  
Coast Guard
- \* U.S. Navy

#### State Agencies

- \* Department of Accounting and General Services
- \* Department of Agriculture  
Department of Budget and Finance
- \* Department of Defense  
Department of Education  
Department of Hawaiian Home Lands
- \*\* Department of Health  
Department of Labor and Industrial Relations
- \* Department of Land and Natural Resources  
State Historic Preservation Officer
- \* State Parks
- \*\* Department of Planning and Economic Development
- \*\* Department of Social Services and Housing
- \* Department of Taxation  
Department of Transportation
- \*\* Office of Environmental Quality Control  
Office of Hawaiian Affairs  
State Archives  
State Energy Office



**University of Hawaii - Manoa**

- \*\* Environmental Center
- Marine Programs
- \*\* Water Resources Research Center

**Hawaii County**

- Mayor - Dante K. Carpenter
- \*\* Department of Parks and Recreation
- \* Department of Public Works
- \* Department of Water Supply
- \*\* Department of Research and Development
- \* Fire Department
- Office of Housing and Community Development
- Hawaii Redevelopment Agency
- Planning Department

**Hawaii County Council**

James L. K. Dahlberg  
Frank De Luz, III  
Takashi Domingo  
Robert Herkes  
Lorraine Jitchaku-Inouye  
Russell Kokubun  
Merle K. Lai  
Spencer Kalani Schutte  
Stephen K. Yamashiro

**Public Utilities**

- Hawaii Electric Light Company
- \*\* Hawaiian Telephone

**Community Organizations and Other Groups/Individuals**

- American Lung Association
- Big Island Economic Development Board
- Bishop Estate
- Conservation Council for Hawaii
- \*\* Graham, Bill
- Hawaii Hotel Association
- Hawaii Island Chamber of Commerce
- Hawaii Island Economic Development Board
- Hawaii Leeward Planning Conference
- \*\* Huehue Ranch
- Japanese Chamber of Commerce
- Kamehameha Schools Hawaiian Studies Department
- Kohala Businessmen's Association
- Kona Hawaiian Civic Club
- Kona/Kohala Chamber of Commerce
- Kona Village Resort
- Mauna Lani Resort

- \*\* Moku Loa Group, Hawaii Chapter Sierra Club
- \*\* Na Ala Hele  
Office of Hawaiian Affairs  
Princess Hotels
- \*\* Springer, Hannah and Michael Prosper Tomich  
West Hawaii Committee

**Libraries**

Hilo Regional Library  
Kaimuki Regional Library  
Kaneohe Regional Library  
Legislative Reference Bureau  
Lihue Regional Library  
Pearl City Regional Library  
U.H. Hamilton Library, Hawaiian Collection  
Wailuku Regional Library  
Waimea Area Thelma Parker Memorial Library

**Media**

Honolulu Star-Bulletin  
Honolulu Advertiser  
Hawaii Tribune Herald  
West Hawaii Today - Kona

UNITED STATES  
DEPARTMENT OF  
AGRICULTURE

SOIL  
CONSERVATION  
SERVICE

P. O. BOX 50004  
HONOLULU, HAWAII  
96850

May 15, 1986

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MAY 15 1986  
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BILT, COLLINS  
& ASSOCIATES  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1162

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
Room 104, Old Federal Building  
335 Merchant Street  
Honolulu, HI 96813

Dear Ms. Ueda:

Subject: Draft EIS for Kaupulehu Developments, North Kona, Hawaii  
We reviewed the subject draft environmental impact statement and offer the following comments:

The importation of soil for landscaping will create a potential for erosion and sedimentation during stockpiling and spreading. We recommend that a source of water for irrigation and a distribution system be provided prior to bringing soil in to allow dust control and timely establishment of vegetative cover.

The environmental impact statement should also address what dust control measures will be carried out on the entire site during grading and construction.

Thank you for the opportunity to review the document.

Sincerely,

*W. H. Mann*  
HERBERT J. LYFORD  
Acting State Conservationist

cc:  
Mr. Alexander Kinzler  
Kaupulehu Developments  
2828 Paa St., Suite 2085  
Honolulu, HI 96819

Ms. Anne L. Mapes  
Bilt Collins and Associates  
606 Coral St.  
Honolulu, HI 96813

Mr. Herbert J. Lyford  
Acting State Conservationist  
United States Department of Agriculture  
Soil Conservation Service  
P.O. Box 50004  
Honolulu, Hawaii 96850

Dear Mr. Lyford:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 15, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development.

Comment: Soil importation will intensify the potential for erosion and sedimentation. We recommend providing a water source for irrigation prior to bringing in soil. The EIS should also address the dust control measures to be used during grading and construction.

Response: The intention of the proposed dust and erosion control measures discussed in the Draft EIS on page IV-48, section 4.7, is to relieve the erosion potential to the greatest extent possible. The methods discussed in this section will be implemented as needed in order to minimize erosion and sedimentation. These include watering, erecting dust barriers and landscaping. Water will be available from one of the existing wells mauka of the proposed Kaupulehu Resort site.

We trust that the above addresses your concerns.

Sincerely,

*Anne L. Mapes*  
Anne L. Mapes

cc: Kaupulehu Developments

Honolulu: 406 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex: BELTUZ1447A  
Singapore: 141 Orchard Road, #12-06, International Building, Singapore 0923, Telephone 215-6870, Telex: RS 50444 IKTSIN  
Auckland: Level 2, Jett Floor, 19 Convent Street, Neutral Bay, Sydney, NSW 2089, Telephone 9041344



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
100 ALA MOANA BOULEVARD  
P.O. BOX 5042  
HONOLULU, HAWAII 96810

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JUN 2 - 1986

EMT, COLLINS & ASSOCIATES

MAY 30 1986

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
Room 104, Old Federal Building  
335 Merchant Street  
Honolulu, Hawaii 96813

Re: DEIS for Kaupulehu Resort,  
Kaupulehu, North Kona, HI

Dear Ms. Ueda:

The Fish and Wildlife Service staff has completed their review of the subject DEIS and offers the following comments for your consideration.

General Comments

The stated purpose of the DEIS is to satisfy Chapter 343, Hawaii Revised Statutes requirements in conjunction with a State Land Use District boundary amendment petition. However, the document presents only conceptual development plans of the proposed project site which are too vague to adequately determine the scope of probable impacts upon fish and wildlife resources. Specifically, the DEIS does not address siting and alignment of buildings, roads and appurtenances; it does not quantify the volume, chemical content or discharge location(s) of stormwater runoff from the project site; and, it does not present an anchialine pond management plan.

SPSIS COMMENTS

Page I-3. If the marina is considered by the developers to be an integral part of the proposed resort development, then we recommend that a full discussion of its siting, construction and operation be included in this EIS.

Page IV-10. OI Consultants, Inc., found and described eight anchialine ponds during their 1985 and 1986 studies of the project area. Yet, Maciolek and Brock (1974) reported finding twelve ponds at the Kaupulehu site during their 1972-73 surveys. Nowhere in the OI Consultants, Inc., report (DEIS appendix 2) is this discrepancy explained. The Service recommends that a resurvey for anchialine ponds at the proposed project area be conducted at high (spring) tide levels to adequately identify all ponds and to accurately determine the total anchialine habitat area at Kaupulehu.



Save Energy and You Serve America!

Page IV-14. We are pleased to note that the developers do not intend to fill or otherwise alter any of the anchialine ponds within their property boundaries. In accordance with the Service's national Mitigation Policy (46 FR 7644-7663), we have classified these anchialine ponds as Resource Category 1: they are of high habitat value to their indigenous aquatic biota, and are scarce on a national and ecoregion basis. The ponds are also known to periodically provide feeding and loafing habitat for the endangered Hawaiian stilt and duck, and for a host of migratory shorebirds.

It is Service policy that any loss or degradation of these important national resources is unacceptable. As such, it is the goal of the Service to insure that no loss of natural anchialine pond habitat occurs. Therefore, we will recommend denial of any County, State or Federal permits for filling or destructive physical modification of these, or other, anchialine ponds.

Page IV-22. As stated in our previous letter of December 27, 1985 to Belt Collins and Associates, the Service encourages the enhancement of waterbird habitat at Waikuhī Pond. We ask that the specific design for habitat improvement be coordinated with our office as early in the planning process as possible.

We appreciate the opportunity to comment on this DEIS. Please contact me at 546-7530 if we can be of any further assistance.

Sincerely,

Ernest Kosaka  
Project Leader  
Environmental Services

cc: RD, FWS, Portland, OR (ARD-HR)  
EPA, San Francisco  
U.S. Army Corps of Engineers, PODCO-0  
NHFS-WPPO  
DOFAM  
DAR

Mr. Albert Lyman, Hawaii County Planning Office  
Mr. Alexander Kinzler, Kaupulehu Developments  
Ms. Anne L. Hapes, Belt Collins and Associates

June 5, 1986  
86-1149

Mr. Ernest Kosaka, Project Leader  
Environmental Services  
U. S. Department of the Interior  
Fish and Wildlife Service  
P. O. Box 50167  
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 30, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, on the Draft EIS for the proposed Kaupulehu Resort development. I spoke with John Ford of your staff this week regarding your comments and the following reflects our conversation.

**Comment:** The DEIS does not address siting and alignment of buildings, roads, and appurtenances; it does not quantify the volume, chemical content or discharge locations of stormwater runoff from the project site.

**Response:** The Kaupulehu Resort is in the early stages of planning and only a concept plan is available at present. No individual site plans are available and, hence, the above concerns cannot be addressed now. They will need to be addressed later on in the permitting process before construction can occur.

**Comment:** The DEIS does not present an anchialine pond management plan.

**Response:** As discussed with Mr. Ford, Kaupulehu Developments intends to preserve all ponds and manage the resource. An anchialine pond management plan has not yet been prepared, but the developer proposes to consult with the Fish and Wildlife Service as well as other agencies in developing such a plan.

**Comment:** If the marina is considered to be an integral part of the proposed resort development, provide a full discussion of its siting, construction and operation.

**Response:** No detailed plans are available for the marina at Kaupulehu's north site. As stated in the EIS, development of the north site is beyond the time frame of the current petition for boundary amendment. We expect that an EIS will be required at a later date during the permitting process for development of the north site, including the marina.

**Comment:** OI Consultants, Inc. found 8 anchialine ponds during their 1985 and 1986 studies of the project area. Yet, MacIolek and Brock found 12 ponds during their 1972-73 surveys. The Service recommends that a resurvey for anchialine ponds be performed at high tide levels.

Honolulu 648 Ceval Street, Honolulu, Hawaii 96813. Telephone (808) 521-5361. Telex BEL11174 BOKWZ  
Singapore 360 Orchard Road, #12-06, International Building, Singapore 0223. Telephone 215 6870. Telex RS 51884 HKTSLN  
Australia, Level 2, 144 Flinders Street, Sydney, NSW 2000. Telephone 938 1188

Mr. Ernest Kosaka  
June 5, 1986 - page 2

**Response:** David Ziemann of OI Consultants points out that ponds 1 through 9 in the MacIolek and Brock study (see Quad G on page 31 of the report) are at the Kona Village Resort and not at the proposed Kaupulehu Resort site. Ponds 10, 11, and 12 were later rediscovered by OI Consultants (ponds 3, 4, and 7 in the later survey). In addition, OI Consultants found 5 other ponds or wetland areas for a total of 8 ponds. This information was conveyed to Mr. Ford, who agreed that based on it, a resurvey is not necessary.

**Comment:** The Service encourages the enhancement of waterbird habitat at Waiaukuhi Pond. Specific design for habitat improvement should be coordinated with the Fish and Wildlife Service.

**Response:** The developer will work with the Service and other agencies, as appropriate, to improve wildlife habitat suitable for waterbirds.

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments



US Department  
of Transportation  
Federal Aviation  
Administration

May 16, 1986

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
Room 104, Old Federal Building  
335 Merchant Street  
Honolulu, Hawaii 96813

Dear Ms. Ueda:

We have reviewed the Draft EIS for Kaupulehu Resort dated April 1986 and have no substantive comments. We do have one minor correction on page IV-39; Waimea - Kohala Airport serves a "limited number of scheduled commuter and charter flights and private aircraft".

Thank you for the opportunity to review this report.

Sincerely,

*David J. Welhouse*

David J. Welhouse  
Airports Engineer/Planner

Henry A. Sumida  
Airports District Office Manager

cc:  
✓ Alexander Kinzler  
Anne L. Mapes



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MAY 20 1986

ELL COLLINS & ASSOCIATES  
AIRPORTS DISTRICT OFFICE  
BOX 50244  
HONOLULU, HI 96850-0001  
Telephone: (808) 546-7129

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1150

Mr. David J. Welhouse, Airports Engineer/Planner  
Mr. Henry A. Sumida, Airports District Office Manager  
U.S. Department of Transportation  
Federal Aviation Administration  
Airports District Office  
Box 50244  
Honolulu, Hawaii 96850-7129

Dear Mr. Welhouse and Mr. Sumida:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your letter of May 16, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. Your correction on the Waimea-Kohala Airport has been incorporated into the Final EIS.

Sincerely,

*Anne L. Mapes*

Anne L. Mapes

cc: Kaupulehu Developments

Honolulu 1716 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex 101111 743474  
Singapore 161 Orchard Road, #12-06, International Building, Singapore 0723, Telephone 215 6670, Telex RS 54464 RTSIM  
Australia Level 2, First House, 19 Conynon Street, Neutral Bay, Sydney, NSW 2089, Telephone 910 1100

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MAY 28 1986



GEORGE B. ADAMS  
Director of Health

HIKI, CHINA & ASSOCIATES

1015 S. WILSON  
Honolulu, Hawaii

STATE OF HAWAII  
DEPARTMENT OF HEALTH

P. O. BOX 379  
HONOLULU, HAWAII 96810

IN REPLY, PLEASE REFER TO:  
E PMSD

May 23, 1986

Ms. Esther Ueda  
May 23, 1986  
Page 2

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
Room 104, Old Federal Building  
335 Merchant St.  
Honolulu, Hawaii 96813

Dear Ms. Ueda:

Subject: Draft Environmental Impact Statement for Kaupulehu Developments, North  
Kona, Hawaii

Please address air, drinking water, solid waste and sewage control commitments in  
the construction plans.

Drinking Water

This project proposes to develop an independent water system to support its luxury  
hotel-condominium resort area. According to the EIS, Kaupulehu Well 4658-01 was drilled  
in 1981 and received Department of Health approval of a potable water source in October,  
1981. A second well has recently been drilled, but has not received approval.

The new wells and distribution system are subject to all applicable terms and  
conditions of Chapter 20, Title II, Administrative Rules.

Section 11-20-29 of Chapter 20 requires that all new sources of potable water  
serving public water systems to be approved by the Director of Health prior to their use  
to serve potable water. Such approval is based primarily upon the satisfactory submission  
of an engineering report which adequately addresses all concerns as set down in Section  
11-20-29. The engineering report must be prepared by a registered professional engineer  
and bear his or her seal upon submittal.

Section 11-20-30 requires that new or substantially modified distribution systems for  
public water systems be approved by the Director of Health. Such approval depends upon  
the submission of plans and specifications for the project prior to construction and the  
demonstration that the new or modified portions of the system are capable of delivering  
potable water in compliance to all maximum contaminant levels as set down in Chapter 20  
once the distribution system or modification is completed.

Wastewater Disposal

The proposed private wastewater treatment works must be environmentally  
compatible with the drinking water source.

Sincerely yours,

JAMES K. IKEDA  
Deputy Director for  
Environmental Health

cc: DHS-A, Hawaii  
Mr. Alexander Kinzler  
Ms. Anne L. Mapes ✓

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1166

Mr. James K. Ikeda, Deputy Director  
for Environmental Health  
State Department of Health  
P.O. Box 3378  
Honolulu, Hawaii 96801

Dear Mr. Ikeda:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 23, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. The following are our responses to your comments in the order of appearance in your letter.

**Comment:** Section 11-20-30 requires that new or substantially modified distribution systems for public water systems be approved by the Director of Health. Such approval depends upon the submission of plans and specifications for the project prior to construction and the demonstration that new or modified portions of the system are capable of delivering potable water in compliance with all maximum contaminant levels as set down in Chapter 20, once the distribution system or modification is completed.

**Response:** The private water system to be developed by Kaupulehu Developments will be capable of delivering potable water to the Kaupulehu Resort and will meet all of the requirements stipulated by the Department of Health. The engineering report and actual design of the system will be developed at the appropriate time in the planning process. As stated in Chapter IV, Section 6.5.2, one well has been drilled which meets the requirements for potable water. A second well has been drilled to serve as a standby well, and a third well will be drilled to meet project demand at build-out.

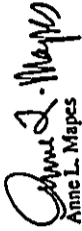
**Comment:** The proposed private wastewater treatment works must be environmentally compatible with the drinking water source.

**Response:** Both the wastewater treatment system and the potable water system will be located on the mauka lands of Kaupulehu. The placement of the treatment system and the water wells will be placed so as to avoid any contamination of the water system by the wastewater system.

Mr. James K. Ikeda  
June 5, 1986 - Page 2

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments





STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
DIVISION OF STATE PARKS  
P. O. BOX 631  
HONOLULU, HAWAII 96809  
May 23, 1986

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MAY 30 1986  
MIT, COLLINS & ASSOCIATES

SURNAME DUD, CHAIRMAN  
COMMISSION ON LAND USE, NATURAL RESOURCES  
AND CULTURAL HERITAGE

EDGAR A. MULLALLY  
SECRETARY TO THE COMMISSION

DIVISIONS:  
ADMINISTRATIVE DEVELOPMENT  
ADULTIC RESOURCES  
CONSERVATION AND  
RECREATION ENHANCEMENT  
CULTURAL RESOURCES  
FORESTRY AND WILDLIFE  
LAND MANAGEMENT  
STATE PARKS  
WATER AND LAND DEVELOPMENT

Memorandum  
- 2 -  
May 23, 1986

information needed for significance assessments. Based on the PHRI preliminary report (Walker & Rosendahl 1986 - Appendix G, Draft EIS), it seems likely that sufficient information has been recovered to determine site significance. This cannot be fully verified until the final report is reviewed, because that report will contain most of the vital information gathered in the PHRI intensive survey. It be best for this final report to accompany the LUC petition, but we believe that it can be assumed the information has been gathered -- given the record of the PHRI firm, the preliminary report and phone conversations with PHRI.

3. Site Significance.

The consulting archaeologist's significance terminology is a little different than that used by the State. However, we agree with the assessments, as summarized below.

18 sites are still considered significant.

a. 12 of the 18 sites are significant for their information content (sites 25, 43, 44, 92, 93, 165, 166, 167, 175, 189, T-107, T-108). The important information includes burial (osteological) data, religious activity data, and data on habitation activities. [Initially, all the sites in this part of Kaupulehu were significant for their information content. Archaeological work has recovered an adequate and reasonable sample of this information in all but these 12 sites -- assuming the final report of the intensive survey work documents this information.]

b. All 18 of the sites also have probable cultural significance. These include

- (1) the above 12 sites
  - (1) 8 with burials or with probable burials, burials often being culturally significant. (25, 44, T-107, T-108 - probable. 93, 165, 167, 173 - burial sites).
  - (2) 3 sites with possible shrines, with religious structures often being culturally significant. (Sites 43, 166, 189). It must be emphasized, however, that the structures are only considered possibly to be religious in the preliminary report. Presumably, the final report will make a final decision on this matter.
  - (3) 1 site with both burials & a possible shrine (92).

MEMORANDUM

TO: Esther Ueda, Executive Officer, State Land Use Commission

FROM: Ralston H. Nagata, State Parks Administrator

SUBJECT: Review of 1986 Draft EIS for LUC District Boundary Amendment Petition -- Kaupulehu Resorts  
Kaupulehu, North Kona, Hawaii  
TRK: 7-2-03: portion 1

Thank you for the opportunity to comment on this document.

HISTORIC SITES SECTION CONCERNS:

In the past our major concerns with this land use change petition have been that

1. All sites be located.
2. Sufficient information be recovered to identify significant historic sites.
3. Significant sites be identified.
4. Impacts to significant sites be clarified.
5. Mitigation plans be presented in a general form to reduce any adverse impacts to historic sites.

These are also clearly vital concerns of the Land Use Commission under your Chapter 205. We believe that in essence these concerns have been met in this Draft EIS. They are summarized below for the Land Use Commission's information. We conclude with two recommended conditions for the amendment to ensure quality historic preservation compliance.

1. Location of All Historic Sites.

It is likely that most, if not all, sites have been found. About 205 sites have now been identified in makai Kaupulehu, and approximately 108 sites seem to be in the area covered by this petition.

2. Recovery of Sufficient Information to Identify Significant Sites.

A 1985 Bishop Museum study (Carter 1985) recorded basic site information. A 1986 PHRI study followed to recover additional

Memorandum

- 3 -

May 23, 1986

(ii) 6 trails which are not included in the sites significant for their information content. (Sites 26, 34, 107, 156, 178, T-104.) These trails may be significant as traditional access routes.

c. 9 sites also are considered significant as unusual examples of site types. These include  
(i) the 6 trails.

(ii) the possible boundary shrine (189).

(iii) two habitation complexes (43, 166).

These sites are not unusual on an island-wide or district basis, but they have local significance as examples of sites types.

#### 4. Impacts.

All the sites will be adversely impacted to some degree, either by construction or greater amounts of visitors.

#### 5. Mitigation.

The applicant's general mitigation plan seems quite acceptable (I-10, IV-28). Of the 18 significant sites, 9 are to be preserved and exhibited (the 6 trails, 43, 166, 189). The remaining 9 are significant for their information content and burials. It is proposed to either preserve these sites or to conduct archaeological data recovery work to recover adequate amounts of the significant information and to reinter the burials. The applicant indicates that this work will be coordinated with our office and the County's Planning Department (V-3).

Additionally, the applicant proposes to place approximately 25 sites in two archaeological preserves, which will go back into Conservation zoning (I-10). These sites represent a full range of sites, many of which still contain archaeological information. It is proposed to have these sites be a recreational and educational resource (IV-28).

#### Summary & Recommended Conditions for the LUC Petition

In sum, we believe the Draft EIS has covered needed historic preservation concerns for this petition, and we find the mitigation plan quite acceptable. If the petition is approved, we recommend two conditions simply to ensure quality historic preservation compliance.

1. An acceptable final report of the intensive survey done by PHRI be submitted within a reasonable period of time (perhaps 6

Memorandum

- 4 -

May 23, 1986

months). If review by the Historic Sites Section indicates some additional information needs to be gathered, this simply be included in the mitigation plan.

2. Preservation and archaeological data recovery take place prior to construction as presented in the mitigation plan. Detailed preservation and data recovery plans be submitted for review and approval by the State's Historic Sites Section and the County's Planning Department before preservation and data recovery take place. The data recovery report also be submitted for review and approval by these two offices prior to construction at the historic site locations.

#### RECREATION CONCERNS:

There are no known public parks concerns. Public shoreline access has been addressed. Since this is a large area, the need for public parking and restrooms for general public use should also be addressed.

cc: Alexander Kinzler, Kaupulehu Developments  
2828 Paa St., Suite 2085, Honolulu, Hawaii 96819

Anne L. Hayes, Belt Collins & Associates  
606 Coral Street, Honolulu 96813

Paul Rosendahl, PHRI

RAJSTON H. NAGATA

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1151

Mr. Ralston H. Nagata  
State Parks Administrator  
State of Hawaii  
Department of Land and Natural Resources  
Division of State Parks  
P.O. Box 621  
Honolulu, Hawaii 96809

Dear Mr. Nagata:

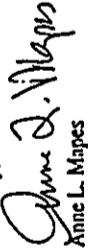
Environmental Impact Statement (EIS) for  
Kaunapala Resort, Kaunapala, North Kona, Hawaii

Thank you for your comments of May 23, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaunapala Resort development.

If the petition for boundary amendment is approved, the developer will comply with the two conditions concerning historic preservation which you suggest:

- 1) that an acceptable final report of the intensive survey done by PHRI be submitted within a reasonable period of time, and
- 2) that preservation and archaeological data recovery take place prior to construction as presented in the mitigation plan.

Sincerely,

  
Anne L. Mapes

cc: Kaunapala Developments

Honolulu 480 Coastal Street, Honolulu, Hawaii 96813, Telephone: (808) 521-5361, Telex: BE1111 74 BM74  
Singapore: 801 Orchard Road, #12-08, International Building, Singapore 07123, Telephone: 235-6870, Telex: BS 5148-04 IK ISHM  
Australia: Level 2, First Floor, 191 Catherine Street, North Sydney, Sydney, NSW 2060, Telephone: 918-1108



DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

STATE OF HAWAII, 250 SOUTH KING STREET, HONOLULU, HAWAII 96820-1070  
MAILING ADDRESS: PO BOX 2108 HONOLULU HAWAII 96820-1108  
TELEPHONE: 535-1188

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MAY 27 1986  
LINDA KAHUNAI ROSEHILL  
GENERAL AFFAIRS  
BUSINESS AND POLICY DEVELOPMENT DIVISION  
IN CHARGE  
POLICY DIVISION  
PLANNING DIVISION  
RESEARCH AND ECONOMIC ANALYSIS DIVISION  
OFFICE  
ADMINISTRATIVE SERVICES OFFICE  
INFORMATION OFFICE

S. Esther Heles  
Page 2  
May 21, 1986

MEMORANDUM

TO: S. Esther Heles, Executive Officer  
Lana Heles Commission

FROM: Kent J. Felch

SUBJECT: Paupulehu Resort, Draft Environmental Impact Statement, North Kona, Hawaii

May 21, 1986

XIII-13

We have reviewed the subject draft EIS and have the following comments to offer.

1. One of the unresolved issues discussed in the draft EIS is the impact of the proposed development on the existing Kona Village Resort, an exclusive and remote luxury establishment. The proposed development may affect the sense of isolation that is desired by the guests of the Kona Village Resort.
2. Priority Guidelines of the Hawaii State Plan express the desire to improve and maintain the quality of visitor facilities and surrounding areas. This is related to other Priority Guidelines to enhance visitor satisfaction, rehabilitate urban areas, and protect the health and long-term marketing of the visitor industry and, consequently, Hawaii's economy.
3. We are also aware of a resort proposal at Kukio Beach, immediately to the south of Paupulehu. The Paupulehu area is currently designated as an Intermediate Resort according to the County of Hawaii General Plan. The proposed Kukio Beach project will also seek an Intermediate Resort designation. If both Kukio and Paupulehu are developed as Intermediate Resorts and successfully integrated, the result would be at the major Resort scale.
4. The draft EIS discusses the probable impacts associated with a major Resort area at Kukio-Paupulehu on the existing Kona Village Resort, as well as the impact on the major Resort Area of Paupulehu/Kona/Kaunaloa. Continued development of Intermediate and major Resort Areas between Paupulehu and Kaunaloa (Kaunaloa) may have a detrimental effect on the unique isolation of Kona Village and the exclusive luxury of the Paupulehu and Kaunaloa Resorts.

5. The EIS should discuss comments 3 and 4 in accordance with Policy B(4) in the State Tourism Functional Plan:

"insure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities."

6. The Draft Kona Regional Plan Revisions dated November 28, 1985, states that housing problems are perceived to be the most serious problem area for Kona. This is especially true in relation to the development of affordable housing stock. The draft EIS states that long-term housing needs are expected to be met for the most part on the open market. There is no analysis as to the demand for housing which will be created by the proposed development. Impacts on housing demand should be discussed in the final EIS.

7. The EIS should identify the recreational resources and recreational uses of the project area and immediate surroundings, particularly along the coastline. The U.S. Army Corps of Engineers' West Hawaii Coral Reef Inventory indicates that Kukio Bay is a popular site for water-related recreational activities. This and other publications identify this area as good to excellent for surfing and skin diving. The rocky headlands are reportedly popular for shoreline fishing.

The probable impacts of the proposed project on these resources and users should be clarified. In addition, the visual impact of the project from Kua and Kukio Bays should be assessed.

8. The draft EIS indicates that there will be several areas through which the public will be able to gain access to the shoreline. The northern access will temporarily consist of a bulldozed jeep trail and will be paved as development on the northern section of the proposed project occurs. It is unclear who (what types of vehicles) will be able to use this access route. The EIS states that there are two alternative sites for public parking in the southern section of the project. Whichever site is eventually chosen, there should be assurance that there will be adequate parking stalls for the public. Additionally, the EIS does not specifically state whether the public will be allowed to use the recreational beach club facility adjacent to the proposed hotel.

Ms. Esther Ueda  
Page 3  
May 21, 1986

9. On page IV-18, the document states that "the use of pesticides, herbicides and fungicides on golf courses in Hawaii is relatively insignificant especially compared to its use in sugar cane and pineapple cultivation." Given the proximity of the site to the shoreline and the porous nature of the ground that this project will be built on, special care should be taken to ensure that herbicides and pesticides will not percolate into nearshore waters.

Thank you for the opportunity to review and comment on the subject document.

cc: Mr. Alexander Kintler  
Kaupulehu Developments  
Ms. Anne I. Hayes  
Belt Collins & Associates

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1152

Mr. Kent Keith, Director  
Department of Planning and  
Economic Development  
P.O. Box 2359  
Honolulu, Hawaii 96804

Dear Mr. Keith:

**Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii**

Thank you for your comments of May 21, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. The following are our responses to your comments in the order of appearance in your letter.

(1) Comment: One of the unresolved issues discussed in the DEIS is the impact of the project on Kona Village. The Kaupulehu Resort may affect the sense of isolation desired by the guests of the Kona Village Resort.

Response: The Kaupulehu Resort will be developed so as to be sensitive to the unique qualities and experience of Kona Village Resort. The owners of Kaupulehu Resort and Kona Village Resort have recently agreed on development conditions which will mitigate and minimize the impacts of Kaupulehu Resort on Kona Village Resort. These conditions include a buffer zone around the Kona Village Resort property which will be landscaped in the area closest to development by Kaupulehu Resort.

In addition, within 300 feet of Kona Village Resort, Kaupulehu Developments will restrict development to two-story buildings and a density limit of six units per acre. Within 1,350 feet of Kona Village Resort, the height of structures is limited to four stories up to 50 feet. Within 700 feet of Kona Village Resort, construction restriction will limit significant activity to 8:30 a.m. to 4:30 p.m. on weekdays. Heavy golf course construction would be limited to 8:30 a.m. to 4:30 p.m. as well. Restrictions on noise and light will further limit the severity of impacts to the Kona Village Resort.

Per Mr. Fred Duer's letter of June 5, 1986, a copy of which you have been sent, he and the owners of Kona Village Resort feel that the combination of our responses to their comments and the agreed upon development conditions will sufficiently mitigate the impact of Kaupulehu Resort on Kona Village Resort such that they now support the acceptance of the Final EIS by the State Land Use Commission.

(2) Comment: Priority Guidelines of the Hawaii State Plan (HSP) express the desire to improve and maintain the quality of visitor facilities and surrounding areas.

Honolulu 466 Coval Street, Honolulu, Hawaii 96813, Telephone (808) 571-5361, Telex BELH11 743077  
Singapore 341 Orchard Road, #12 08, International Building, Singapore 0923, Telephone 233-6270, Telex RS 44444 BELSIN  
Australia Level 2, First Floor, 19 Conventer Street, Neutral Bay, Sydney, NSW 2069, Telephone 9481 188

Mr. Kent Keith  
June 5, 1986 - Page 2

Response: The objective and policies and priority actions of the HSP are discussed in Chapter V, Section 2.

(3) Comment: If both Kukio Beach and Kaupulehu are developed as Intermediate Resorts and successfully integrated, the result would be at the Major Resort scale.

Response: An area generally inclusive of both the Kaupulehu Resort and the Kona Village Resort sites is currently designated by the county General Plan as "Intermediate Resort." Both resorts are to be developed within the existing guidelines of an Intermediate Resort area. The proposed Kukio Beach resort has recently submitted an EIS to the Planning Department of Hawaii County for a General Plan amendment. Whether or not the Kukio Beach Resort will ultimately receive approval for development depends on whether the General Plan amendments and all other necessary approvals and permits are granted. Because of its present position in the approval process, predicting the future General Plan designation of the area is difficult. Should the Kaupulehu Resort be approved for development, the area would remain within the 1,500 unit General Plan limit. Should the Kukio Beach Resort be approved, the vicinity would be developed beyond the present guidelines for an Intermediate Resort area, and the General Plan designation may then have to be changed to Major Resort. It should be noted that designations and respective guidelines of various resort areas may be reviewed and altered during the ongoing General Plan comprehensive review program.

(4) Comment: The EIS should discuss the probable impacts associated with a Major Resort area at Kukio-Kaupulehu on the existing Kona Village Resort, as well as the impact on the Major Resort area of Waikoloa/Mauna Lani/Mauna Kea. Continued development of Intermediate and Major Resort areas between Keahole and Anahonohu may have a detrimental effect on the unique isolation of Kona Village and the exclusive luxury of the Mauna Kea and Mauna Lani Resorts.

Response: The addition of luxury resorts within the Kona-Kohala coastal area will undoubtedly decrease the exclusiveness of existing resorts in the region and may create competition among such resorts. However, as Ming Chew Associates has reported, this is not necessarily a negative phenomenon. Visitors attracted to the area by one resort may be induced to return to be guests at a neighboring resort. As evidenced by the Mauna Kea Resort, which was one of the first to be established in the South Kohala region, the development, in relatively close proximity of the Mauna Lani and Waikoloa Resorts, had no apparent negative impact on the number of visitors attracted to the Mauna Kea Resort. In fact, the demand for visitor units in the area continues to increase, as the South Kohala coastal region becomes an established and recognized resort destination.

(5) Comment: The EIS should discuss comments 3 and 4 in accordance with Policy (B)(4) in the State Tourism Functional Plan: "Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities."

Response: See responses to comments 3 and 4.

(6) Comment: The DEIS has no analysis as to the demand for housing which will be created by the proposed development. Impacts on housing demand should be discussed.

Response: Environment Capital Managers, Inc., which performed the "Public Revenue-Cost and Economic Impact Analysis," has addressed the issue of housing demand in the attached letter.

(7)(a) Comment: The EIS should identify recreational resources and uses of the project area and its immediate surroundings, particularly along the coastline.

Mr. Kent Keith  
June 5, 1986 - Page 3

Response: The recreational resources associated with the shoreline area and immediate surroundings include such water-related activities as fishing and skin diving. Some areas near the site may be used for surfing as well. Portions of the Kaupulehu coastline are not suitable for water-related recreational activities such as swimming and bodysurfing, as the shoreline is either strewn with lava boulders and coral rubble or is made up of rough a'ala lava which abruptly drops off to the ocean. Kahuwai Bay, Kaupulehu Bay and Kukio Bay are listed with the State Comprehensive Outdoor Recreation Plan (SCORP) as potential resources. Foot trails along the shoreline are also a valuable potential resource. A foot trail traveling north of Kiholo Bay is now being proposed by SCORP. Archaeological sites of significance are abundant in the area and can be accessed via the coastal foot trails. This information will be included in Chapter IV, Section 7.1.

(7)(b) Comment: The probable impacts of the proposed project on the water-related recreational resources and users should be clarified.

Response: The DEIS describes the impacts of the development on the shoreline and water-related recreational resources and their users on page IV-57, Section 7. In addition, it can be expected that increased use of the coastal area will stimulate more fishing and snorkeling in surrounding waters as well as off Kaupulehu. In the marine study conducted for the project, fish diversity and abundance was reported to be fairly good, especially in the area north of Kona Village. Depending on the popularity of fishing in the vicinity, a decrease in those species of fish which are most popular for eating could result. No impacts on users of the shoreline resource are expected. Current use of the shoreline area is minimal and the addition of resort guests and residents is not expected to create serious competition for the use of the resource.

(7)(c) Comment: The visual impact of the project from Kua and Kukio Bays should be assessed.

Response: The DEIS describes the visual impacts of the proposed project on the area as it currently exists. Kukio Bay joins Kaupulehu at its southern end and project facilities, particularly the hotel, would be visible from the bay. It is not known if the project would be visible from Kua Bay. This bay lies about one mile to the south and the topography and vegetation between Kua Bay and Kaupulehu may or may not interrupt a line of site to the project area.

(8) Comment: It is unclear who (what types of vehicles) will be able to use the northern access route, which will consist of a bulldozed jeep trail, until development occurs and it is paved. Whichever site is chosen in the southern section for the public parking, there should be assurance that there will be adequate parking stalls for the public. The EIS does not specifically state whether the public will be allowed to use the recreational beach club facility adjacent to the proposed hotel.

Response: Any vehicles capable of safely traveling the unimproved roadway will be permitted on the northern access route during the resort's development. Adequate parking stalls will be provided by Kaupulehu Developments at the future southern access site. The Beach Club facility will be open for use to guests, residents and visitors of Kaupulehu Resort.

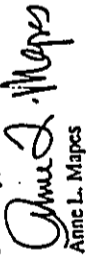
(9) Comment: The DEIS states that "the use of pesticides, herbicides and fungicides on golf courses in Hawaii is relatively insignificant especially compared to its use in sugar cane and pineapple cultivation." Given the proximity of the site to the shoreline and the porous nature of the ground that this project will be built on, special care should be taken to ensure that herbicides and pesticides will not percolate into nearshore waters.

Mr. Kent Keith  
June 5, 1986 - Page 4

Response: As Section 1.9.2.2 on page IV-18 explains, most of the chemicals that would be used on landscaped areas break down into inert compounds relatively fast and are not expected to impact surrounding waters. According to Charles Murdock at the University of Hawaii, Department of Horticulture, standard golf course maintenance included the use of herbicides three to four times per year. These herbicides primarily consist of MSMA, Dicamba and 2,4-D. Insecticides and fungicides are applied on a monthly basis. To ensure that significant amounts of insecticides, herbicides or fungicides do not enter marine waters, the waters offshore of Kaupulehu will be tested on a regular basis to ensure that these chemicals are having no significant negative effect on the environment.

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

Attachment

cc: Kaupulehu Developments



SUITE 805 CITY BANK BUILDING - P. O. BOX 1232 - HONOLULU, HAWAII 96807 - TELEPHONE (808) 537-3007

June 5, 1986

Mrs. Anne Hapes  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Mrs. Hapes:

Environmental Impact Statement (EIS) for the  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

As requested, we have reviewed the comments received from Mr. Kent Keith of the Department of Planning and Economic Development (memorandum dated May 21, 1986) on the DEIS for the proposed Kaupulehu Resort. The comments pertain to several main areas of concern on the West Hawaii coast relating to the following:

- \* Availability of housing.
- \* Affordable housing.

1. Availability of Housing.

The existing supply of housing consists of owner-occupied homes and condominiums as well as rental units including hotel condominiums.

A. Construction Employee Housing. The demand for housing by construction workers temporarily relocated from other-islands depends on the timing and scale of other projects under construction in the region at the time. The range of estimated demand for housing is from zero to 100 percent of the workers requiring housing.

Because construction work is temporary, these workers are best housed in rental units. Housing allowances of about \$30/day are generally provided other-islands construction workers by union contracts. As of February, 1986, the HWB lists 1883 condominium units available for short term rentals in the region. In recent years, it has been estimated that these condos have been only occupied 70 percent during peak periods. Most of these vacant 565 condo units have one and two bedrooms and can accommodate between 1130 and 2260 construction workers.

B. Operational Employee Housing. The 1850 direct operational employees equates to 1050 full time equivalent workers on site. The

demand for additional housing on the island is estimated to be less than the number of employees requiring housing because households could include more than one resort worker. The household formation rate per job was estimated at 0.45 (William Dickey Merrill Study). The 1050 full time equivalent workers at Kaupulehu in relation to the 1850 direct workers indicates a 0.57 rate.

Assuming a household formation rate of 0.6 per job, the estimated 15-20 percent direct, indirect and induced other-islands workers from Kaupulehu project would require 216 to 289 housing units.

2. Affordability of Housing.

A. Construction Employees. As previously stated, union contracts provide housing allowances for other-islands construction workers of about \$900 per month. Two workers sharing a one bedroom condo unit would have \$1,800 per month for housing. Four workers sharing a two bedroom condo unit would have \$3,600 per month. The construction workers could afford to rent hotel condominium units in the region.

B. Operational Employees. It is estimated that about 20 percent of the operational employees would be managerial or salaried. Of this group, about half or 10 percent of the employees are projected to be able to afford market rate housing.

In Survey of Big Island Residents on Planning and Housing Concerns, December, 1983, Hawaii Opinion, Inc., the household incomes indicated that in West Hawaii about 13 percent of the households can afford market rate housing, 14 percent would need Hula Mae financing, 28 percent were in the gap group, and 44 percent were in the low/moderate income group needing subsidy.

The estimated 15-20 percent other-islands direct, indirect, and induced operational workers would have the following categories of affordability:

<u>Affordability</u>	<u>Housing units</u>
Market	28 - 38
Hula Mae Financed	31 - 41
Gap Group	61 - 82
Low/Moderate Group	96 - 128
Total	216 - 289

We appreciate this opportunity to respond to the comments and concerns raised by Mr. Keith. If there is further information required, please contact me.

Very truly yours,

Bay-K. C. Yee



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MAY 29 1986

1986 5 29 10 15 AM

P. O. Box 339  
Honolulu, Hawaii 96809  
May 22, 1986

BELT, COLLINS  
& ASSOCIATES  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1153

MEMORANDUM

TO: Ms. Esther Ueda, Executive Officer  
State Land Use Commission

FROM: Franklin Y. K. Sunn, Director

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR KAUPULEHU DEVELOPMENTS

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for Kaupulehu Resort.

We would like to recommend that the developer work closely with the Hawaii Housing Authority (HHA) or the County of Hawaii to provide for development of affordable residential units which will be accessible to those who would be employed in jobs created by this development. We request the developer keep the Authority apprised of the details of the housing needs once they have been assessed.

Should there be any further questions, please contact Colette Sakoda at 848-3226.

*Franklin Y. K. Sunn*

Director

cc: Mr. Alexander Knizler  
Ms. Anne L. Mapes

Mr. Franklin Y. K. Sunn, Director  
State of Hawaii  
Department of Social Services and Housing  
P.O. Box 339  
Honolulu, Hawaii 96809

Dear Mr. Sunn:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 22, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development.

In response to your comment on the need for affordable employee housing, please refer to the attached letter from ECMI. Also, the Draft EIS states on page IV-37 in section 2.2.4.2, Chapter IV-37, that Kaupulehu Developments is discussing housing alternatives with the Hawaii County Housing Agency, the Hawaii Housing Authority, and concerned resort developers. Kaupulehu Developments intends to continue to work toward a mutually agreed upon housing solution with the above parties. Kaupulehu Developments will keep the Authority apprised of the details of employee housing needs as the project progresses and these needs more accurately assessed.

Sincerely,

*Anne L. Mapes*  
Anne L. Mapes

cc: Kaupulehu Developments  
Attachment

Honolulu 616 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex BELH117430474  
Singapore 160 Orchard Road #12-06, International Building, Singapore 0923, Telephone 235-6870, Telex RS 50464 ICTSIN  
Australia Level 2, First Floor, 19 Conventer Street, Neutral Bay, Sydney, NSW 2089, Telephone 9441300



ENVIRONMENT  
CAPITAL  
MANAGERS  
INC.

SUITE 805 CITY BANK BUILDING • P. O. BOX 1232 • HONOLULU, HAWAII 96807 • TELEPHONE (808) 537-3007

June 5, 1986

Mrs. Anne Mapes  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Mrs. Mapes:

Environmental Impact Statement (EIS) for the  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

As requested, we have reviewed the comments received from Mr. Franklin Sunn of the State Department of Social Services and Housing (memorandum dated May 22, 1986) on the DEIS for the proposed Kaupulehu Resort. The comments pertain to concerns on the West Hawaii coast relating to the following:

\* Affordable housing.

1. Availability of Housing.

The existing supply of housing consists of owner-occupied homes and condominiums as well as rental units including hotel condominiums.

A. Construction Employee Housing. The demand for housing by construction workers temporarily relocated from other-islands depends on the timing and scale of other projects under construction in the region at the time. The range of estimated demand for housing is from zero to 100 percent of the workers requiring housing.

Because construction work is temporary, these workers are best housed in rental units. Housing allowances of about \$30/day are generally provided other-islands construction workers by union contracts. As of February, 1986, the HVB lists 1883 condominium units available for short term rentals in the region. In recent years, it has been estimated that these condos have been only occupied 70 percent during peak periods. Most of these vacant 565 condo units have one and two bedrooms and can accommodate between 1130 and 2260 construction workers.

B. Operational Employee Housing. The 1850 direct operational employees equates to 1050 full time equivalent workers on site. The demand for additional housing on the island is estimated to be less than the number of employees requiring housing because households could include more than one resort worker. The household formation rate per

job was estimated at 0.45 (William Dickey Merrill Study). The 1050 full time equivalent workers at Kaupulehu in relation to the 1850 direct workers indicates a 0.57 rate.

Assuming a household formation rate of 0.6 per job, the estimated 15-20 percent direct, indirect and induced other-islands workers from Kaupulehu project would require 216 to 289 housing units.

2. Affordability of Housing.

A. Construction Employees. As previously stated, union contracts provide housing allowances for other-islands construction workers of about \$900 per month. Two workers sharing a one bedroom condo unit would have \$1,800 per month for housing. Four workers sharing a two bedroom condo unit would have \$3,600 per month. The construction workers could afford to rent hotel condominium units in the region.

B. Operational Employees. It is estimated that about 20 percent of the operational employees would be managerial or salaried. Of this group, about half or 10 percent of the employees are projected to be able to afford market rate housing.

In Survey of Big Island Residents on Planning and Housing Concerns, December, 1983, Hawaii Opinion, Inc., the household incomes indicated that in West Hawaii about 13 percent of the households can afford market rate housing, 14 percent would need Hula Mae financing, 28 percent were in the gap group, and 44 percent were in the low/moderate income group needing subsidy.


The estimated 15-20 percent other-islands direct, indirect, and induced operational workers would have the following categories of affordability:

<u>Affordability</u>	<u>Housing units</u>
Market	28 - 38
Hula Mae Financed	31 - 41
Gap Group	61 - 82
Low/Moderate Group	96 - 128
Total	216 - 289

The above number of housing units requiring Hula Mae financing by the State of Hawaii as well as the gap group and low/moderate income group solutions will require the developer to work closely with the Hawaii Housing Authority and the Country of Hawaii.

We appreciate this opportunity to respond to the comments and concerns raised by Mr. Sunn. If there is further information required, please contact me.

Very truly yours,

  
Ray K. C. Yee



STATE OF HAWAII  
OFFICE OF ENVIRONMENTAL QUALITY CONTROL  
465 South King Street, Room 115  
HONOLULU, HAWAII 96813

May 14, 1986

Ms. Esther Ueda  
Executive Officer  
State Land Use Commission  
Room 104, Old Federal Building  
335 Merchant Street  
Honolulu, Hawaii 96813

Dear Ms. Ueda:

Subject: Draft EIS for Kaupulehu Developments, Kaupulehu,  
North Kona, Hawaii

We have reviewed this document and offer the following  
comments for consideration:

1. The eight anchialine ponds located on the project site should be protected by establishing a buffer zone that will insulate the ponds from the development.
2. If recycled wastewater is intended to be mixed with brackish water for the irrigation of the proposed golf course, safeguards should be implemented to insure that this water does not reach the anchialine ponds.
3. There are a number of burial complexes in the area proposed for development. These sites have high cultural value and should be preserved. The Department of Land and Natural Resources' Historic Sites Division should be consulted in regard to the preservation of other archaeological sites.

Thank you for providing us the opportunity to review the draft EIS.

Sincerely,

*Letitia N. Uyehara*

Letitia N. Uyehara  
Director

cc: Kaupulehu Developments  
Belt, Collins & Associates

BELT, COLLINS  
& ASSOCIATES  
Engineering • Planning  
Landscape Architecture

Ms. Letitia N. Uyehara, Director  
State of Hawaii  
Office of Environmental Quality Control  
465 South King Street, Room 115  
Honolulu, Hawaii 96813

Dear Ms. Uyehara:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 14, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. Following are our responses to your comments in their order of appearance in your letter.

Comment: The anchialine ponds should be insulated from development by a buffer zone.

Response: Adequate natural buffers will surround ponds and wetlands. Fencing or other means of further protection will be implemented if development and the human activities that are associated with it should pose a significant threat to the natural pond environment.

Comment: Safeguards should be implemented so that recycled wastewater used for irrigation does not reach the anchialine ponds.

Response: It is impossible to preclude all recycled wastewater from reaching the ponds. The use of sewage effluent for irrigation could increase nutrient levels in the ponds. However, no negative impact to on-site ponds was detected at Mauna Lani Resort following construction and subsequent use and care of the surrounding terrain, including use of recycled wastewater. Kaupulehu Resort will monitor the effect of sewage effluent, should it be used, and will attempt to mitigate significant adverse effects on the ponds if such effects are detected.

Comment: Burial complexes in the area of development should be preserved. The Department of Land and Natural Resources' Historic Sites Division should be consulted in regard to the preservation of other archaeological sites.

Response: In its May 23, 1986 memo to the State Land Use Commission, the Department of Land and Natural Resources' Division of State Parks states: "We believe that the Draft EIS has covered needed historic preservation concerns for this petition, and we find the mitigation plan quite acceptable." Kaupulehu Resort and its archaeological consultants will work with the Department and the County of Hawaii Planning Department to address any further archaeological concerns.

Sincerely,

*Anne L. Mapes*

Anne L. Mapes

cc: Kaupulehu Developments

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University of Hawaii at Manoa

Environmental Center
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U.S. POSTAGE & METS OFFICE

May 23, 1986
RE:0434

Ms. Esther Ueda, Executive Officer
State Land Use Commission
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Dear Ms. Ueda:

Draft Environmental Impact Statement
Kaupulehu Developments
Kaupulehu, North Kona, Hawaii

We have reviewed the above cited document which has been prepared in conjunction with a State Land Use District Boundary Amendment petition submitted by Kaupulehu Developments to the State Land Use Commission (LUC). Kaupulehu Developments has requested that the LUC redesignate 698 acres: 575 acres from Conservation to urban and 123 acres from urban to conservation, in North Kona, Hawaii for the purposes of developing 698 acres as a self-contained resort/residential community to be known as Kaupulehu Resort. The project will also require a Special Management Area Use Permit (SMP), as well as requiring a review by the Historic Sites Division, Department of Land and Natural Resources (DLNR).

Our review was prepared with the assistance of Matthew Spriggs, Anthropology; Chuck Gee, Kevin Roberg, Dexter Choy, Juanita Liu, and George Ikeda, Travel Industry Management; James Dell, WRRC; Paul Eken, Agronomy and Soils; Richard Brock, Sea Grant; Augustine Furumoto, Hawaii Institute of Geophysics; and Martha Diaz, Environmental Center. We have identified several points which should be noted in preparation of the Final EIS.

DESCRIPTION OF PROPOSED DEVELOPMENT

The table, p. II-10, (Kaupulehu Resort-Land Use by Acreage and Units) lists 300-450 units golf condominium units, while in the subsequent paragraph (last sentence) states, "...350 to 450 condominium units will be situated...within the golf-courses. The Final EIS should reflect the appropriate numbers. We also note, that this comment was made at the preparation stage and has not been corrected in the Draft EIS.

AN EQUAL OPPORTUNITY EMPLOYER

Ms. Esther Ueda

-2-

May 23, 1986

CLIMATE

The Draft EIS describes the climate of Kaupulehu (p. IV-4) as "sunbaked" with low rainfall and relatively small seasonal fluctuation in temperature. The air quality impact analysis (Appendix I) cites frequency distribution of wind direction at the Mauna Kea Beach Hotel as an example of what can be expected to occur at Kaupulehu. The results of several more recent studies indicate that wind roses from Mauna Kea Beach Hotel probably do not represent the Kaupulehu situation. While a sea breeze exists in this area, wind directions, durations, and velocities, are speculative since data are lacking. If the winds are strong, vegetative wind breaks may be needed. In this regard, the use of the report on Deformation of trees in Hawaii and its Relative to Wind, (by Yasuo Noguchi, Journal of Ecology, 1979) may be of interest.

The section on climatic conditions at the proposed development site, indicates that this portion of the island receives high solar insolation (rate of delivery of all direct solar energy per unit of horizontal surface), therefore, the area has a tremendous potential for the use of cost-effective solar technologies for domestic purposes i.e. particularly water heating. Given the size of this development, the use of solar water heaters could reflect a significant savings in energy costs and the use of fossil fuels.

COASTAL PONDS

The document, (p. IV-10), states that, "the total number of anchialine ponds...are estimated to be about 450 to 500. Hence, the eight ponds at Kaupulehu represent a very small portion (1.6 percent) of the total pond resource in Hawaii." Does this statement reflect the decreased number of anchialine ponds as a result of the construction of the tennis court facilities at Waikoloa? If not, then the accurate numbers and percentages should be reflected in the Final EIS.

Probable Impacts

Pages IV-14 and IV-15 indicate that, "no filling of ponds is projected..." However, p. IV-14 indicates that only the ponds surveyed (87) will not be filled. Furthermore, it is unclear whether all/or some of the ponds are to be included in the "Pond Management Plan." Clarification is needed.

The document states that some erosion, due to construction may occur, and that irrigation and maintenance of the golf course will probably involve the use of treated sewage water and pesticides (primarily herbicides). The statement goes on to say that none of these factors are anticipated to occur at a level which would cause adverse impacts to the ponds, thus the affect would be minimal. The basis for assuming no impact to the ponds is not provided. It is our understanding that herbicides can have serious consequences on the ponds. It is also likely that cumulative impacts may result from the additional sedimentation, increased nutrient loading, runoff, and herbicides.

Ms. Esther Ueda

-4-

May 23, 1986

are good indicators for some potential negative impacts but not for others. The chances of negative impacts occurring to the coral communities due to dust, high nutrients etc. are small if we look at other developments along the Kona coast. The one thing that does occur repeatedly, however, with developments, is the loss of commercially important fish with greater access to a given area. The study does not quantify the fish community so changes in the community would be difficult to detect. The fish survey work should be redone in a more quantitative fashion to establish a reasonable baseline and all permanent stations should be marked and locality described so that data from subsequent surveys can be compared.

We appreciate the opportunity to comment on this Draft EIS.

Yours truly,

*Jacquelin Miller*  
 Jacquelin Miller  
 Acting Associate Director

Attachment

- cc: Patrick Takahashi
- OEQC
- Matthew Spriggs
- Jim Bell
- Paul Ekern
- Richard Brock
- Chuck Gee
- Kevin Roberg
- Dexter Choy
- Juanita Lili
- George Ikeda
- Martha Diaz
- Kaupulehu Developments
- Belt Collins and Associates

Ms. Esther Ueda

-3-

May 23, 1986

Mitigation Measures (p. IV-15)

Precautions will be taken (p. IV-15) during construction so that proposed activities, i.e. clearing and grubbing will not disturb the ponds. However, there is no indication of what the "precautionary" or mitigative measures will be. The Final EIS should include a discussion of the proposed "plan," and also a commitment to coordinate with the appropriate State agencies in the design of such a plan.

MARINE ENVIRONMENT  
Increased Sedimentation (p. IV-18)

The discussion presented in this portion of the Draft EIS attempts to identify probable impacts and the possible mitigative measures which might be effectively employed to address those impacts. In addition to the primary impacts related to the resort development (i.e. those identified in the Draft EIS) the Final EIS should include the impacts due to increased fishing that will result from increased access to this otherwise remote coastal area.

FLORA  
Mitigative Measures (p. IV-21)

We commend your efforts to preserve the endangered plant Sesbania arborea by revising the Kaupulehu Resort concept plan so that the adjacent use is now an archaeological preserve. Will the patch of mangroves located on the project site (where the black-crowned night herons were spotted) be preserved as well?

ARCHAEOLOGY (p. IV-23)

The archaeological plans proposed for the Kaupulehu development are adequate. For review purposes, it would be helpful to include the Final Report of the Survey and Testing of Sites by Paul Rosenthal, Inc. and any further archaeological reports or management plans as they become available.

SOCIOECONOMIC CONSIDERATIONS (p. IV-30)

See the attached comments from School of Travel Industry Management.

TRANSPORTATION FACILITIES (p. IV-39)

See attached comments from School of Travel Industry Management.

APPENDIX C - Offshore Marine Environment

A basic premise in the marine assessment is that permanent stations were set up so that one could go back at later dates to resurvey and obtain directly comparable data from the same transects. To do this one needs exact localities and these were not given. A second problem is that the author concentrated quantitative efforts on the corals which



# University of Hawaii at Manoa

School of Travel Industry Management  
Hotel, Restaurant, Tourism and Transportation Administration  
George Hall - Zaza Campus Road - Honolulu, Hawaii 96822  
Telephone: (808) 949-8540  
Cable Address: UHMANOA - Telex: 7431701

May 15, 1986

## MEMORANDUM

TO: Jacquelin Miller  
Environmental Center

FROM: Chuck Y. Gee, Director

SUBJECT: Comments on Environmental Impact Statement Kaupulehu  
Developments, North Kona, Hawaii

The following comments represent a summary of appropriate TIM faculty member viewpoints focused on the socioeconomic considerations (IV.2.) and transportation facilities (IV.3.) sections of the EIS.

### Socioeconomic Considerations

1. The question of housing is inadequately addressed since it is a critical problem given the shortage of available resident housing in West Hawaii. If new residents entering the labor pool place additional population pressure in the area, it will possibly result in resentment on the part of local residents. It is a problem that must be faced because the available labor supply in the county of Hawaii is in East Hawaii and new employees will have to relocate from the Hilo area or come from off-island.
2. The public revenue/cost analysis of 4:1 seems very high. In reviewing the list of public services, the developers seem to assume the best situation in that many public assistance and community services are excluded. In education and training alone, all of the training facilities required for employment preparation are located in East Hawaii and would need to be provided in West Hawaii to prepare any unemployed or new entrants into the labor force. The ratio also does not appear to assess the population impacts as they relate to transportation facilities, i.e. does the 4:1 ratio include highway and airport expenditures? maintenance? congestion cost?

AN EQUAL OPPORTUNITY EMPLOYER

MEMO TO: Jacquelin Miller

- 2 -

May 15, 1986

### Transportation Facilities

There are several transportation related concerns which are either contradicted in the EIS or not adequately explained and clarification should be sought. They include the following:

1. Chapter 1, Introduction and Summary - It is stated that the traffic generated by the resort and Kona Village additions is not expected to have significant impact on highway capacity or movement (p. 1-8). This appears to be a contradiction of what is later reported on p. IV-43 that "the project will contribute significantly to the regional and local traffic." Vehicular Traffic is expected to be a significant long-term source of noise associated with the project (1-8) but the cost of noise pollution is not addressed and it is uncertain if this has been included in the revenue-cost ratio discussed in Section IV. Even if no decline is expected in the adequacy of public services (I-9), the increase in public service requirements has not been analyzed in relation to the transportation requirements, i.e., is the highway network adequate for necessary emergency police and fire protection, health care provision, safe transit to schools?
2. It is difficult to assess the impact on service unless service level D (IV-44) is adequately explained in greater detail with regard to factors like congestion, property damage, bodily injury, deaths, "hot spots," etc.
3. While the percent of total traffic accounted for by both heavy and light trucks may decline, there will surely be an absolute increase in commercial traffic especially to service 1500 units (1450 new), golf courses and a beach club.
4. Developers suggest that resort goers tend to remain on the property, therefore, mitigating some of the traffic problem. This seems to ignore the residential aspects of the project, as well as the golf courses and beach access since residents will be unlikely to remain on the property and the public will be going to the beach or golfing facilities thus contributing to the traffic flow.
5. On many points, the developers seem to be suggesting that their individual resort will not be a large burden on transportation facilities although they avoid the question of the cumulative effects of Kohala development may strain the infrastructure. This seems to suggest the need for a regional, cooperative EIS in addition to the EIS for an individual resort.
6. There seems to be no addressing of the question of people getting to and from work or the multiplier and gravity effects of this development on traffic flows.
7. The report alludes to the need for improved highways and airports by 1995 and beyond. Monies in the federal highway trust fund and airport trust fund currently are being sequestered and thus are not available for building. The future does not appear promising since the federal government seems more disposed to refurbishing already crowded or dilapidated facilities, rather than building new ones or improving those which are not overcrowded.

MEMO TO: Jacquelin Miller

- 3 -

May 15, 1986

(1979)

With best wishes  
Yasuo Noguchi

Other Comments

1. In terms of physical environment, the project will essentially transform lava rock areas into a resort which may add to the general attractiveness but the environmental implications are unknown.
2. Although impacts of the construction and operation of the resort itself on flora and fauna are discussed, the question of impacts of increased transportation factors on the same elements are not discussed.

cc: Dr. K. Boberg  
 Dr. D. Chey  
 Dr. J. Liu  
 Dr. G. Ikeda

*Journal of Ecology* (1979), 67, 611-628

DEFORMATION OF TREES IN HAWAII AND ITS RELATION TO WIND

YASUO NOGUCHI\*

*Department of Geography, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.*

SUMMARY

- (1) The reliability of the use of wind-deformed trees as indicators of wind direction and magnitude was examined at 390 sites in Hawaii, where the NE trade-wind is persistent throughout the year.
- (2) The consistency in magnitude and direction of tree-deformation shown by individual trees of the same and of different species at a given site was studied.
- (3) After adjustments had been made for five notably wind-resistant or wind-sensitive species, observations on the fifteen most frequently encountered species were used to delineate estimated wind patterns for the islands of Oahu and Maui.
- (4) Comparison of the wind patterns based on the observation of wind-deformed trees with those based on instrumental observations showed a reasonable agreement; any discrepancies were probably attributable to the differences in the periods of time represented by the data on which the maps were based.

INTRODUCTION

In wind-swept areas, particularly in alpine-subalpine or coastal environments, trees deformed by the wind create unusual natural landscapes (Lawrence 1939; Daubenmire 1943; Richmond & Mueller-Dombois 1972; Smith 1977). Recent studies on wind-deformed trees have indicated that observations of these trees provide useful information on patterns of wind distribution where data for direct measurement of wind direction and speed are not available (Sekiguti 1951; Onodera 1964; Yoshino 1964; Holroyd 1970; Hollinger 1971; Owada & Yoshino 1971; Yoshimura 1971; Thomas 1973; Yoshino *et al.* 1976a, b).

There can be no doubt that the wind is the principal factor which causes tree deformation. However, wind-deformed trees can only be used as indicators of wind direction and speed in places where accurate causal relationships between the wind and tree deformation have been established; and the relationships may involve particular components only of the seasonal wind pattern. Thus prevailing wind during the growing season may be more important in some areas as a cause of tree deformation (Sekiguti 1951; Holroyd 1970). In alpine-subalpine regions, Lawrence (1939) and Yoshino (1973) reported the development of different types of tree deformation by summer and winter winds respectively, while Wardle (1968) and Ogawa (1974) discussed the importance of desiccating winds under severe winter conditions as a possible cause of tree deformation. As the abrasion by wind-blown ice and snow particles adds complexity to the wind/tree deformation relationship in high mountain areas (Kilkoiff 1965), so in coastal areas salt spray plays another important role in tree deformation (Wells & Shunk 1938; Smith

\* Present address: EWC Box 1234, 1777 East-West Rd., Honolulu, Hawaii 96822, U.S.A.  
 0022-0477/79/0700-0611\$02.00 ©1979 Blackwell Scientific Publications

PROJECT AHUPUA'A - SOLAR METEOROLOGICAL FIELD MEASUREMENTS ON THE ISLAND OF HAWAII, SUMMER 1978 - 3. TRADE WIND INTERACTIONS WITH LOCAL WINDS IN SOUTH KOHALA

by Thomas A. Schroeder Department of Meteorology University of Hawaii

Supported by U. S. Department of Energy under Grant number DE-AC03-79ET20184

February 1980

Items are often designed to provide domestic hot water; thus the solar space heating systems analyzed here are in reality combined solar water and space heating systems. Typical systems of both types are shown in Figs. 1 and 2.

The solar domestic hot water system (Fig. 1) consists essentially of solar energy collectors, a water storage tank, a heat exchanger, a drain down tank, a circulating pump, a tempering valve, and a differential thermostat. In this example the backup system is a conventional electric resistance domestic water heater.

Whenever the temperature of the solar collectors is higher than the storage tank temperature, the differential thermostat energizes the circulating pump. Water is circulated between the solar collectors and the storage tank, thereby heating the storage water. Cold city water is introduced into the bottom of the storage tank, where it is heated by solar-heated water. Heated water is supplied to faucets after passing through the conventional water heater and a tempering valve. The tempering valve mixes solar-heated water with cold city water, if necessary, to provide the desired water temperature. However, if solar-heated water is not available, the conventional water heater is energized. Whenever solar energy is not available and the solar collector temperature is lower than the storage tank temperature, the differential thermostat de-energizes the circulating pump and causes the water contained in the tank to drain into the drain down tank, thus preventing energy losses from the collectors and freezing of components.

The combined solar water and space heating system (Fig. 2) consists essentially of solar energy collectors, a water storage tank, a heat exchanger, two circulating pumps, a water heating coil, and a differential thermostat. The backup systems are an electric resistance domestic water heater and a space heater. Royce Bebek is chief of the Pacific and Center Research, Construction and Solar Applications, Department of Energy, Washington, D.C. Also the author is grateful to William Hubert for his assistance in preparing this manuscript. Honolulu, Hawaii 96813.

SCIENTIA, VOL. 20, 23, FEBRUARY 1980

Direct use of the sun's energy is of interest as a means of alleviating U.S. energy problems. The expected response of consumers to the financial incentives contained in the National Energy Conservation Policy Act (NECPA) of 1978 is of particular concern to energy policy-makers. These incentives are primarily directed toward solar applications for supplying domestic hot water and for space heating, which together represent 20 percent of annual U.S. energy consumption.

Economic Feasibility of Solar Water and Space Heating

Roger H. Bezdack, Alan S. Mirshberg, William H. Izbick

The economic feasibility of solar water and space heating is analyzed for single-family detached residences and multifamily apartment buildings in four representative U.S. cities: Boston, Massachusetts; Washington, D.C.; Grand Junction, Colorado; and Los Angeles, California. Three economic decision criteria are utilized: payback period, years to recovery of investment, and years to net positive cash flow. The cost competitiveness of the solar systems compared to heating systems based on electricity, fuel oil, and natural gas is then discussed for each city, and the impact of the federal tax credit for solar energy systems is assessed. It is found that even without federal incentives some solar water and space heating systems are competitive. Enactment of the solar tax credit, however, greatly enhances their competitiveness. The implications of these findings for government tax and energy pricing policies are discussed.

The ability of solar energy systems to contribute to this large market depends on the current economic feasibility of solar water and space heating systems and the effectiveness of the financial incentives in enhancing their attractiveness. In this article we discuss the economic feasibility for 1977 and 1978 of solar water and combined water and space heating for single-family and multifamily

makers. These incentives are primarily directed toward solar applications for supplying domestic hot water and for space heating, which together represent 20 percent of annual U.S. energy consumption. The ability of solar energy systems to contribute to this large market depends on the current economic feasibility of solar water and space heating systems and the effectiveness of the financial incentives in enhancing their attractiveness. In this article we discuss the economic feasibility for 1977 and 1978 of solar water and combined water and space heating for single-family and multifamily

makers. These incentives are primarily directed toward solar applications for supplying domestic hot water and for space heating, which together represent 20 percent of annual U.S. energy consumption. The ability of solar energy systems to contribute to this large market depends on the current economic feasibility of solar water and space heating systems and the effectiveness of the financial incentives in enhancing their attractiveness. In this article we discuss the economic feasibility for 1977 and 1978 of solar water and combined water and space heating for single-family and multifamily

makers. These incentives are primarily directed toward solar applications for supplying domestic hot water and for space heating, which together represent 20 percent of annual U.S. energy consumption.



**PAN EVAPORATION:  
STATE OF HAWAII, 1894-1983**

**GROUNDWATER RECHARGE AND COASTAL DISCHARGE  
FOR THE NORTHWEST COAST OF THE ISLAND OF HAWAII:  
A COMPUTERIZED WATER BUDGET APPROACH**

Report R74

by  
Brian Y. Kanehiro  
Frank L. Peterson

Prepared by  
**PAUL C. EKERN and JEN-HU CHANG**  
University of Hawaii at Manoa  
WATER RESOURCES RESEARCH CENTER  
Honolulu, Hawaii 96822

Technical Report No. 110

July 1977

*Approved  
for release  
1/15/78  
L. Peterson*

In Cooperation with  
**HAWAIIAN SUGAR PLANTERS' ASSOCIATION**  
Aiea, Hawaii 96701

Project Completion Report  
for

**NORTHWEST HAWAII GROUNDWATER BUDGET AND COASTAL DISCHARGE**

OWRT Project No.: A-067-HI  
Grant Agreement No.: 14-31-0001-6012  
Project Period: 15 September 1975 to 31 December 1977  
Principal Investigators: L. Stephen Lau and Frank L. Peterson



State of Hawaii  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**  
Division of Water and Land Development

The programs and activities described herein were supported in part by funds provided by the United States Department of the Interior as authorized under the Water Resources Act of 1964, Public Law 88-379; and the Water Resources Research Center, University of Hawaii.

Honolulu, Hawaii  
August 1985

June 5, 1986  
86-1154

Ms. Jacquelin Miller  
Acting Associate Director  
University of Hawaii at Manoa  
Environmental Center  
Crawford 317  
2550 Campus Road  
Honolulu, Hawaii 96822

Dear Ms. Miller:

Environmental Impact Statement (EIS) for  
Kauapulehu Resort, Kauapulehu, North Kona, Hawaii

Thank you for your comments of May 23, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kauapulehu Resort development. Following are our responses to your comments in their order of appearance in your letter and attachments.

Comments from Letter

**Comment:** There is a discrepancy in the table on page II-10 and in the text as to the number of condominium units planned for development.

**Response:** The revised EIS will reflect the same number of units in both.

**Comment:** Studies which are more recent than that cited in Appendix I indicate that wind conditions at the Westin Mauna Kea site are not necessarily the same as at the proposed Kauapulehu Resort site. If winds are strong, vegetative wind breaks may be needed.

**Response:** Thank you for bringing the additional sources to our attention; our air quality consultant is reviewing them. Should winds prove to be stronger than expected, the use of wind breaks such as vegetation will be considered.

**Comment:** The use of solar water heaters at the project could effect a significant savings in energy costs and the use of fossil fuels.

**Response:** The evaluation of the latest technological innovations, including cost effective energy sources and delivery, will be part of the design process.

**Comment:** Does the estimate of 450 to 500 anchialine ponds in Hawaii reflect the decreased number of anchialine ponds as a result of the construction of the tennis court facilities at Waikoloa?

Ms. Jacquelin Miller  
June 5, 1986 - page 2

**Response:** The estimate does take into account the decreased number of anchialine ponds as a result of development at Waikoloa Resort, including the construction of tennis facilities at Waikoloa.

**Comment:** Clarification is needed on the subject of the anchialine ponds at the project site.

**Response:** Both statements that you point out from the Draft EIS are correct. No filling of ponds is projected since the 8 ponds surveyed are all the ponds that were found and none of these will be filled. All of the ponds at Kauapulehu will be included in management of the resource.

**Comment:** The basis for assuming no impact to the ponds from the use of treated effluent and pesticides (primarily herbicides) is not provided. Herbicides can have serious consequences for the ponds. It is likely that cumulative impacts may result from the additional sedimentation, increased nutrient loading, runoff, and herbicides.

**Response:** Some adverse effect on the ponds may occur due to the reasons cited above. However, the degree of impact is expected not to be significant. Marine consultant Steven Dollar states on page 20 of his report (appendix C) that much of the increased nutrient loading from irrigation and fertilization will be taken up by the vegetation on the golf course. Chemical processes will also lessen the nutrient load that could potentially reach the ponds and nearshore waters through groundwater runoff. The ponds will be monitored for any changes after development occurs.

**Comment:** The Final EIS should include a discussion of the proposed pond management plan and a commitment to coordinate with the appropriate State agencies in the design of such a plan.

**Response:** Although Kauapulehu Developments intends to adopt a pond management plan, the details of such a plan have not yet been determined and therefore a discussion of its contents cannot be included in the Final EIS. The developer is, however, committed to the design and implementation of such a plan in coordination with the appropriate Federal, State, and County agencies.

**Comment:** The Final EIS should include the impacts due to increased fishing that will result from increased access to the otherwise remote coastal area.

**Response:** It is stated in section 1.7.2, Chapter IV of the DEIS that "With the establishment of public access to the shoreline, more people will frequent nearshore areas and the water off these areas. Recreational pursuits will include fishing as well as other ocean sports. The greatest likely impact of improved access will be the increased removal of fish from the reef area." (page IV-10)

Although there is the potential for the depletion of certain fish populations due to increased public access to the shoreline at Kauapulehu, the extent of change is unknown at present. We can currently only consider the experience of other coastal resorts in West Hawaii. In Appendix C of the Kauapulehu Resort DEIS, marine research consultant Steven Dollar states: "The conclusions of the marine biological survey conducted in 1983 at the Mauna Lani Resort state that it appears that reef fish populations are depressed along the shoreline especially with respect to species highly desirable for eating. Observations by long-time residents indicated increased numbers of both pole and spear fishermen with the opening of the Mauna Lani Resort. Similar changes in land use and access will undoubtedly occur at Kauapulehu." (page C-12)

Ms. Jacquelin Miller  
June 5, 1986 - page 3

- Comment:** Will the patch of mangroves located on the project site be preserved?
- Response:** The patch of mangroves where the black-crowned night herons were spotted are in an area of the project site planned to be left in open space. There are no current plans to remove the patch.
- Comment:** For review purposes, it would be helpful to include PHRI's final report and any further archaeological reports or management plans as they become available.
- Response:** The above reports will be made available to appropriate State and County agencies and interested parties as they are completed.
- Comment:** The exact localities of transects are not given in the marine assessment. The study does not quantify the fish community.
- Response:** The figure showing the location of transect stations has been included in Appendix C on page C-23. Tables showing the number of fish species and individuals have been added on page C-24.

#### Comments from School of Travel Industry Management Memo

- Comment:** Given the shortage of available resident housing in West Hawaii, the critical problem of housing is inadequately addressed.
- Response:** We have asked Environmental Capital Managers, Inc. (ECMI), the consulting firm that performed the revenue-cost and economic impact analysis for the EIS, to respond to the above concern. Please refer to the attached letter.
- Comment:** The revenue-cost ratio of 4:1 seems very high. Clarify what the ratio includes.
- Response:** Please refer to the attached ECMI letter.
- (The responses to the remaining comments on transportation facilities were prepared in consultation with Belf, Collins' civil engineer, Ed Iida.)
- Comment:** The statement that traffic generated by Kaupulehu Resort and Kona Village Resort additions is not expected to have significant impact on highway capacity or movement appears to contradict the statement that the project will contribute significantly to the regional and local traffic.
- Response:** The two statements are not contradictory. It is true that the project will contribute significantly to total regional and local traffic because of the number of trips that the project is expected to generate. However, the trips generated by the project are not expected to significantly affect the capacity of the highway due to its large capacity and currently low levels of traffic. If necessary improvements are made, high levels of service will be maintained at the intersection of the entry road and the highway.

Ms. Jacquelin Miller  
June 5, 1986 - page 4

- Comment:** The cost of noise pollution due to traffic is not addressed.
- Response:** The impacts of noise pollution have been addressed in the EIS and in Y. Ebisu's noise study (Appendix J).
- Comment:** The increase in public service requirements has not been analyzed in relation to the transportation requirements.
- Response:** The highway network with necessary improvements is deemed adequate for necessary emergency police and fire protection, health provision, and safe transit to schools.
- Comment:** Level of service D should be adequately described.
- Response:** In the Highway Capacity Manual, "the concept of levels of service is defined as a quantitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety." Level of service "D" represents high density. However, stable flow, speed and freedom to maneuver within the traffic stream are severely restricted and the driver experiences a generally poor level of comfort and convenience.

The level of service definition does not address factors such as property damage, bodily damage, deaths, "hot spots," etc.

- Comment:** There surely will be an absolute increase in commercial traffic due to the project.
- Response:** We agree that the number of trips by trucks will probably increase. However, the percentage of trucks in the traffic stream will probably decrease due to the greater increase of passenger vehicle trips.
- Comment:** Mitigation measures proposed for traffic seem to ignore the residential aspects of the project.
- Response:** Kaupulehu Resort is a planned destination resort where amenities such as golf courses, tennis facilities, a beach club, shops, dining facilities, etc., would tend to keep on-site residents and visitors at the resort much of the time. Many of the condominium units are expected to be in the visitor accommodations pool, and visitors staying in the units are expected to spend much of their time at the destination resort. Area residents will have access to resort amenities such as the golf courses. However, the number of vehicular trips due to public movement on and off site will probably be modest compared to the total number of trips.
- Comment:** The question of cumulative effects of Kohala development as a stimin on infrastructure is not addressed. There seems a need for a regional EIS.
- Response:** The growth of traffic based on historical data was used to assess the impact of the project on Queen Kaahumanu Highway. The historical data represents the growth of traffic in the area where resorts have developed in recent years and is an indicator of the cumulative effect of development in the area.

Ms. Jacquelin Miller  
June 5, 1986 - page 5

We agree that a regional EIS might be beneficial to address cumulative effects of resort development. Such cumulative effects cannot be adequately addressed in individual analyses such as the EIS for Kaupulehu resort.

**Comment:** The question of the impact of worker traffic seems not to be addressed.

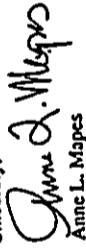
**Response:** The traffic generation factors used in the Kaupulehu Resort traffic analysis account for persons going to and returning from work and the attraction of various land uses.

**Comment:** The question of impacts of increased transportation factors on flora and fauna are not discussed.

**Response:** Flora and fauna studies have been performed for the EIS and are included as appendices to the report. Roadways will not be sited in areas of sensitive natural resources.

We trust that the above addresses the concerns raised in your letter and the memo from the U.H. School of Travel Industry Management.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments

Attachment



ENVIRONMENTAL  
CAPITAL  
MANAGERS  
INC.

SUITE 805 CITY BANK BUILDING • P. O. BOX 1222 • HONOLULU, HAWAII 96807 • TELEPHONE (808) 537-3007  
June 5, 1986

Mrs. Anne Hapes  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Mrs. Hapes:

Environmental Impact Statement (EIS) for the  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

As requested, we have reviewed the comments received from Mr. Chuck Y. Gee of the U.H. School of Travel Industry Management (memorandum dated May 15, 1986) on the DEIS for the proposed Kaupulehu Resort. The comments pertain to several main areas of concern on the West Hawaii coast relating to the following:

- \* Availability of housing.
- \* Public Revenue/Cost analysis.

1. Availability of Housing.

The existing supply of housing consists of owner-occupied homes and condominiums as well as rental units including hotel condominiums.

A. Construction Employee Housing. The demand for housing by construction workers temporarily relocated from other-islands depends on the timing and scale of other projects under construction in the region at the time. The range of estimated demand for housing is from zero to 100 percent of the workers requiring housing.

Because construction work is temporary, these workers are best housed in rental units. Housing allowances of about \$30/day are generally provided other-islands construction workers by union contracts. As of February, 1986, the HWB lists 1883 condominium units available for short term rentals in the region. In recent years, it has been estimated that these condos have been only occupied 70 percent during peak periods. Most of these vacant 565 condo units have one and two bedrooms and can accommodate between 1130 and 2260 construction workers.

B. Operational Employee Housing. The 1850 direct operational employees equates to 1050 full time equivalent workers on site. The

Mrs. Anne Hapes  
June 6, 1986  
Page 2

demand for additional housing on the island is estimated to be less than the number of employees requiring housing because households could include more than one resort worker. The household formation rate per job was estimated at 0.45 (William Dickey Merrill Study). The 1050 full time equivalent workers at Kaupulehu in relation to the 1850 direct workers indicates a 0.57 rate.

Assuming a household formation rate of 0.6 per job, the estimated 15-20 percent direct, indirect and induced other-islands workers from Kaupulehu project would require 216 to 289 housing units.

In the event Kaupulehu was developed after the other major projects, conceivably all of the 2405 direct, indirect and induced operational workers would be from other-islands. Using the household formation rate of 0.6 per job, the worst case situation would require 1,443 housing units.

2. Public Revenue/Cost Analysis.

The incremental public costs resulting from the development of Kaupulehu had considered the costs of education and transportation. The higher education costs included instruction, public service, academic support, student services and institutional support. The lower education costs included regular instruction programs, other regular instruction, student activities, adult education and public libraries. The transportation cost included mass transit services.

Certain variables, such as highway and airport maintenance and utilities were excluded from this analysis. Although these variables might be affected by the project, they are funded through user fees which are kept solvent. Therefore, the inclusion of these costs, along with the assessed user would result in a "wash".

We appreciate this opportunity to respond to the comments and concerns raised by Mr. Gee. If there is further information required, please contact me.

Very truly yours,

*Ray K. Lee*  
Ray K. Lee



University of Hawaii at Manoa

Water Resources Research Center  
Holmes Hall 283 • 2540 Dole Street  
Honolulu, Hawaii 96822

MAY 23 1986

BELT, COLLINS & ASSOCIATES

BELT, COLLINS & ASSOCIATES  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1156

19 May 1986

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
Room 103, Old Federal Building  
335 Merchant Street  
Honolulu, Hawaii 96813

Dear Ms. Ueda:

**SUBJECT:** Draft Environmental Impact Statement for Kaupulehu Resort, Kaupulehu, North Kona, Hawaii, April 2986

We have reviewed the subject DEIS and offer the following comments:

1. The use of treated sewage effluent for landscape and golf irrigation should be encouraged as a means of disposal as well as extending potable water supplies which might otherwise be used for irrigation.
2. The excellent near shore water quality is almost entirely attributable to the lack of runoff from land in this area. Therefore, in order to preserve this water quality, every effort should be made to prevent runoff from reaching the sea by using appropriate design techniques. It should be remembered that imported soil placed over lava will greatly reduce infiltration and "kona storms" with precipitous rains can occur anywhere including normally dry areas.

Thank you for the opportunity to comment. This material was reviewed by WRRRC personnel.

Sincerely,

*Edwin T. Murabayashi*  
Edwin T. Murabayashi  
EIS Coordinator  
ETM:jjm

cc: A. Kinzler, Kaupulehu Development  
A.L. Mapes, Belt Collins

AN EQUAL OPPORTUNITY EMPLOYER

Mr. Edwin T. Murabayashi, EIS Coordinator  
University of Hawaii at Manoa  
Water Resources Research Center  
Holmes Hall 283  
2540 Dole Street  
Honolulu, Hawaii 96822

Dear Mr. Murabayashi:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 19, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. Following are our responses to your comments in their order of appearance in your letter.

- Comment:** The use of treated sewage effluent for irrigation should be encouraged.
- Response:** As stated on page IV-54 of the Draft EIS, brackish water wells will be developed for golf course irrigation so as to minimize the need to use potable water supplies for irrigation purposes. The use of treated sewage effluent is proposed; its use will be monitored for potential adverse effects on the environment.
- Comment:** Every effort should be made to preserve excellent nearshore water quality by preventing runoff from reaching the sea.
- Response:** It is expected that some runoff will inevitably reach the sea, but design techniques and operational procedures to minimize the amount will be implemented. Experience at established coastal resorts in Hawaii shows that no significant adverse effects on coastal water quality have been detected.

We trust that the above addresses your concerns.

Sincerely,

*Anne L. Mapes*  
Anne L. Mapes

cc: Kaupulehu Development

Honolulu 4185 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5161, Telex: BELH 7430974  
Singapore 161 Orchard Road, #1216, International Building, Singapore 0723, Telephone: 235-6870, Telex: RS 5146-4 HCLISIN  
Australia Level 2, First Floor, 19 Convent Street, Neutral Bay, Sydney, NSW 2089, Telephone: 916-1188

Dante K. Carpenter  
Mayor

Eugene N. Tiwaniak  
Managing Director

RECEIVED

MAY 5 1986



Patricia G. Engelhard  
Director

Ronald Ohama  
Deputy Director

BELT, COLLINS  
& ASSOCIATES

Engineering • Planning  
Landscape Architecture

DEPARTMENT OF PARKS & RECREATION

COUNTY OF HAWAII

June 5, 1986  
86-1157

May 1, 1986

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
335 Merchant Street, Room 104 (Old Federal Bldg.)  
Honolulu, HI 96813

Subject: Kaipulehu Development, North Kona, Hawaii - EIS

Dear Ms. Ueda:

We are pleased to note that public access to and along the shoreline is being planned.

The following comments are also submitted for your consideration:

1. Pg. IV-57 - The district has three County beach parks -- Pahoehoe, White (Disappearing) Sands, and Kahaluu.
2. Pg. IV-58 - The map designating recreational facilities should include the Kona Imin Center (aka Holualoa Community Center), and Pahoehoe Beach Park.

Thank you for the opportunity to review the EIS document, which is being returned for your further use.

Sincerely,

*Patricia Engelhard*  
Patricia Engelhard  
Director

PE:GH:ai

encl.

cc: Mr. Alexander Kinzler (Kaipulehu Dev.)  
Ms. Anne Mapes (Belt, Collins & Assoc.)

• 25 AUPUNI STREET • HILO, HAWAII 96720 • TELEPHONE 961-8311

Ms. Patricia Engelhard, Director  
County of Hawaii  
Department of Parks and Recreation  
25 Aupuni Street  
Hilo, Hawaii 96720

Dear Ms. Engelhard:

Environmental Impact Statement (EIS) for  
Kaipulehu Resort, Kaipulehu, North Kona, Hawaii

Thank you for your comments of May 1, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaipulehu Resort development. The corrections which you suggested have been included in the Final EIS.

Sincerely,

*Anne L. Mapes*  
Anne L. Mapes

cc: Kaipulehu Developments

Honolulu 416 Canal Street, Honolulu, Hawaii 96813, Telephone (808) 521-5361, Telex: BE1111 7430474  
Singapore 341 Orchard Road, #12-01, International Building, Singapore 0711, Telephone 235 6070, Telex: MS 50444 DECSIN  
Auckland Level 2, Ford House, 19 Governor Street, Auckland (N.Z.), New Zealand, Telephone 381 100

DANTE K. CARPENTER, MAYOR  
DERRIS M. YAMAMOTO  
Director

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MAY 12 1985



DEPARTMENT OF RESEARCH AND DEVELOPMENT  
COUNTY OF HAWAII - 31 KAILUOWA DRIVE - HONO, HAWAII 96720 - TELEPHONE (808) 941-1344

ENT. CONSULTANTS & ASSOCIATES

May 6, 1985

Hs. Esther Ueda, Executive Officer  
State Land Use Commission  
335 Merchant St., Room 104-  
Honolulu, HI 96813

Dear Hs. Ueda:

This is to express support for the Kaupulehu Resort project as presented in the draft environmental impact statement dated April, 1986.

The project will have a favorable impact on Hawaii County's economy in several ways including the creation of employment opportunities, increasing the economic base through taxes and operational funds and contributing to the diversification of the economy.

The County of Hawaii has many diverse resources. It is an opinion, the Kaupulehu project will convert presently underutilized resources to employment opportunities for the Big Island. While both Kona districts and South Kohala boast unemployment rates below the Big Island average, nearby districts of North Kohala and Kau carried double digit unemployment through 1985.

The increasing cost of providing current and future public services will place a burden on the County budget. The reduction of federal funding further compounds the financial outlook. It is anticipated project such as the Kaupulehu District will contribute to the resolution of the budget problem.

Besides creating employment opportunities in the resort trade, Kaupulehu will contribute to diversification of the Big Island's economic base. Payrolls and expenditures for goods and services will create job opportunities in other sectors of the economy. That will enhance the areas which are not directly related to the tourist industry.

The Kaupulehu Resort project provides another important economic opportunity for the Big Island. The contribution of the project to the economy of the island overshadows any concern for the transformation of the environmental in the project area. We strongly recommend favorable action on the E.I.S.

Sincerely,

*Dennis H. Yamamoto*  
Dennis H. Yamamoto  
Director

cc: Alexander Kinzler  
Anne L. Hapes



**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1158

Mr. Dennis M. Yamamoto, Director  
County of Hawaii  
Department of Research and Development  
34 Rainbow Drive  
Hilo, Hawaii 96720

Dear Mr. Yamamoto:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 6, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. We appreciate your expression of support for the project as it is presented in the document. Kaupulehu Developments intends to continue to work with governmental agencies such as yours during the development process to ensure the construction of a project which is consistent with both private and public interests.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments

Honolulu 1416 Coastal Street, Honolulu, Hawaii 96813, Telephone (808) 521-5363, Telex: H111174 MATA  
Singapore: 101 Orchard Road, #12-01, International Building, Singapore 19113, Telephone 274-0270, Fax: RS 544-4117 (IN)  
Auckland: Level 2, First House, 19 Governors Street, Neutral Bay, Sydney, NSW 2059, Telephone 985-1188



COUNTY OF HAWAII

PLANNING DEPARTMENT

25 ALPHEUS STREET • HILO, HAWAII 96720  
(808) 931-2326

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JUN 4 1986

HUI, GRUWS & ASSOCIATES

DANTE E. CARPENTIER  
Mayor

ALBERT LONO LYMAN  
Director

HEINA A. PRINALEA  
Deputy Director

May 30, 1986

Ms. Anne L. Mapes  
Belt, Collins and Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Ms. Mapes:

Draft Environmental Impact Statement  
Kaupulehu Resort - Kaupulehu, North Kona, Hawaii

We have reviewed the subject draft EIS and submit the following comments:

1. Pages II-1 and II-6: The EIS notes that Kaupulehu would serve a "gateway" into the South Kohala Resort area. We would note that this may or may not be the case as other resort developments are also being proposed in the area between Keahole Airport and Kaupulehu.
2. Page IV-6: The natural hazards section should include a discussion of volcanic (eruptive) hazards since the rift zone of Hualalai is located just south of Kaupulehu.
3. Page IV-7: The discussion on groundwater notes that "a rate of about two million gallons per day per coastal mile is a reasonable estimate of the rate of groundwater flow." However, data from the draft Kukio EIS suggests an outflow in excess of 6 million gallons per day per coastal mile for the area immediately south of Kaupulehu. We assume that at the time the northern component of the overall resort project, including the marina, is developed that a supplemental EIS will be drafted and other necessary permits be applied for.
4. Other comments which are submitted for the EIS preparation notice have been adequately discussed.

Sincerely,

*Albert Lono Lyman*  
ALBERT LONO LYMAN  
Planning Director

VKG:aeb

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

Mr. Albert Lono Lyman, Director  
Hawaii County Planning Department  
25 Aupuni Street  
Hilo, Hawaii 96720

Dear Mr. Lyman:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 30, 1986 regarding the Draft EIS for the proposed Kaupulehu Resort development. The following are our responses to your comments in the order of appearance in your letter.

**Comment:** The EIS notes that Kaupulehu would serve as a "gateway" into the South Kohala Resort area. This may or may not be the case as other resort developments are also being proposed in the area between Keahole Airport and Kaupulehu.

**Response:** If the Kaupulehu Resort is approved and completed according to the existing development schedule, it will be the first major resort encountered as one travels north to the South Kohala Resort Region from Keahole Airport. For this reason Kaupulehu Resort has been termed the "gateway" to the resort area. This designation would no longer be applicable if other resorts, such as the proposed Kukio Beach Resort, are developed in the future.

**Comment:** The natural hazards section should include a discussion of volcanic (eruptive) hazards since the rift zone of Hualalai is located just south of Kaupulehu.

**Response:** Almost the entire Kaupulehu Resort development will take place on the Kaupulehu lava flow of 1800-1801. Consequently, the potential danger of eruptive volcanic hazards is visibly evident. The Final EIS for the Kukio Beach Resort (May 1986), gives a thorough explanation of the current hazards which could impact developments in the area of the Hualalai rift zone. The report states that scientists are now suggesting that an eruption is probable within the next 200 years and could occur within the next few decades. Volcanic hazards may also result from outfall from explosive eruptions. However, lava flows are a more serious potential threat due to the steepness of Hualalai's west and northwest sides. Seismic monitoring instruments located on Hualalai and monitored by the Hawaii Volcano Observatory will be able to assist in the prediction of eruptions in order to safeguard residents and visitors in the area.

**Comment:** Discussion on groundwater notes that "a rate of about two million gallons per day per coastal mile is a reasonable estimate of the rate of groundwater flow." However, data from the draft Kukio EIS suggests an outflow in excess of 6 million gallons per day per coastal mile for the area immediately south of Kaupulehu.

**Response:** As indicated in Chapter IV, Section 1.6.1, groundwater flow rate calculations for the

Mr. Albert Lono Lyman  
June 5, 1986 - Page 2

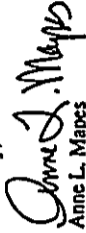
area to the north of Kaupulehu "have ranged from three to seven million gallons per day per coastal mile, the variations resulting from assumptions of contributing area, evapotranspiration rates, and other analytic differences." The estimate of two million gallons per day per coastal mile is a conservative estimate of the groundwater flow rate.

**Comment:** We assume that at the time the northern component of the overall resort project, including the marina, is developed that a supplemental EIS will be drafted and other necessary permits be applied for.

**Response:** All permit applications will be requested in accordance with state and county guidelines. An EIS will be prepared if required at the time that Kaupulehu Developments is preparing for development of the northern area.

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments

June 5, 1986  
86-1167

HAWAIIAN TELEPHONE  
STB

May 14, 1986

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MAY 29 1986  
FBI - OMAHA : ASSAULTS

BELT, COLLINS  
& ASSOCIATES  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1159

State of Hawaii  
Office of Environmental Quality Control  
465 South King Street, Room 115  
Honolulu, Hawaii 96813

Dear Sirs:

We have reviewed the DRAFT Environmental Impact Statement dated April 1986 for the Kaupulehu Resort Development. The following may have an impact on the environment of this area:

1. An existing aerial pole line serving Kona Village is in way of the proposed golf course and will have to be relocated. Future discussions with the developers will determine where pole locations will be set.
2. If underground facilities are not provided for communications, an aerial pole line to serve the development will be necessary.

Should you have any questions, please call me at 935-9515 or Duane Tanouye at 935-9589.

*Derrick M. Uyeda*  
Derrick M. Uyeda  
Island Manager - Hawaii

Attachment

KRU:DTT:KT:ph

cc: Ken Tanaka

Mr. Derrick M. Uyeda,  
Island Manager, Hawaii  
Hawaiian Telephone  
P.O. Box 4249  
Hilo, Hawaii 96720

Dear Mr. Uyeda:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 14, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development.

Kona Village Partnership and Kaupulehu Developments will discuss the locations of pole lines with your company at the appropriate time. It is expected that underground transmission facilities will be provided for communications.

Sincerely,  
*Anne L. Mapes*  
Anne L. Mapes

cc: Kaupulehu Developments

Honolulu 1406 Coral Street, Honolulu, Hawaii 96813, Telephone (808) 521-5261, Telex: HI 111174 HAWAII  
Singapore: 161 Orchard Road, #12-06, International Building, Singapore 0723, Telephone 235 6870, Telex: KS 54444 IKTSIN  
Australia: Level 2, First Floor, 19 Governor Street, Neutral Bay, Sydney, NSW 2089, Telephone (081) 148

PO BOX 4249 • HILO, HAWAII 96720 • TELEPHONE (808) 935-9411 • CABLE: TELHAWAII

May 9, 1986

RECEIVED

MAY 14 1986

EIS, CULTS & RECREATION

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
335 Merchant Street, room 104  
Honolulu, HI 96813

Dear Ms. Ueda,

I write with comments on the draft EIS for Kaupulehu Developments located in North Kona on the Big Island.

Two major areas of concern for me are the lack of consideration of secondary effects and the lack of analysis of the cumulative impact of this project taken along with other West Hawaii resorts. I believe the E.I.S. should be more thorough and more quantitative in its evaluation of the secondary effects and the cumulative impacts.

EIS regulations Sub-Part E 1:42e, which in the new regs becomes Section 11-200-171 states in part,

" Consideration of all phases of the action and consideration of all consequences on the environment; secondary or indirect, as well as primary or direct shall be included. The interrelationships and cumulative environmental impacts of the proposed action and other related projects shall be discussed in the EIS."

With regard to population impact, the Draft EIS does not quantify off-site population impact, nor address cumulative population impact with the other upcoming resort projects. It only says that ten percent immigration would increase the population by 300 persons, taking into account the average household size. It certainly gives no basis for using the 10% figure. For the Hyatt EIS, an immigrant percentage was estimated by Community Resources, Inc. but they had a large fraction of the workforce coming from other Kona hotels. There was no determination of where the replacement workers for the other "Kona hotels" would come from. Certainly, with the extensive resort growth now planned and underway, a much larger immigrant percentage would be anticipated.

When Belt Collins prepared the Mahukona Resort EIS in 1981 there was a full and quantitative analysis of labor force requirements and population impacts, taking into account other proposed developments. Five years later, with increased knowledge of planned resort development, Belt Collins would serve the community well by treatment in depth once again.

Housing impacts taken in conjunction with other planned resorts will also be substantial but there is no quantitative analysis in the draft EIS.

With regard to schools, "no significant enrollment impact on public educational facilities is expected." I believe that conclusion was drawn by the DOE after considering only the resort population, not the secondary growth, or the effect of other upcoming resorts coming on-line in the same time frame.

Looking at transportation, the service level of Queen Kaahumanu highway is given as level "A" at present, not reaching level "E" until after 1995. Will the EIS please give us the meaning of levels B,C, and D, the volume of traffic that will correspond to these levels, and the years in which these intermediate levels are expected to come about.

Finally, on the public access proposal I see that the lateral access "will most likely go inland around Kona Village Resort in order to facilitate pedestrian access to the proposed archaeological preserves." Although the archaeological preserves are a worthy objective of access, shoreline access does generally focus on use and enjoyment of the shoreline. So I would like the EIS to take a good look at the alternative of providing access makai of Kona Village Resort. If this is infeasible or not in line with the wishes of Kona Village Resort then a full explanation should be included.

Thank you for your attention to my concerns. I am forwarding a copy to Belt Collins and also to Mr. Kintzler of Kaupulehu Developments.

sincerely,

Bill Graham

Box 155  
Hawi, HI 96719



**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

Mr. Bill Graham  
Box 155  
Hawi, Hawaii 96719

Dear Mr. Graham

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 9, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. Following are our responses to your comments in their order of appearance in your letter.

**Comment:** Two major areas of concern are the lack of consideration of secondary effects and the lack of analysis of the cumulative impact of the project.

**Response:** Please refer to the responses to your more specific comments below.

**Comment:** The DEIS does not quantify off-site population impact, nor address cumulative population impact with the other upcoming resort projects.

**Response:** We have requested that Environmental Capital Managers, Inc. (ECMI), the consulting firm that prepared the public revenue-cost and economic impact analysis for the project, respond to the above comment. Please see the attached letter.

**Comment:** The DEIS gives no basis for the 10 percent immigration figure. With the extensive resort growth now planned and underway, a much larger immigrant percentage would be anticipated.

**Response:** The DEIS states on Page IV-36 that a ten percent ratio of immigrant employees would account for an increase in population of about 300 at full operation of the resort in 1996. Also stated is that an increase or decrease in the number of immigrant workers would entail a corresponding increase or decrease in population growth on the island of Hawaii. Further analysis of immigrant population is given in the attached letter from ECMI.

**Comment:** There is no quantitative analysis of housing impacts in the context of other planned resorts.

**Response:** See the attached letter from ECMI.

**Comment:** The conclusion drawn by the DOE that no significant enrollment impact on public educational facilities is expected seems to consider only the resort population, not the secondary growth or the effect of other resorts coming on-line in the same time frame.

June 5, 1986  
86-1160

Mr. Bill Graham  
June 5, 1986 - page 2

**Response:** See the attached letter from ECMI for a response to this comment.

**Comment:** Give the meaning of levels B, C, and D of traffic, the volume of traffic that will correspond to these levels, and the years in which these intermediate levels are expected to come about.

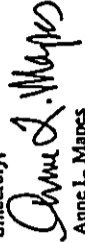
**Response:** Please refer to the attached pages from the 1985 edition of the Highway Capacity Manual which was used in the traffic analysis for the Kaupulehu Resort EIS. Described are levels of service A through F for two-lane highways. Page IV-44 of the Draft EIS states that the level of service on Queen Kaahumanu Highway is expected to be no worse than level of service C or D during the development period through 1995. At level of service C, traffic flow is stable, but is becoming susceptible to congestion due to turning traffic and slow-moving vehicles. Unstable traffic flow is approached as traffic flows enter level of service D. The years in which these intermediate levels will come about cannot be accurately predicted at present. Increased highway usage will depend on Kaupulehu Resort's actual development and that of various other planned and proposed developments in the West Hawaii coastal area.

**Comment:** Consider the alternative of providing access makai of Kona Village Resort. If infeasible or not in line with the wishes of Kona Village resort, include a full explanation.

**Response:** As described in the DEIS, Kona Village Resort is a separately owned and operated visitor facility adjacent to the proposed Kaupulehu Resort. Kona Village Resort rather than Kaupulehu Resort would make the decision whether to provide improved public access makai of the Village if that access traverses Kona Village Resort land. It is recognized, however, that the public has the right to traverse the entire shoreline of the State, and therefore the shoreline makai of Kona Village Resort. Kaupulehu Developments' alternatives do, in fact, provide public access to the shoreline. It should be noted that Kona Village Resort has operated for more than 20 years as a secluded retreat facility, characterized by its reclusive nature. Kaupulehu Resort's public access alternatives are in part intended to avoid and minimize direct, significant, adverse effects on the character of the Kona Village Resort.

We appreciate your comments and trust we have adequately addressed your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Resort

Attachment



**ENVIRONMENTAL  
CAPITAL  
MANAGERS  
INC.**

SUITE 805 CITY BANK BUILDING - P. O. BOX 1232 - HONOLULU, HAWAII 96807 - TELEPHONE (808) 537-3007

June 5, 1986

Mrs. Anne Hapes  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Mrs. Hapes:

Environmental Impact Statement (EIS) for the  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

As requested, we have reviewed the comments received from Mr. Bill Graham of Havi, Hawaii, (letter dated May 9, 1986) on the DEIS for the proposed Kaupulehu Resort. The comments pertain to several main areas of concern on the West Hawaii coast relating to the following:

- \* Availability of labor.
- \* Availability of housing.
- \* Cumulative impacts on housing.
- \* Cumulative impacts on education.

**1. Availability of labor**

The existing labor pool of the County consists of: 1) unemployed or underemployed persons; 2) labor market entrants, including high school graduates; and 3) persons working elsewhere on the island.

ECMI projected that 1,850 new jobs would be created directly by the completion of the project. The number includes both full-time, part-time, and seasonal on-call jobs, so that the 1,850 direct jobs can be equated to 1,060 full-time equivalent jobs. Indirect and induced operational employment (555 jobs) that would remain on the island is based on the 1975 study of Kauai's economy by Anderson et al.

Experience shows that luxury resorts in West Hawaii similar to the proposed Kaupulehu Resort, such as the Mauna Lani Bay Hotel and the Sheraton Royal Waikoloa, have hired most of their employees from the island of Hawaii. As a result of the extensive planned resort development on the Kohala/Kona coast over the next decades, however, it is expected that job opportunities will increase at a higher rate than the local population. Hence, in-migrants from outside the County will be needed to fill some positions at the various resorts, including Kaupulehu Resort and Kona Village Resort.

Estimates of 15 percent to 20 percent of operational employment by persons from other-islands were made in the EIS Revised Master Plan for

Mrs. Anne Hapes  
June 5, 1986  
Page 2

Mauna Lani Resort-Appendix D:2 by Peat, Marwick, Mitchell & Co. This would result in 360 to 480 persons coming from other-islands.

In the event Kaupulehu was developed after the other major projects, conceivably all of the 2405 direct, indirect and induced operational workers would be from other-islands.

The population increase as a result of the creation of new jobs at Kaupulehu would amount to 1,044 to 1392 persons (15 to 20 percent of the operational persons were from other-islands. If all of the workers were from other-islands, the population would total 6975.

**2. Availability of Housing.**

The existing supply of housing consists of owner-occupied homes and condominiums as well as rental units including hotel condominiums.

The 1850 direct operational employees equates to 1050 full time equivalent workers on site. The demand for additional housing on the island is estimated to be less than the number of employees requiring housing because households could include more than one resort worker. The household formation rate per job was estimated at 0.45 (William Dickey Merrill Study). The 1050 full time equivalent workers at Kaupulehu in relation to the 1850 direct workers indicates a 0.57 rate.

Assuming a household formation rate of 0.6 per job, the estimated 15-20 percent direct, indirect and induced other-islands workers from Kaupulehu project would require 216 to 289 housing units.

**3. Cumulative Impacts on Housing**

The following summarizes the resort developments in West Hawaii that have been approved plus Kaupulehu Resorts proposed development:

Resort	Existing	1985-		1991-		Total
		1990	1995	2000	2000	
Mauna Kea Beach Resort Hotels	310	350				660
Condos	74	245	465			784
Waikoloa Beach Resort Hotels	543	1250	600	600		2993
Condos		100		3300		3400
Mauna Lani Resorts Hotels	351	500	500			1351
Condos	80	116	914			1110
Kaupulehu Kona Village Hotels	100	600	300			1000
Condos		40	410			450
<b>Total Hotels</b>	<b>1304</b>	<b>2700</b>	<b>1800</b>	<b>600</b>	<b>3300</b>	<b>6004</b>
<b>Total Condos</b>	<b>154</b>	<b>501</b>	<b>1789</b>	<b>3300</b>		<b>5744</b>

Mrs. Anne Hapes  
June 5, 1986  
Page 3

The Mauna Kea Properties Environmental Assessment (August, 1984) had operational employees at 1.4 per hotel room and 0.5 per condo unit. The cumulative effect of these resorts on operational employment is:

Type of Operation	1991-1996		1996-2000	
	1990	1995	1995	2000
Hotel	3780	5740	6580	
Condominium	250	1145	2795	
Total	4030	6885	9375	

Assuming all of the operational workers will be from other-islands and a household formation rate of 0.6 per job, the cumulative demand for housing resulting from the development of the resorts would be as follows:

Households	1986-1990		1991-1996		1996-2000	
	1990	1995	1995	2000	1995	2000
Total	2418	4131	5625			

The above estimated cumulative demand for housing is the worst case situation in which all of the workers are from other-islands.

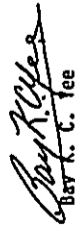
4. Cumulative Impacts on Education.

Based on the resort developments listed above and the assumption that all of the workers are from other-islands, the enrollment in lower education resulting from households formed from employment created at the resorts is as follows:

Year	Enrollment
1986-1990	1451
1991-1995	2479
1996-2000	3375

We appreciate this opportunity to respond to the comments and concerns raised by Mr. Graham. If there is further information required, please contact me.

Very truly yours,

  
Ray K. Lee  
Ray K. C. Lee



RECEIVED

HUEHUE RANCH

72-3667 Hawaii Belt Road  
Kailua-Kona, Hawaii 96740  
Phone 325-7110

RECEIVED

HUEHUE RANCH

72-3667 Hawaii Belt Road  
Kailua-Kona, Hawaii 96740  
Phone 325-7110

May 22, 1986

Ms. Nancy Brown  
May 22, 1986  
Page 2

Ms. Nancy Brown  
Belt, Collins and Associates  
506 Coral Street  
Honolulu, Hawaii 96813

Dear Ms. Brown:

Huehue Ranch is presently seeking a General Plan amendment to develop a resort on lands south of and adjacent to Kaupulehu Development's proposed resort area. Our proposed resort may be impacted by Kaupulehu's proposal.

We feel that Kaupulehu's DEIS does not address the following issues relating to Huehue Ranch's proposed resort:

1. Visual Impact.

The DEIS should analyze the visual impacts that Kaupulehu's proposed resort would have on Huehue's proposed Kukio Beach Resort. This is necessary due to Kaupulehu's proposal to build a major hotel on the lava flow located on its southwestern boundary and northwest of Huehue's proposed resort. Since the lava flow is approximately 20 to 30 feet above sea level, the proposed resort may have a major visual effect on Huehue's proposed resort unless Kaupulehu's hotel is set back a significant distance from the ocean.

2. Highway Access.

Kaupulehu proposes to provide access to its resort at a point approximately 1600 feet north of Huehue's boundary and approximately 3200 feet north of Huehue's designated highway access. The revised EIS should respond to the safety aspects of locating Kaupulehu's access so close to Huehue's designated highway access and proposed resort access.

3. Public Shoreline Access.

The DEIS implies that Kaupulehu will be providing public access through to Kukio Bay. The revised EIS should point out that Kaupulehu will provide direct access to the shoreline seaward of its proposed resort since the proposed resort at Kukio Bay will be providing its own access route for the public.

Thank you for the opportunity to comment on the DEIS. We are looking forward to working with Kaupulehu Development on this project.

Sincerely yours,

*Carl A. Carlson, Jr.*

Carl A. Carlson, Jr.

CAC/jo  
cc: State Land Use Commission  
County of Hawaii Planning Department  
Alexander Kinzler, Kaupulehu Developments

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

Mr. Carl A. Carlson, Jr.  
Huehue Ranch  
72-3667 Hawaii Belt Road  
Kailua-Kona, Hawaii 96740

Dear Mr. Carlson:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 22, 1986 regarding the Draft EIS for the proposed Kaupulehu Resort development. Following are our responses to your comments in their order of appearance in your letter.

**Comment:** The DEIS should analyze the visual impacts that Kaupulehu's proposed resort would have on Huehue's proposed Kukio Beach Resort.

**Response:** The DEIS addresses the visual impacts of the proposed Kaupulehu Resort on the environment which includes existing development. Assuming that development occurs on Huehue Ranch's property, we agree that the Kaupulehu Resort hotel would most likely be visible from shoreline facilities at Kukio Beach Resort. Mitigation measures including terracing, adequate setbacks, the use of buffers, and generous landscaping, will lessen visual impact to Kaupulehu Resort's neighbors to the north and south, at Kona Village Resort and the proposed Kukio Beach Resort.

**Comment:** The revised EIS should respond to the safety aspects of locating Kaupulehu's access so close to Huehue's designated highway access and proposed resort access.

**Response:** The spacing of entrance roads to the Kaupulehu and Huehue Ranch properties of 3,200 feet is adequate for safety aspects. The American Association of State Highway and Transportation Officials suggest a spacing of one-half mile between intersections on principal arterials. According to Belt, Collins highway design engineers, Queen Kaahumanu Highway has good geometrics so that intersections could probably be spaced as close as 1,200 to 1,500 feet apart.

Mr. Carl S. Carlson, Jr.  
June 5, 1986 - page 2

**Comment:** The revised EIS should point out that Kaupulehu Developments will provide direct access to the shoreline seaward of its proposed resort. The proposed Kukio Bay Beach Resort will provide its own access.

**Response:** Kaupulehu Developments will provide public access to the shoreline from Queen Kaahumanu Highway. Lateral access will be coordinated with any lateral access provided by neighboring landowners to the north and south of Kaupulehu. It is recognized that the adjacent Kukio Bay Beach Resort will provide its own access to the shoreline.

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments

June 5, 1986  
86-1161



PO Box 1299  
 Kaupulehu-Kona, Hawaii 96745  
 Phone (808) 325-5555  
 Cable: COCONUT

**RECEIVED**

MAY 22 1986

May 14, 1986

REI, COLLINS & ASSOCIATES

Ms. Nancy E. Brown  
 Belt, Collins and Associates  
 606 Coral Street  
 Honolulu, Hawaii 96813

Re: Draft Environmental Impact Statement ("DEIS") for  
 Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Dear Ms. Brown:

The overriding interest and concern of Kona Village Partnership and its Kona Village Resort is the preservation of the tranquil environment which has persisted since the opening of the resort 21 years ago. This atmosphere has been deliberately accomplished by careful programming of each facet of the resort as it has evolved over the years.

The resort's unpretentious entrance and its barren, rugged entry road immediately sets the tone for a resort of unusual qualities. This entrance provides a dramatic contrast with the first visual encounter of the lush vegetation of the Village proper.

The creators of the resort attempted and succeeded in constructing a Polynesian style village in concert with the land. Great care was taken that all structures would blend into the natural setting of the area.

The low density development of the site and the placement of visitor units in an informal setting lends individuality to each visitor unit and immediately creates an atmosphere of privacy for each accommodation. The individual structure heights are in scale with the natural environment while affording panoramic views in all directions without the intrusion of neighboring or distant urban intrusions.

Automobile access is limited to the resort office and parking is confined to one enclosed designated area which eliminates any conceivable conflicts with the calm and quiet setting of the Village. At the Village, the only mode of guest transportation is walking.

Night lighting is subdued and noise emissions of all sources are closely monitored. No radios, televisions or telephones are immediately available to the guests. Crime is nil. The overall sensory experience of the visitor is one of complete solitude and an isolation from the bombardment of their normal daily activities. It is this atmosphere Kona Village Partnership wants to maintain and preserve. Within the last two years, additional positive steps have been taken to enhance this quiet enjoyment. The airstrip has been abandoned and landscaped. The heliport is located at the extreme east end. Gas powered carts have been replaced with silent electric powered units. Major paths and beach front are lighted with torches and electric path lights reduced to a minimum but safe level.

A Clusion Resort

Plans for the future envision the same low key design, small increments of individual haies as needed "without change." It has taken three years and millions of dollars in renovation, new construction and operational costs to return the Village to an acceptable level of guest satisfaction and income to support itself.

This fragile balance of enhancing the visitor's enjoyment, protecting and enhancing the environment and the economics of this unique operation is of major concern.

Although the DEIS for Kaupulehu Developments is comprehensive, it fails to adequately address the impact that the proposed project would have on Kona Village Resort. The Revised EIS should provide additional information to clarify: (1) the project's relationship to Kona Village Resort; and (2) the impact that the proposed project will have on Kona Village Resort and effective mitigating measures that will be implemented to minimize such impacts.

Relationship of the Proposed Project to Kona Village Resort

The description of the project and the development concept, with reference to Kona Village Resort, is misleading and could easily be misconstrued. The DEIS implies that Kona Village Resort is an applicant with the accepting agency, the Land Use Commission. This inference is incorrect since Kaupulehu Developments is the only party that is applying for a boundary amendment.

Kona Village Partnership is negotiating to purchase five acres to the south (which is presently designated urban) and fifteen acres to the north of which 5.5 acres is designated urban and the balance of 9.5 acres is to be reclassified.

Kona Village Resort and its adjoining lands have had three lessees in the past - Mr. Jackson, Bhalalai Development Corporation and Cambridge Pacific, Inc. When Barwell Hawaiian Properties, Inc., a joint venture partner in Kaupulehu Developments, purchased a controlling interest in the master lease of the property from Cambridge Pacific, Inc., Kona Village Resort was purchased by Kona Village Partnership, a separate entity. Kaupulehu Developments' plans for adjacent lands are totally separate from Kona Village, and should not be interpreted as being connected to the Village in any way.

The DEIS makes reference to the site's "locational identity", and implies that the proposed resort would take advantage of possible "pent-up demand" that exists at Kona Village. The proposed resort is very different than the resort that exists at Kona Village. As Kaupulehu noted in its petition to the Land Use Commission, the proposed resort will have its own "unique identity", distinguished from Kona Village. As such, Kaupulehu could not utilize or rely upon demand generated by Kona Village.

Kona Village wants to be able to construct 50 additional units in the future. Twenty-five of these units would be built in the near future with fifteen units being constructed by 1988, and ten more units being constructed by 1989. Kona Village Resort's first priority is to preserve the tranquil environment that

has existed throughout the history of the resort. Expansion plans are secondary to this goal. Kona Village will not advocate an expansion that will result in the destruction of the ambience of the existing resort. Any contemplated development will be in keeping with the present character of the resort.

Kona Village has been successful in providing a unique resort environment to a consistent clientele for over twenty years. The absence of artificial noise (i.e. radio, telephones, television, automobiles), outdoor lighting (use of lava torches and low wattage bulbs) and crime provide guests a tranquil haven from the outside world. Obviously, Kaupulehu Developments' planned resort could significantly affect, and in fact destroy the unique experience that Kona Village has to offer, if it is not developed in a manner that is sensitive to the Village. It would not be in our best interest to support Kaupulehu's proposal, and an expansion of the Village, if this development would ultimately have a negative effect on the economic viability of the existing resort.

#### Impact of the Proposed Resort on Kona Village Resort and Mitigating Measures

The DEIS does not adequately identify and propose mitigating measures for impacts that the proposed project would have on Kona Village. Such impacts include the following:

#### Economic Impact on Kona Village

The DEIS does not accurately reflect potential economic impacts that the proposed resort may have on Kona Village Resort. If Kaupulehu's proposed resort is not planned and controlled in a sensitive and stringent manner, Kona Village Resort will lose its clientele and the long-term economic viability of the existing resort will ultimately suffer. The Revised EIS should address the impacts of this economic reality.

#### Impact of Light from the Proposed Project

The use of artificial light at Kona Village is carefully limited. Improper site planning and design of the proposed resort and its related facilities would impact the Village. The DEIS fails to analyze the impact of street lights, building lights, outdoor lighting and automobile headlights on the Village. The Revised EIS should analyze these potential impacts. Mitigating measures, such as the implementation of landscaped buffers which would prevent light penetration, should be considered for the boundaries of the resort to assure that lights from the resort will not impact Kona Village.

#### Visual Impacts

Each visitor accommodation at Kona Village Resort has been carefully sited to provide guests with unobstructed view planes and to create an atmosphere of privacy. Structure heights are non-obtrusive and are in scale with the natural environment. The entrance and roadway leading to Kona Village is unpretentious and devoid of vegetation. This barren entryway provides the visitor with an impressive impact upon arrival at the lushly landscaped Village.

The ambience and privacy of the Village demand that visitor accommodations and

entryway to the Village remain free from incompatible visual intrusions. The Revised EIS should analyze the impact that the proposed resort would have upon view planes at the Village. Mitigating measures such as buffer areas and height limits should be proposed to prevent the destruction of the serenity and privacy of the Village.

#### Aural Impact

Although the DEIS refers to noise generated by traffic, resort operations, and construction, the document fails to adequately set forth effective mitigating measures to minimize aural impacts upon Kona Village. The Noise Study that was prepared for Kaupulehu Developments (Appendix J of DEIS) analyzed noise impacts on Kona Village Resort. The study concluded that traffic and intrusive noise impacts on the Village would be acceptable because of the large setback distances incorporated into the development plan.

This conclusion was based on a development plan that included: (1) a seven hundred foot wide buffer between resort roadways and Kona Village; (2) a two hundred seventy-five foot wide buffer between the proposed hotel and beach club buildings and Kona Village; (3) the location of the proposed hotel and beach club approximately one-half mile from Kona Village; (4) three hundred fifty foot wide buffers separating the condominium units from each other and from the hotel and beach club; and (5) an internal roadway speed limit of 25 to 35 miles per hour.

The study concluded that construction noise at the proposed resort would temporarily degrade the quality of the acoustic environment at the Village. Mitigating measures that were suggested included properly muffled construction equipment and the early phasing of the construction of landscaped buffers and berms.

The use of the buffer areas, speed limits, and other mitigating measures that are proposed in this study should be included in the Revised EIS. The study concludes that it is unavoidable that Kona Village will be impacted by construction noise from the proposed resort. Noise intrusion presents a serious impact that could destroy the serenity of the Village and severely impact its occupancy rate. As such, the Revised EIS should include additional mitigating measures to minimize the impact of construction noise such as limiting construction work to weekdays and specified hours of the day, and controlling the intensity of noise through the monitoring of decibel levels.

#### Impact from Dust Generation

The DEIS notes that most of the resort will be built on a'a lava. The a'a will be shaped by bulldozers and crushed to a smooth cobble surface. In addition, an undetermined amount of soil cover will be imported to the site for golf course and resort landscaping. The Revised EIS should provide an analysis of possible impacts due to dust generation and sediment run-off. Mitigating measures to minimize potential impacts should be specified.

#### Impact on Security and Seclusion

Privacy and Security are two very important aspects of Kona Village. Much of

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 4, 1986  
86-1139

Mr. Fred Duerr, General Manager  
Kona Village Resort  
P.O. Box 1299  
Kaupulehu-Kona, Hawaii 96745

Dear Mr. Duerr:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 14, 1986 regarding the Draft EIS (DEIS) for the proposed Kaupulehu Resort development. We appreciate the time you spent reviewing the document. Following are our responses to your comments which we hope adequately address your concerns. For ease of review, we are responding to the comments in their order of appearance in your letter.

**Comment:** Kona Village Resort is not an applicant for boundary amendment. Kona Village Partnership is, however, negotiating to purchase five acres to the south of the existing Kona Village Resort (currently designated Urban) and fifteen acres to the north, of which 5.5 acres are designated Urban and the balance of 9.5 acres is to be reclassified from Conservation to Urban.

**Response:** The DEIS states that Kaupulehu Developments is the party requesting that the State Land Use Commission amend certain State Land Use District boundaries to allow development (see pages I-1 and II-13). Also, the September 1985 petition (docket no. A85-597) lists Kaupulehu Developments as the sole petitioner. In neither document is Kona Village Resort meant to be construed as a party to the petition and any confusion on the issue is regretted.

Kona Village Partnership has, however, negotiated with Kaupulehu Developments to undertake to acquire a leasehold interest in a total of about 20 acres of land to the north and south of the existing Kona Village Resort to allow expansion of its facilities. It is our understanding that a final agreement has been reached. The acreage in question is currently partially in the Conservation district and thus that portion of the land needs to be reclassified before expansion of Kona Village Resort may proceed. Kaupulehu Developments has included the Conservation acreage to be leased to Kona Village Partnership as part of its petition in view of the proposed use by the partnership of the land. For the purposes of the EIS and by the parties' agreement, the expansion of Kona Village Resort facilities has been included as part of the "proposed project" so that potential impacts due to the expansion may be addressed along with potential impacts due to Kaupulehu Resort development on adjacent lands, in conformance with EIS rules and regulations.

the success of the Village can be attributed to these two factors. The location of the internal access roads within the proposed project will directly impact the security and seclusion of the Village. Public access alternative 2a, which is delineated on Figure II-5 of the DEIS, would cause severe impacts. This access route would lead to the condominium sites which are directly adjacent to Kona Village. The corresponding increase in persons intruding into the resort area would certainly impact the Village, by increasing the potential for crime which is virtually nil at present, and would effect the reclusive atmosphere that the Village has strived to maintain.

The Revised EIS should consider the impact that this access route would have on the Village, and should analyze preferred alternatives. Mitigating measures such as the implementation of buffer areas at all boundaries of the resort which are adjacent to Kona Village should be proposed.


Chapter V of the DEIS analyzes the relationship of the proposed action to applicable land use plans and policies. Section 205-17, Hawaii Revised Statutes, requires the Land Use Commission to consider the extent to which a proposed reclassification conforms to the applicable goals, objectives and policies of the Hawaii State Plan.

As was noted in the DEIS, specific objectives and policies for the State with regards to the visitor industry include: improving the quality of existing visitor destination areas and ensuring that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities (Section 226-8, Hawaii Revised Statutes). Unless acceptable and effective mitigating measures are implemented to minimize the impact of the proposed project upon Kona Village Resort, it would be incorrect to state that the project fulfills these criteria.

As the above comments indicate, many issues regarding the impact of the proposed resort on Kona Village Resort remain unresolved. It is simply incorrect to state, as is done in Chapter IX of the DEIS, that none of the unresolved issues "constitute areas of real controversy". The outcome of these issues will ultimately determine the economic feasibility of Kona Village Resort.

Unless these issues can be addressed properly and mitigated in an acceptable manner, we must urge the Land Use Commission to find Kaupulehu's EIS to be inadequate, and to refuse to accept its Revised EIS.

Representatives of Kona Village Resort and Kaupulehu Developments have been meeting to discuss, and hopefully resolve, many of the concerns that have been raised herein. Kona Village would have no disagreement with the proposed resort if these concerns can be addressed through the imposition of mutually agreed upon restrictive covenants which would run with the land. It is our sincere hope that these issues will be resolved in a timely manner, and that Kona Village, which has existed as a one-of-a-kind resort for over twenty years now, can maintain its unique atmosphere.

Sincerely,  
  
Fred Duerr  
General Manager

cc: Land Use Commission  
Department of Planning and Economic Development  
Hawaii County Planning Department and Hawaii County Planning Commission

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Fred Duerr, Kona Village Resort  
June 4, 1986 - page 3

**Response:** It is our understanding that conditions on the future development of both projects have been adopted by Kona Village Partnership and Kaupulehu Developments. As agreed between the two parties, a 200-foot wide buffer area will surround Kona Village Resort. No structures, improvements or other use will be allowed within these buffer areas without Kona Village Properties' written approval. Other design and operational considerations that are sensitive to the retreat character of Kona Village Resort will attenuate potential adverse effects on the Village. There will be a 100-foot wide landscaped buffer along the southern boundary with Kaupulehu Resort. Dense vegetation will minimize penetration into Kona Village of noise, night lighting, and views of structures. As understood by both parties, Kaupulehu Developments' proposed project is intended not to destroy the unique character of Kona Village Resort, but to complement it with separate but compatible facilities. Kaupulehu Developments is sensitive to the unique experience of Kona Village Resort.

**Comment:** There is concern that if Kaupulehu Resort is not planned and controlled in a sensitive manner, Kona Village Resort risks losing its clientele, which would lead to economic hardship.

**Response:** Ming Chew Associates projects some possible loss in clientele at Kona Village Resort when Kaupulehu Resort becomes operational. However, as stated previously, this loss is expected to be more than offset by new clientele that otherwise might not have been aware of the Village had they not been visitors at Kaupulehu Resort. In Ming Chew Associates' opinion, joint use of facilities for certain occasions or activities and joint marketing would probably enhance Kona Village Resort's economic standing rather than harm it.

**Comment:** The DEIS does not address the impact of street lights, building lights, outdoor lighting and automobile headlights on the Village. Mitigation measures should be considered.

**Response:** The agreement between Kona Village Partnership and Kaupulehu Resort addresses the impact of various light sources. Conditions of development preclude persistent activity which could lead to increased intrusion of night light. Outdoor lighting within a 300-foot zone along the southern boundary will be controlled. Major roadways and parking lots within 200 feet of the southern boundary will be precluded.

**Comment:** The revised EIS should analyze the impact of the proposed resort on view planes at the Village. Mitigation measures should be proposed to maintain privacy of the Village.

**Response:** The visual impacts of development on Kona Village Resort are discussed in Chapter IV, section 8.3 of the EIS. Kona Village Partnership and Kaupulehu Developments have agreed to a landscaped buffer as well as to height restrictions within one-quarter mile of Kona Village Resort, which will mitigate visual impacts on the Village.

**Comment:** The DEIS does not adequately present effective mitigating measures to minimize noise impacts.

Fred Duerr, Kona Village Resort  
June 4, 1986 - page 2

We note that of the fifteen acres north of Kona Village Resort, 5.5 acres are designated Urban and 9.5 are in Conservation according to your current plans for expansion. In the Draft EIS, the table for Kona Village Resort Land Use on page II-10 shows that about 2.5 acres are in Urban and 12.5 acres in Conservation. We understand that the difference is due to your revised site plan for the lands north of Kona Village Resort, a copy of which we received after the Draft EIS was submitted to the State Land Use Commission. The impact analysis, text, and figures for the Final EIS will be modified to reflect this change in Kona Village Resort plans. It should be noted, however, that the total acreage requested for reclassification remains the same: 575 acres from the Conservation to the Urban district and 123 acres from Urban back to Conservation.

The EIS reflects the changes that you have requested, and to that extent you are necessarily involved.

**Comment:** The two adjacent projects, Kona Village Resort and the proposed Kaupulehu Resort, have separate plans for development which should not be interpreted as being connected.

**Response:** We agree that the two resorts are independent entities to be managed separately. In Chapter II of the Draft EIS, we state that "...in May 1984, a separate partnership, unrelated to Kaupulehu Developments, purchased the sublease for the Kona Village Resort property from Cambridge Pacific, Inc. in an unrelated transaction. Today, Associated Inns and Restaurants Company of America (AIRCOA) operates the Kona Village Resort for that partnership." (emphasis added) (page II-7)

**Comment:** Kona Village Resort and the proposed Kaupulehu Resort will have separate identities and will be very different from each other. Therefore, Kaupulehu could not rely on any demand generated by Kona Village.

**Response:** It is the opinion of Ming Chew Associates, the firm that performed the market study for proposed development at Kaupulehu, that "pent-up demand" exists which could benefit both Kona Village Resort and Kaupulehu Resort, in large part because the two resorts offer different experiences, yet might appeal to the same clientele. Although the two resorts have totally separate identities and will be operated independently, Ming Chew Associates sees a likely synergistic relationship between the two. Any loss of clientele at Kona Village Resort due to Kaupulehu Resort development is projected to be more than offset by new clientele initially attracted to the area by Kaupulehu Resort. According to Ming Chew Associates, some guests at Kaupulehu Resort would want to return to the same location while seeking a different environmental setting which will be available at the adjacent Kona Village Resort. Also, visitors at Kona Village Resort are potential purchasers of condominium units at Kaupulehu Resort. Ming Chew Associates points to the successful synergistic relationship between the Westin Mauna Kea and Mauna Lani Resort, as well as between the Hyatt Regency Maui and the Maui Marriott Resort. Similar benefits are expected to be derived by both Kona Village Resort and Kaupulehu Resort.

**Comment:** Kaupulehu Developments' proposed project could significantly affect or even destroy the unique experience of Kona Village Resort if it is not developed in a manner that is sensitive to the Village.

Fred Duerr, Kona Village Resort  
June 4, 1986 - page 4

**Response:** Noise impacts and mitigating measures are discussed in Chapter IV, section 5.3 of the DEIS and in Appendix J. The noise impacts section of the revised EIS will take into consideration your concerns and propose possible mitigation measures. The conditions of development agreed upon include noise mitigation measures. Kaupulehu Developments will provide Kona Village Partnership with construction schedules so that any significant construction activity which might result in unusual noise problems will be communicated to Kona Village Partnership in advance. Construction activities within 700 feet of Kona Village Resort will be conducted between 8.30 a.m. and 4.30 p.m., Monday through Friday. No blasting or heavy earth moving will occur on Kaupulehu makai property before 8.30 a.m. or after 7.30 p.m.

**Comment:** The revised EIS should provide an analysis of possible impacts due to dust generation and sediment runoff and specify measures to minimize potential impacts.

**Response:** Chapter IV, Sections 4.6 and 4.7 of the DEIS provide a summary of possible impacts due to dust generation which is expected to be greatest during construction, as well as mitigation measures. For further detail, please refer to Appendix I, Air Quality Impact Analysis, sections 7 and 8.3. Dust control measures are recommended to prevent violations of state fugitive dust standards. Kaupulehu Developments intends to follow these recommendations, thereby reducing the impact of fugitive dust on the adjacent Kona Village Resort during the temporary construction period.

**Comment:** Increased sedimentation due to development is discussed in section 1.9.2.1 (page IV-18), Chapter IV of the DEIS. Appendix C, an assessment of the offshore marine environment, contains a substantial discussion on increased sedimentation and cites studies performed and examples of experience at other projects in the Hawaiian Islands.

**Comment:** The revised EIS should consider the impact of public access alternative 2A on the Village and analyze preferred alternatives. Mitigation measures such as the implementation of buffer areas at all boundaries of the resort which are adjacent to Kona Village should be proposed.

**Response:** The public access alternatives shown in Figure II-5 are conceptual renditions of possible locations of the public accessways. Kaupulehu Developments intends to provide public access from Queen Kaahumanu Highway to the shoreline. However, the actual right-of-way will be determined in consultation with the County of Hawaii at the appropriate future stage of the permitting process.

The alternative 2A access will be about 1,000 feet from Kona Village Resort at the closest point and the Village will be separated from the public pathway by a vegetative buffer, as shown in Figure II-5. This buffer and security measures at the planned Kaupulehu Resort will allow the Village to maintain an atmosphere of seclusion. It is recognized that the actual isolation of Kona Village Resort will be affected, but the adjacent resort will be designed and operated so that the sense of isolation can be maintained. A condition to development is that a buffer zone surround the entire landed areas of Kona Village Resort.

Fred Duerr, Kona Village Resort  
June 4, 1986 - page 5

**Comment:** Consistency of the proposed project with State Plan policies and objectives that direct visitor facilities to be carefully planned and sensitive to existing neighboring communities should be addressed.

**Response:** The relevant policies and objectives have been addressed in the EIS.

**Comment:** It is incorrect to assert that none of the unresolved issues constitute areas of real controversy. The outcome of these issues will ultimately determine the economic feasibility of Kona Village Resort.

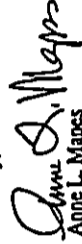
**Response:** Kona Village Partnership and Kaupulehu Developments have reached an agreement which resolves the areas of controversy between the parties. Kaupulehu Developments intends to proceed with development so that the impact of its planned resort on the Village is minimized, thus allowing the Village to operate much as it is currently. As previously stated in this letter, Ming Chew Associates projects beneficial economic impacts to Kona Village Resort rather than adverse economic effects due to the synergistic relationship between the two resorts.

**Comment:** Kona Village would have no disagreement with the proposed resort if the concerns that have been raised can be addressed through the imposition of mutually agreed upon restrictive covenants.

**Response:** It is our understanding that Kona Village Partnership and Kaupulehu Developments have agreed to conditions of development for both parties. The conditions are aimed directly at mitigating potential adverse impacts due to development and the concerns that have been raised are addressed in these conditions.

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments



PO Box 1299  
Kaupulehu-Kona, Hawaii 96745  
Phone (808) 325-5555  
Cable: COCONUT

June 5, 1986


Ms. Anne L. Mapes  
Beit, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Re: Environmental Impact Statement for Kaupulehu  
Resort, Kaupulehu, North Kona, Hawaii

Dear Ms. Mapes:

Your letter of June 4, 1986 responding to my comments of May 14, 1986 adequately addresses issues of concern to Kona Village Resort. We trust that the revised EIS will incorporate changes that take into consideration potential impacts on Kona Village Resort and mitigating measures to minimize these impacts. Given these proposed revisions, and our agreement with Kaupulehu, we support the Land Use Commission's acceptance of the EIS although we have not had an opportunity to review the revised EIS.

Sincerely,

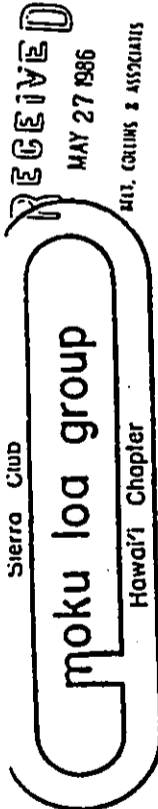
  
Fred Duerr  
General Manager

3973F

cc: Land Use Commission  
Dept. of Planning and Economic  
Development  
Hawaii County Planning Department  
and Hawaii County Planning Commission

A Clusion Resort





Sierra Club  
 HAWAII CHAPTER  
 P.O. Box 1137, Hilo, HI 96720  
 May 20, 1986

Ms. Esther Ueda, Executive Officer  
 State Land Use Commission  
 335 Merchant St., Room 104  
 Honolulu, HI 96813

KAUPULEHU RESORT  
 DRAFT EIS, APRIL 1986

Dear Ms. Ueda:

Thank you for the copy of the above EIS, received by mail on May 9. Inclusion of consultants' reports is appreciated and this should be done consistently in EIS documents.

In response to the draft we express the following concerns and commentary.

The document does not go into detail regarding the north site (p. I-3) despite a suggestion from the County Planning Department that it do so (p. XI-42). We realize that the north development is rather far in the future.

There is no discussion on several of the questions we asked about the Golf course (p. XI-55), as volume of fill and source of fill materials.

Public Access, p. II-11; Fig. II-5. We are pleased to read the section detailing public access considerations. The northern jeep trail will provide a restricted use of this shore area as a fishermen's access. Is some provision being made for trash receptacles and for rubbish removal?

The planned shoreline access trail for the full length of the beach, with the inland diversion around Kona Village Resort, appears to be an appropriate solution to several sensitive problems and will provide trail access to the Archaeological Reserves.

Anchialine Ponds, pp. IV-10 to IV-15. If the stated intentions of preserving and managing these ponds are carried out, with mitigating measures, we anticipate reasonable positive results in protection of related native biota.

Marine Environment, pp. IV-15 to IV-19. It is presumed that future construction of the Marina will require a separate EIS and set of permits. We note (Appendix B) that the consultant fails to include his referenced Figure 1 to show location of the transects. In any case, a baseline transect should be established offshore from the Marina site before construction begins.

Sierra Club, Page 2

Flora, pp. IV-19 to pp. IV-21. Propagation of native plants as listed on p. IV-21 should be couched in stronger terms and made a requirement for complementary landscaping of open space. An additional species of the coast, and found at neighboring Kukio Bay, is the native fan palm or loulu (*Pritchardia*). It would be a magnificent addition to the flora, and should be added to the list of species required for propagation.

American mangrove (pp. D-4 and IV-59) is not a native species, and though of interest, its encroachment on natural ponds should not be encouraged.

Fauna, pp. IV-21, IV-22. Effort in encouragement of birds should be concentrated in providing suitable habitat for the Hawaiian stilt. It is a most unusual as well as rare and endangered species. Bruner makes the recommendation in his report, p. E-3. The bird has a limited habitat that is increasingly menaced on the Kohala-Kona coast. There is a precedent for successful expansion of stilt ponds on Oahu. Other water birds would be attracted to such improved conditions at Kaupulehu. Control of stray cats and dogs, and of the mongoose, would be of general benefit to bird populations.

Archaeological Resources, pp. IV-23 to IV-29. Reasonable solutions seem to be spelled out in the plan for trail preservation and in establishing three Archaeological Reserves.

Operational Employee Housing, p. IV-37. We note that Hawaii Housing Authority raised questions about affordable housing (p. XI-29) yet there is no detailed discussion of that issue other than the paragraph on p. IV-37.

Water Supply, p. IV-53. There seems to be a discrepancy between the gallons per day needed after 10 years and the amount expected from the three wells drilled.

Treated Effluents, p. IV-55. Excess effluents may be disposed of in deep wells on the project site. State DOR has Underground Injection Controls which might regulate placement of such wells. And p. XI-27, where is the treatment plant to be located?

Solid Waste Disposal, p. IV-55. What volume figures led your consultants to suppose that existing and anticipated solid waste facilities could accommodate the output of the Resort?

We look forward to inspecting the Final EIS on Kaupulehu Resort.

CC: Alexander Kinzler  
 Anne L. Mapes

Sincerely yours,  
 P. Quentin Tomich  
 Co-Chair for Conservation

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

Mr. P. Quentin Tomich  
Sierra Club, Hawaii Chapter  
P.O. Box 1137  
Hilo, Hawaii 96720

Dear Mr. Tomich:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 20, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. The following are our responses to your comments in the order of appearance in your letter.

**Comment:** The EIS does not go into detail regarding the north site.

**Response:** Your letter correctly indicates that the northern development site will not be developed for some time. As stated in Chapter II, Section 3, development on this site will not be initiated within the planning time frame of this boundary amendment request and is beyond the scope of this EIS. The environmental effects of development at the north site will in all likelihood require the preparation of an EIS at the appropriate time during the permitting process.

**Comment:** Include discussion of the volume of fill and source of fill materials for the golf course, as previously requested.

**Response:** According to landscape architects at Belt, Collins and Associates, an average golf course in this area (about 160 acres in size) uses approximately 250,000 cubic yards of top soil. This allows for an average layer of 12 inches over the entire course. There are at least two sources from which this material could come: one is from the mauka lands owned by Kaupulehu Developments, and another is from an offsite private source in West Hawaii, of which there are several. A choker layer of 3 inches, consisting of crushed lava or gravel from on-site material, would lie beneath the top soil. In addition, a layer of sand or cinder would be used for the greens and tees and amount to approximately 10,000 cubic yards. It is likely that this material will come from either on-site or nearby quarries.

**Comment:** Is some provision being made for trash receptacles and rubbish removal at the restricted northern jeep trail access?

**Response:** The northern access site will be restricted in that only vehicles able to withstand a rough roadbed will be able to use it until it is improved and paved as part of future development. Rubbish removal by those using the site will be encouraged. Trash receptacles will also be provided. Pick-up and disposal will take place on a regular basis.

Mr. P. Quentin Tomich  
June 5, 1986 - Page 2

**Comment:** The consultant fails to include his referenced Figure 1 to show location of the transects.

**Response:** Neither Figure 1 nor Figure 2 of the "Baseline Assessment of the Offshore Marine Environment in the Vicinity of Kaupulehu Developments, North Kona, Hawaii" were reproduced in the DEIS. Both figures will be included in Appendix C, page C-23 of the final EIS.

**Comment:** Propagation of native plants should be couched in stronger terms and made a requirement for complementary landscaping of open space. Another coastal species found at neighboring Kukio Bay, is the native fan palm or loulou (Pritchardia). It should be added to the list of species required for propagation. American mangrove is not a native species and should not be encouraged to encroach on natural ponds.

**Response:** Although the use and propagation of native plant species is desirable, making this a requirement is not feasible. Kaupulehu Developments understands the desires of the community to maintain the healthy existence of native plant species, especially those which are considered threatened or endangered. The use of the endangered *Scaevola arborescens* will be considered in the landscape design. There may be several areas where the native fan palm *Pritchardia* affinis can be used as well. The encroachment of American mangrove will be discouraged at the site.

**Comment:** Habitat improvement for the endangered Hawaiian stilt should be considered, including the control of stray cats, dogs and mongooses.

**Response:** The survey conducted by Philip Bruner (Appendix E of the EIS), addresses potential habitat improvements along with the development of the site. Kaupulehu Developments has discussed the protection of waterbird habitat with Department of Land and Natural Resources. It is likely that such habitat improvements will take place; the wetland areas will be preserved and some may be cleared of debris, thereby becoming more attractive habitat for the Hawaiian stilt. The control of stray animals will be addressed if it becomes a problem.

**Comment:** There should be more detailed discussion of the affordable housing issue.

**Response:** Environment Capital Managers, Inc. has studied the affordable housing issue and the subject will be addressed in more detail in the attached letter.

**Comment:** There is a discrepancy between the gallons per day needed after 10 years and the amount expected from the three wells drilled.

**Response:** Estimating the practical pumping limit at 400 GPM, as described on page IV-54, two wells pumping 16 hours per day would produce 0.77 MGD. The total potable water demand for the Kaupulehu Resort is .53 MGD, which includes water for human consumption and resort landscaping. The additional water needed for golf course irrigation could be provided by brackish wells and treated sewage effluent. In sum, these sources combined will provide the potable water and irrigation needs of the currently proposed project.

**Comment:** Where is the sewage treatment plant to be located?

**Response:** The exact location of the wastewater treatment plant has not been identified at this stage of planning. However, it is known that it will be sited on the mauka lands of Kaupulehu. More detailed design elements will be developed at the appropriate time.

Mr. P. Quentin Tornich  
June 5, 1986 - Page 3

Comment: What volume figures were used to make the deduction that existing and anticipated solid waste facilities could accommodate what is produced by the resort?

Response: The DEIS estimates an occupancy rate of 1,890, or 70% of resort potential, by the year 2000. In addition, 1,060 full-time equivalent jobs would result from the resort's development. At an average generation rate of 6 pounds per person per day of solid waste, according to sanitary engineers at Belt, Collins and Associates, on-site solid waste generation would be approximately 17,700 pounds of per day, or about 6.5 million pounds per year. In addition, those migrating to the area as a result of project development, such as the families of employees, would contribute to the off-site generation of solid waste. Ten percent in-migrant employees would account for an increase in population of about 300, according to the DEIS, page IV-36. These immigrants would generate an additional .66 million pounds of solid waste per year. A higher percentage of immigrants due to the project would generate proportionately more solid waste.

We trust that above addresses your concerns.

Sincerely,

  
Anne L. Mapes

Attachment

cc: Kaupulehu Developments



**ENVIRONMENTAL  
CAPITAL  
MANAGERS  
INC.**

SUITE 805 CITY BANK BUILDING · P. O. BOX 1232 · HONOLULU, HAWAII 96807 · TELEPHONE (808) 537-3007

Mrs. Anne Hapes  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, HI 96813

Dear Mrs. Hapes:

Environmental Impact Statement (EIS) for the  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

As requested, we have reviewed the comments received from Mr. P. Quentin Tomich of the Hoku Loa Group, Sierra Club (letter dated May 20, 1986) on the DEIS for the proposed Kaupulehu Resort. The comments pertain to concerns on the West Hawaii coast relating to the following:

\* Affordable housing.

1. Availability of Housing.

The existing supply of housing consists of owner-occupied homes and condominiums as well as rental units including hotel condominiums.

A. Construction Employee Housing. The demand for housing by construction workers temporarily relocated from other-islands depends on the timing and scale of other projects under construction in the region at the time. The range of estimated demand for housing is from zero to 100 percent of the workers requiring housing.

Because construction work is temporary, these workers are best housed in rental units. Housing allowances of about \$30/day are generally provided other-islands construction workers by union contracts. As of February, 1986, the HWB lists 1883 condominium units available for short term rentals in the region. In recent years, it has been estimated that these condos have been only occupied 70 percent during peak periods. Most of these vacant 565 condo units have one and two bedrooms and can accommodate between 1130 and 2260 construction workers.

B. Operational Employee Housing. The 1850 direct operational employees equates to 1050 full time equivalent workers on site. The demand for additional housing on the island is estimated to be less than the number of employees requiring housing because households could include more than one resort worker. The household formation rate per

Mrs. Anne Hapes  
June 5, 1986  
Page 2

job was estimated at 0.45 (William Dickey Merrill Study). The 1050 full time equivalent workers at Kaupulehu in relation to the 1850 direct workers indicates a 0.57 rate.

Assuming a household formation rate of 0.6 per job, the estimated 15-20 percent direct, indirect and induced other-islands workers from Kaupulehu project would require 216 to 289 housing units.

2. Affordability of Housing.

A. Construction Employees. As previously stated, union contracts provide housing allowances for other-islands construction workers of about \$900 per month. Two workers sharing a one bedroom condo unit would have \$1,800 per month for housing. Four workers sharing a two bedroom condo unit would have \$3,600 per month. The construction workers could afford to rent hotel condominium units in the region.

B. Operational Employees. It is estimated that about 20 percent of the operational employees would be managerial or salaried. Of this group, about half or 10 percent of the employees are projected to be able to afford market rate housing.

In Survey of Big Island Residents on Planning and Housing Concerns, December, 1983, Hawaii Opinion, Inc., the household incomes indicated that in West Hawaii about 13 percent of the households can afford market rate housing. 14 percent would need Hula Mae financing, 28 percent were in the gap group, and 44 percent were in the low/moderate income group needing subsidy.

The estimated 15-20 percent other-islands direct, indirect, and induced operational workers would have the following categories of affordability:

Affordability	Housing units
Market	28 - 38
Hula Mae Financed	31 - 41
Gap Group	61 - 82
Low/Moderate Group	96 - 128
Total	216 - 289

We appreciate this opportunity to respond to the comments and concerns raised by Mr. Tomich. If there is further information required, please contact me.

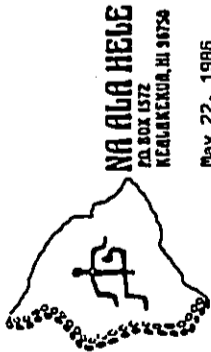
Very truly yours,

*Ray K. Lee*  
Ray K. Lee

RECEIVED

MAY 27 1986

CON. CONSULTANTS & ASSOCIATES



NA ALA HELE  
P.O. BOX 1872  
HONOLULU, HI 96813

May 22, 1986

Ms. Esther Ueda, Executive Officer  
State Land Use Commission  
Room 104, Old Federal Building  
335 Merchant St.  
Honolulu, HI 96813

Re: Comments and Questions on Ka'upulehu Developments'  
Draft Environmental Impact Statement

Dear Ms. Ueda:

1. Hawaiian Trails  
It is encouraging that certain Hawaiian foot trails are being recommended for preservation and are deemed to have "high interpretive and cultural value".  
The fee simple ownership by Hawaii's Government of certain Hawaiian trails (per Highways Act of 1992) should be researched. As in the case of Mauna Lani Resort Inc. the State of Hawaii was asked to "quitclaim" its interests in order to perfect title to lands where trails would not be preserved.

2. Public Access

Public access is not noted along the public shoreline of sandy Kahawai Bay and to the north (Figure 11-5). What kind of public access will be permitted in that area?  
How many parking stalls are planned for the public and what will happen when all stalls are filled?

3. Ala Kahakai Trail System (AKTS)

Nancy Brown's reply to our letter of December 30, 1985 stated that the DEIS would address the dedication of the Ka'upulehu shoreline trail as part of the AKTS. Please note where it is discussed, as I did not find it in my review of the document. (House Resolution No. 355, Eleventh Legislature, 1982 provides good background on the proposed trail system.)

4. Anchialine Ponds

While "450-500" anchialine ponds are considered to exist in West Hawaii, it is more accurate to also note how many of that total have been seriously (perhaps permanently) damaged by the introduction of exotic fishes. Continued loss of habitat for the endemic 'opae'ula could render the shrimp eligible for endangered or threatened species designation.

Ms. Esther Ueda

Page 2

May 22, 1986

We are glad that Ka'upulehu Developments does not plan to destroy any anchialine ponds.

5. Employee Transportation  
Ka'upulehu and Kuki'o are located a good distance from potential employees who reside in North and South Kona. The current public bus system is extremely limited. It would seem a good investment for resorts to cooperate and develop a bus system to facilitate employment of people who could make dependable employees, if given the transportation assistance.

Thank you for your time.

Deborah Chang Abreu

Deborah Chang Abreu  
President, Na Ala Hele

cc: Ka'upulehu Developments  
J. Balt Collins and Associates

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

June 5, 1986  
86-1165

Ms. Deborah Chang Abreu, President  
NA ALA HELE  
P.O. Box 1572  
Kealahou, Hawaii 96750

Dear Ms. Abreu:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 22, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. The following are our responses to your comments in the order of appearance in your letter.

(1) Comment: The fee simple ownership by Hawaii's Government of certain Hawaiian trails (see Highways Act of 1892) should be researched. As in the case of Mauna Lani Resort, Inc. the State of Hawaii was asked to "quietclaim" its interests in order to perfect title to lands where trails would not be preserved.

Response: In the case of the Kaupulehu Resort, the coastal trails will all be preserved.

(2) Comment: What kind of public access will be permitted along the public shoreline of sandy Kahawai Bay and to the north. How many parking stalls are planned for the public and what will happen when all stalls are filled?

Response: The shoreline trail will veer inland before reaching Kahawai Bay, traveling through archaeological preserves and lava terrain, as indicated in Figure II-5. Access to Kahawai Bay, however, is permitted via other avenues, including the established shoreline trails. Initially a jeep road will provide access to the area to the north, as described in Chapter II, Section 3.2.2. The number of parking stalls will be determined during the county permitting process when the project moves closer to the actual development phase. It is anticipated that use and capacity guidelines will be discussed during this process and that possible resolutions to over-capacity will be defined at that time.

(3) Comment: Your letter of 12/30/85 to NA ALA HELE indicated there would be discussion of the Kaupulehu shoreline trail dedication as part of the Ala Kahakai Trail System (AKTS). Please identify where this is discussed within the DEIS.

Response: Discussion of the AKTS was omitted from the DEIS and will be included in the Final EIS in Chapter IV, Section 1.12.1.4, "Mitigation Measures." The overall project design maintains the shoreline area in open space. Historic trail sites exist in this open space area and could be incorporated into the AKTS as the system becomes established. Kaupulehu Developments is willing to discuss the details of trail dedication to the AKTS with NA ALA HELE when all of

Ms. Deborah Chang Abreu  
June 5, 1986 - Page 2

project's required approvals have been granted.

(4) Comment: While "450-500" anchialine ponds are considered to exist in West Hawaii, it is more accurate to also note how many of that total have been seriously damaged by the introduction of exotic fishes.

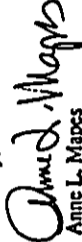
Response: The resort owners understand the damaging effects that introduced species of fish have on the anchialine pond ecosystem. Eradication measures to rid the ponds of such fish will be developed. In addition, signs to warn the public of the dangers of introducing these species to anchialine ponds will be posted.

(5) Comment: Potential employees in North and South Kona are located a good distance from the resort sites. It would seem a good investment for resorts to cooperate and develop a bus system to facilitate employment of people who could make dependable employees, if given the transportation assistance.

Response: Kaupulehu Developments recognizes that transportation problems will need to be addressed. Possible solutions to this problem include staggered work hours and ride-share programs, as well as busing of employees.

We trust that the above addresses your concerns.

Sincerely,

  
Anne L. Mapes

cc: Kaupulehu Developments

Esther Ueda  
State Land Use Commission  
Room 104 Old Federal Building  
335 Kerechant Street  
Honolulu, Oahu  
HI 96813

Honolulu, Hawaii  
Michael Prosperovich  
Kukui'Ohaiwa, Kaupulehu  
72-3403 Kamehameha Highway  
Kalihi, Kane, Hawaii  
HI 96740

RECEIVED

MAY 23 1986

REI, COLLINS & ASSOCIATES

cc: Alex Finster  
John Hayes

21 May, 1986

Aloha ma,

Draft Environmental Impact Statement  
Kaupulehu Development, North Kane, Hawaii

XIII-56

Thank-you for allowing us the opportunity to review and comment upon the Draft Environmental Impact Statement for Kaupulehu Resort. Our comments follow.

- 1) Public Access  
Though the Kaupulehu Bench - Ku'ehe's Trail is shown, in part, in Figure VI-6 as a trail recommended for preservation, it is not discussed in section 3.2.2, on public access. This trail has been used by kama'aina of the region past and present. This trail also offers excellent interpretive, recreational, and integrative opportunities for present and future users of the existing and proposed developments in Kaupulehu, both on kai and ma'uka of the Pa'anihau Highway, and in the adjacent land division of Kaka'o.

- 2) Anchialine Ponds  
Figure IV-4, showing the location of ponds, does not indicate the four small water bodies at Waiulu (the pahoehoe kipuka on Kumuhehu Point) or the small pool on the SW tip of Kumuhehu Point, all of which are in areas designated open space. The presence of these ponds is noted in the Department of the Army letter dated 23 December, 1985 (paragraph "d"), though not in the Final Anchialine Pond Survey Report dated March 1986.

Thank-you for your consideration.

'U ru no se ka 'oia'i'o,  
Hawaii  
Michael Prosperovich  
Kukui'Ohaiwa, Kaupulehu  
72-3403 Kamehameha Highway  
Kalihi, Kane, Hawaii  
HI 96740

**BELT, COLLINS  
& ASSOCIATES**  
Engineering • Planning  
Landscape Architecture

Hannah Kihalani Springer and  
Michael Prosper Tornich  
Kukui'ohiwi, Kaupulehu  
72-3403 Miamalahoa Highway  
Kailua, Hawaii 96740

Dear Ms. Springer and Mr. Tornich:

Environmental Impact Statement (EIS) for  
Kaupulehu Resort, Kaupulehu, North Kona, Hawaii

Thank you for your comments of May 21, 1986 to Ms. Esther Ueda, Executive Officer of the State of Hawaii Land Use Commission, regarding the Draft EIS for the proposed Kaupulehu Resort development. The following are our responses to your comments in the order of appearance in your letter.

**Comment:** The Kaupulehu Beach - Huehue Trail, shown in Figure IV-6 as recommended for preservation, is not discussed in Section II-3.2.2 on public access. This trail has been in use in both recent and historical times and would be a good trail for access as it offers excellent interpretive, recreational, and integrative opportunities for access users.

**Response:** As stated in the DEIS, the significant archaeological sites, including the historic coastal trails, will be incorporated into the overall design of the project. Kaupulehu Developments is considering the use of these trails as part of its public shoreline access system.

**Comment:** Figure IV-4, showing the location of the ponds, does not show the location of four small water bodies at Waiulu (the pahohoe kipuka on Kumuokehu Point) or the small pool on the southwest tip of Kumuokehu Point, all of which are designated open space. Presence of these ponds is noted in the Department of the Army letter dated 23 December, 1985, though not in the Final Anchialine Pond Survey Report of March 1986.

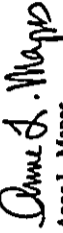
**Response:** An aerial and ground survey of the site was conducted by OI Consultants for the proposed project. All of the areas identified as ponds and potential ponds from helicopter were inspected and surveyed on the ground. The consultant did not identify any other water bodies. As noted in the DEIS, all of the identified ponds will be preserved, and the shoreline area will be maintained as open space. Verification and analysis of the ponds you describe will be conducted. Presuming their existence in the locations you describe, these ponds are within the open shoreline area and would be preserved.

According to OI Consultants, ponds 1 through 9 as identified by Maciolek and Brock (1974) in the ahupua'a of Kaupulehu are within the Kona Village Resort site, and were therefore not surveyed. OI Consultants identified the 3 ponds at the Kaupulehu Resort site which were earlier found by Maciolek and Brock, as well as 5 additional ponds.

Hannah Springer and Michael Tornich  
June 5, 1986 - Page 2

We trust that the above addresses your concerns.

June 5, 1986  
86-1164

Sincerely,  
  
Anne L. Mapes

cc: Kaupulehu Developments



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# Appendices

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# Appendices



## APPENDICES

- A. Market Analysis for Proposed Resort at Kaupulehu: North Kona District, Island of Hawaii, State of Hawaii. Ming Chew Associates.
- B. Anchialine Pond Survey, Kaupulehu, North Kona, Hawaii: Final Report. OI Consultants, Inc.
- C. Baseline Assessment of the Offshore Marine Environment in the Vicinity of Kaupulehu, North Kona, Hawaii. Steven Dollar, Marine Research Consultant.
- D. Botanical Survey for Kaupulehu Developments, Kaupulehu, North Kona, Hawaii. Winona P. Char, & Associates.
- E. An Avifaunal and Feral Mammal Survey of Property Proposed for a Resort-Residential Development at Kaupulehu, Hawaii. Phillip L. Bruner, M.S.
- F. An Archaeological Reconnaissance of the Makai Parcel of Kaupulehu Ahupuaa, North Kona, Hawaii Island. Laura A. Carter, Department of Anthropology, Bernice P. Bishop Museum.
- G. Preliminary Report Upon Completion of Field Work: Archaeological Survey and Test Excavations, Kaupulehu Makai Resort Project Area, Land of Kaupulehu, North Kona, Island of Hawaii. Alan T. Walker, B.A., and Paul H. Rosendahl, Ph.D.
  - Archaeological Field Inspection, Kona Village Expansion Site. Paul H. Rosendahl, Ph.D., Inc. Letter dated April 16, 1986; pages G-18 to G-20.
  - Archaeological Field Inspection, Revised Kona Village Expansion Site. Paul H. Rosendahl, Ph.D., Inc. Letter dated June 2, 1986; pages G-21 to G-24.
- H. Kaupulehu Resort Development: Public Revenue-Cost and Economic Impact Analysis. Environment Capital Managers, Inc.
- I. Air Quality Impact Analysis, Kaupulehu Resort. J.W. Morrow, Environmental Management Consultant.
- J. Noise Study for Resort Development, Kaupulehu, North Kona, Hawaii. Y. Ebisu & Associates.

**Market Analysis  
for  
Proposed Resort at Kaupulehu**

A-1

**North Kona District, Island of Hawaii  
State of Hawaii**

**Prepared for  
Kaupulehu Developments  
Honolulu, Hawaii**

**August 1985**

**Ming Chew Associates**  
Consulting Real Estate Economists

**Ming Chew Associates**

Consulting Real Estate Economists

August 19, 1985

Kaupulehu Development  
C/O Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Gentlemen:

We are pleased to transmit the results of our Market Analysis for the proposed Resort at Kaupulehu, District of North Kona, County of Hawaii, State of Hawaii.

Our conclusions are summarized in Chapter I. The research and analyses upon which they are based appear in the body of the report.

Princess Hotels International has expressed an interest in operating the proposed hotel at Kaupulehu. We believe that an operator as effective as we envision Princess Hotels to be, could be successful in establishing a solid competitive position for Kaupulehu. Moreover, Princess could also enhance the overall attraction of the entire Kohala Coast Resort Region.

We appreciate the opportunity to work with you on this very interesting and challenging assignment, and look forward to assisting further, as requested.

Very sincerely,

MING CHEW ASSOCIATES

J. Ming Chew

JMC:R

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V. County of Hawaii Visitor Industry . . . . .	23
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VIII. Market Analysis for Resort Subdivision Houselots . . . . .	65
IX. Market Analysis for Golf Course . . . . .	66

I. ASSIGNMENT AND SUMMARY

A. Assignment

Our assignment has been to prepare a market analysis for a proposed resort to be located in the coastal area at Kaupulehu-Kona, District of North Kona, County of Hawaii (Island of Hawaii), State of Hawaii. The proposed resort would be situated generally south of the existing 100-unit Kona Village Resort. The results of this analysis are to be used to assist in land use planning and to aid in preparing a petition to the Hawaii State Land Use Commission for reclassification of selected lands.

B. Approach

Our approach has been to identify the primary markets that could be served by the entire resort. General economic trends were assessed, and projections made of likely visitor arrivals for the State and County. These projections in turn were converted into demand estimates for total transient accommodations, hotel rooms, resort multifamily units (units in resort multi-family projects), and golf course demand.

The demand estimates were compared with existing and planned supply to formulate marketability conclusions.

C. Summary of Findings and Conclusions

1. The entire Kohala Coast Resort Region has been designated by the State of Hawaii and County of Hawaii in their various plans as a major resort area. Excellent climate, white sand beaches, accessibility and the present concentration of high-amenity, masterplanned, controlled-environment luxury and super-luxury resorts, combine to make Kohala Coast potentially the highest-quality resort region in the State.
2. Although the Kaupulehu resort is located in the District of North Kona, its topographical and climatic conditions, proposed ambience and potential market have more similarities to the extremely high-quality luxury resorts of the Kohala Coast Resort Region than those of Kona.

TABLE OF ILLUSTRATIONS

I. Regional Map, Kohala and Kona, Hawaii . . . . .	facing page 7
II. Proposed Master Plan, Resort at Kaupulehu . . . . .	facing page 12

Qualifications of the Consultant and the Firm

3. After two flat years for the State visitor industry in 1980 and 1981, visitor arrivals to the State increased 8 percent in 1982, another 3 percent in 1983, and a sizable 11 percent in 1984.
4. The share of state-wide visitor industry activity attracted by the County of Hawaii declined from 1971 to 1984. Although the estimated number of west-bound visitors to the island, the primary source of the County's visitor industry patronage, declined from 1978 to 1981, the number has increased steadily since then.
5. Despite the downward County-wide trends, visitor industry activity on the Kohala Coast has been spirited. Within the last four years, two high-amenity resorts opened championship golf courses and luxury or super-luxury hotels. As a result, at the end of 1983, the number of transient accommodation units in North and South Kohala exceeded the number in Hilo for the first time. Also in 1984, North and South Kohala's share of the Island's occupied units reached about 22 percent, twice the estimated 11 percent recorded in 1980.
5. Continued development of high-quality resort amenities and accommodations, direct flights from the U.S. Mainland west coast to Ke-ahole Airport by United Airlines, cooperative advertising between the Kohala Coast Resort Region and United Airlines (the largest carrier of westbound visitors to Hawaii), programs to promote neighbor island destinations by Japan Air Lines (the largest carrier of eastbound visitors to Hawaii) and increased promotions and marketing efforts by the new facilities on the Kohala Coast are expected to expand basic demand to the Region.
7. We estimate that net additional demand for transient accommodations in North and South Kohala in excess of the February 1985 inventory would be 3,100 units by 1990, 4,900 by 1995 and 6,500 by 2000.
8. Projected demand for hotel units in the proposed resort at Kaupulehu would be 200 to 600 by 1990, 400 to 800 by 1995 and 500 to 900 by 2000. Published daily rates of over \$200 are projected.
9. Estimated demand for low-rise resort multifamily units in the proposed resort would be 200 units in 1990, 400 to 600 in 1995 and 600 to 1,200 in 2000. Achievable average prices are estimated to range from \$250,000 to \$450,000 per unit in 1985 dollars, leasehold.
10. The net additional demand for golfing activity in the proposed Kaupulehu resort is projected to be about 31,000 to 81,000 annual rounds in 1990. This amount of play is not likely to be accommodated by other courses in the region. Thus, a high-quality championship golf course would be needed by the time the proposed hotel begins operations, and a second golf course may need to be under construction by 1990. By 1995, we estimate that demand for golf would reach 62,000 to 119,000 annual rounds, and reach 81,000 to 150,000 annual rounds by 2000.
11. Table I-1 summarizes our marketability conclusions for the proposed resort at Kaupulehu. The projected estimates represent cumulative demand in excess of the existing February 1985 inventory.

Table I-1

	PROJECTED MARKETABILITY (1)	
	1990	1995
RESORT AT KAUPULEHU		
Kohala Coast Resort Region		
County of Hawaii, State of Hawaii		
1990-2000		
	Projected Marketability	
	1990	2000
HOTEL ROOMS	200-600	400-800
		500-900
LOW-RISE MULTIFAMILY UNITS		
Higher-Quality	50	100-150
Mid-Quality	100	200-300
Lower-Quality	50	100-150
	200	300-1,200
TOTAL (ROOMS, UNITS)	400-800	800-1,400
		1,100-2,100
GOLF ROUNDS, ANNUAL	31,000-81,000	52,000-119,000
		81,000-150,000

(1) Cumulative demand in excess of February 1985 inventory.

SOURCE: Ming Chew Associates

II. DESCRIPTION OF THE REGION

The State of Hawaii consists of eight major and 124 minor islands having a total land area of approximately 6,425 square miles. Hawaii County has an area of approximately 4,038 square miles, and contains 63 percent of the State's total land area. Hawaii County comprises nine judicial districts: North and South Kohala, North and South Kona, Hamakua, Ka'u, Puna and North and South Hilo. The magnitude of this island, and the wide range of topography and climate, offer environments more diverse than those of any of the other islands within the State.

Although the proposed resort is located in the District of North Kona, its topographic and climatic conditions, proposed ambience and potential market are more similar in the character to developments in the District of South Kohala. In particular, the proposed resort is most likely to develop an association with the resorts of the Kohala Coast Resort Region than with those of Kona. As such, this chapter has a strong emphasis on the Kohala Coast Resort Region.

A. Kona

The District of North Kona on the Island of Hawaii encompasses the coastal and inland area from just South of the Keauhou Resort to the South Kohala District boundary at Waikoloa Beach Resort and Anaehoohale Bay. It extends inland and includes the peak of Mt. Hualalai, 8,000 feet above sea level.

Most of the urbanized area of North Kona generally is referred to as "Kona." It occupies the strip from the town of Kailua, the major population and commercial center, along the southern one-third of the District's coastline. In addition, there are subdivisions and occasional urbanized areas on the lower slopes of Hualalai along the Mamalahoa and Kuakini Highways.

Due to its mild climate, lush vegetation and slow pace, Kona has been a retreat from the hectic activities of the city. Vacation homes developed along the coastline while most full-time residents settled "uphill" closer to the agricultural centers of the District and at the cooler elevations.

Initially, the economic base of Kona consisted of agriculture, mainly coffee, fruits, nuts, vegetables, flowers and livestock. Tourism began developing in Kona prior to Statehood, and since Statehood, has been

the major component in its economic growth. In fact, until the development of the Kaanapali Beach Resort on Maui in the early 1960's, Kona was the predominant neighbor island resort area in the State. From 1970 to 1980, North Kona had the fastest rate of population growth of any district on the island, almost tripling its population from 4,832 persons in 1970 to 13,748 in 1980.

Interest in gamefishing has added to the popularity of Kona, which now hosts the Annual Hawaiian International Billfish Tournament.

In general, however, visitor activity in Kona has been passive. The rocky coastline and small number of beaches limit the amount of ocean swimming and other ocean activities.

It was not until development of the masterplanned Keauhou Resort south of the Town of Kailua in about 1970 that the area had a golf course and prospects for extensive recreational amenities. This resort encompasses 2,300 acres along the Kona coastline around a small boat harbor at Keauhou Bay. It contains a 27-hole championship golf course, three resort hotels, a resort and neighborhood shopping center, several resort condominium apartment projects and resort houselet subdivision projects.

The portion of the North Kona District from Kailua south is nestled leeward of the tradewinds against relatively steep lower slopes of Hualalai. Magnificent panoramic vistas of the coastline and ocean are available just a short distance inland. This area receives ample rainfall due to its proximity to Hualalai, and is rich in lush vegetation.

On the other hand, the area north of Kailua consists of a wide flat plain at the coastline. The lower slopes of Hualalai rise very slowly and do not become steep until some distance inland. In relation to the prevailing tradewinds, this plain is situated to the side of Hualalai. Thus, its climate is influenced, as is the climate of the South Kohala District coastal area, more by its relationship to Mauna Kea and the Kohala Mountains. From just north of Kailua to just before the northern border of the South Kohala District, the flat coastal plain has a desert-like climate. Moisture in the tradewinds is precipitated

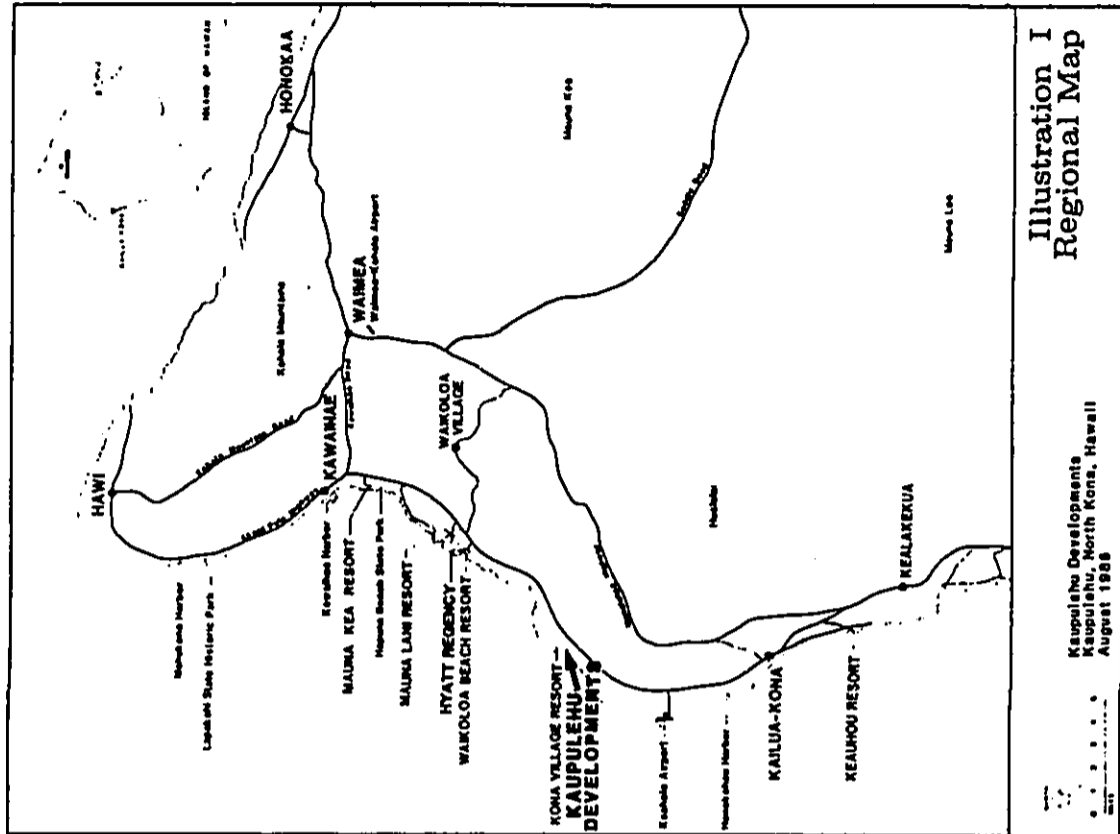


Illustration I  
Regional Map

Kaupulehu Developments  
Kaupulehu, North Kona, Hawaii  
August 1988



environments: the Waimea highland, which is characterized by green rolling hills used for diversified agriculture, and the coastal area from Kawaihae to Anahoomaluu Bay which consists of an arid plain of large lava flows, sharply contrasted with white sand beaches and bright aquamarine bays.

Over a ten-year period from 1960 to 1970, the population of the South Kohala District increased by 50 percent to 2,310, and represented the largest rate of population change of any district in the County. By 1980, the population had doubled to 4,607. The basic population and commercial center within the South Kohala District is Waimea where a variety of small businesses cater mainly to local farming and ranching, and serve the local population.

The primary industries within this area are cattle ranching, diversified agriculture and tourism. More recently in Waimea, a small scientific community has formed to support the numerous astronomy observatories on Mount Mauna Kea, and educational activities centered around Hawaii Preparatory Academy and the Parker School are expanding.

Although the upper plains are best suited for intensive cultivation and grazing, the makai or coastal plains are too dry and barren for agriculture use. The coastal plain is, however, an excellent area for resort development with year-round sunny climate (the average of nine inches of rainfall make the Kohala Coast the sunniest, driest and warmest region in the State), white sand beaches and clear, safe swimming water. This combination of features is recognized as an absolute requisite for successful resort development in Hawaii.

Access to the District is mainly by the Queen Kaahumanu Highway which opened in 1975 and connects Kailua-Kona with Kawaihae (the only deep water harbor in West Hawaii County). The high-speed road which extends 33 miles was completed at a cost of \$16 million. This coastal highway, part of the Island's Belt Highway System, vastly increases accessibility to the South Kohala District from Ke-ahole Airport, the major airport for West Hawaii County. This unique open-air terminal, located about six miles south of the subject property, began operations in July 1970. In September 1983, it began handling direct flights by United Airlines from the U.S. Mainland west coast.

after being deflected upward by Mauna Kea and the Kohala Mountains. Due to the great distances from these high peaks, the dry air gets heated before reaching the coastal area.

The area is also noted for its extensive and stark lava flows, and essentially the only white sand beaches on the Island.

Access to this coastal region is excellent. Interisland flights and direct flights from the U.S. Mainland west coast are accommodated at Ke-ahole Airport. This airport is located in the flat coastal plain at about the midpoint of the North Kona District coastline several miles north of Kailua.

The subject property is located about midway between Ke-ahole Airport and the Waikoloa Beach Resort at Anahoomaluu Bay. It is adjacent to the Kona Village Resort which began operations in 1965 and now contains 100 transient units. This resort is characterized as a retreat resort for rest and relaxation, and a refuge from its guests' normal day-to-day activities. It offers a number of low-energy recreational activities, no golf course, essentially no schedules and no television or telephones in the guest rooms; yet, it achieves a very high average annual occupancy, a very high average room rate and a very high percentage of return visitors.

b. Kohala

The entire Kohala Coast Resort Region, which is situated along the coast of the District of South Kohala, has been designated by the State of Hawaii and County of Hawaii in their various plans as a major resort region. The region contains three very high quality masterplanned resorts. The Mauna Kea Resort (Mauna Kea Beach Hotel and Golf Course) began operations in 1965. Golf courses in Waikoloa Beach Resort and Mauna Lani Resort, as well as the Sheraton Royal Waikoloa Hotel started operations in 1981. The Mauna Lani Bay Hotel opened in 1983.

The locations of these projects relative to the subject property are shown on the facing Regional Map.

The District of South Kohala is located on the northwest coast of the Island of Hawaii and includes topography ranging from white sand beaches to the Kohala Mountains and a portion of Mount Mauna Kea's lower leeward slope. The District of South Kohala has two distinct physical

All of the resorts on the Kohala Coast have begun major marketing efforts. Some promotional activities have been coordinated with matching funds from United Airlines (the largest carrier of westbound visitors to Hawaii). In addition, Japan Air Lines (the largest carrier of eastbound visitors to Hawaii) has begun programs to promote neighbor island destinations. As a result, the promotional efforts for the Resort Region, which previously had been limited to the efforts of the Mauna Kea Resort, will be greatly expanded.

Notwithstanding the promotional efforts of the major resorts as well as the Kohala Coast Resort Association, the preeminent quality of facilities have received a great deal of media attention. The award-winning projects and record-setting prices achieved have stimulated a great deal of word-of-mouth referrals, a great deal of curiosity and much interest.

The availability of additional alternative and complementary facilities is resulting in greater "cumulative attraction" for the entire region. Expanded tourism activity in the region will increase the exposure of all existing resorts in the entire coastal plain as well as on the entire western side of the Island.

The Waimea-Kohala Airport, at an elevation of 2,700 feet, is the highest airport in the State. This air terminal handles only a limited number of scheduled charter flights and private aircraft. Service by Princeville Airways to Waikoloa using an airstrip near Waikoloa Beach Resort began in July 1984.

Kawaihae Harbor, which is located just a few miles north, is the second deep water port on the Island. This marine facility, completed in 1959, serves industrial, recreational and commercial sport fishing activities. Industries supporting this harbor are grain elevator and storage silos, oil tanks and a freight warehouse. A boat marina is part of this harbor complex.

A wide range of natural and man-made recreational diversions and scenic attractions are located throughout the South Kohala District. The white sand beaches situated on the arid, leeward shore are popular throughout the State. The two major public recreation areas are Hapuna Beach State Recreation Area and the Samuel M. Spencer Beach Park. Hapuna is 65 acres in size, and is the major water-oriented recreation area in the County with an exceptionally attractive and wide white sand beach. Spencer Park, near Kawaihae Harbor, has an area of approximately 13 acres and a smaller sandy beach. Both of these recreation facilities permit surfing, swimming, picnicking, skin diving, limited camping and boating. In addition to these major areas, several other beach areas are available including the Anaeohomalu Bay at the Waikoloa Beach Resort and Puako Beach.

Other major recreational activities or sports include wild game hunting including pheasant, wild boar and Bighorn sheep. Deep sea fishing along the Kona and Kohala coasts produce world records for marlin and tuna. Horseback riding and hiking are two other activities offered in this area. A skeet and trap range opened recently in Waikoloa Village and plans are also underway there for a polo field. Annual rodeos are held at Waikoloa Village.

The U.S. National Park Service recently established the Puukohola Heiau National Historic Site as the third National Park facility on the Island, and as only the fourth National Park facility in the State. This site contains two major heiaus near Kawaihae and also includes an historic house previously used by John Young, who was made a full chief by King Kamehameha, and who was governor of the Island of Hawaii from 1802 to 1812.

III. DESCRIPTION OF THE PROPERTY AND PROJECT

A. Description of the Property

Kaupulehu Developments, a joint venture of Cambridge Pacific, Inc. and Barnwell Hawaiian Properties, Inc., leases from the Bernice Pauahi Bishop Estate almost 11,000 acres of land situated in the ahupuaa of Kaupulehu, District of North Kona, Island of Hawaii. The entire property extends from the coastline of the flat coastal plain, across the Queen Kaahumanu Highway, about six miles inland to the Mamalahoa Highway at the 2,000-foot evaluation.

The parcel located makai of the Queen Kaahumanu Highway contains about 2,829 acres and 2-1/2 miles of shoreline. It is identified on the Hawaii Tax maps as Third Tax Division (County and Island of Hawaii) Tax Map Key (TMK) 7-2-03: parcel 1. The 100-unit Kona Village Resort occupies a 60-acre parcel with over 1/2 mile of beach and oceanfrontage near the midpoint of the larger parcel's shoreline around Kahuwai Bay. Kona Village is owned by a separate, non-related partnership and is operated by Associated Inns and Restaurants Company of America (AIRCOA).

Current plans envision developing the proposed subject resort on about 585 acres located from south of the Kona Village Resort, to the southern boundary of the makai parcel. The shoreline in this area consists of a wide white sand beach and a rocky promontory formed by a lava flow into the ocean. Also, at the southern end of the property, access would be available to another large white sand beach which surrounds Kukio Bay.

The subject property is located about 15 miles north of the town of Kailua and about six miles north of Ke-shole Airport.

B. Description of the Project

The proposed project would expand existing resort activities on the makai property into a self-contained resort, residential community in conformance with the Hawaii County General Plan Intermediate Resort designation for the area. A low-density project is envisioned, consisting of a luxury or super-luxury oceanfront hotel and beach club, beach and golf resort condominium apartments, and a range of facilities and amenities including two championship golf courses.

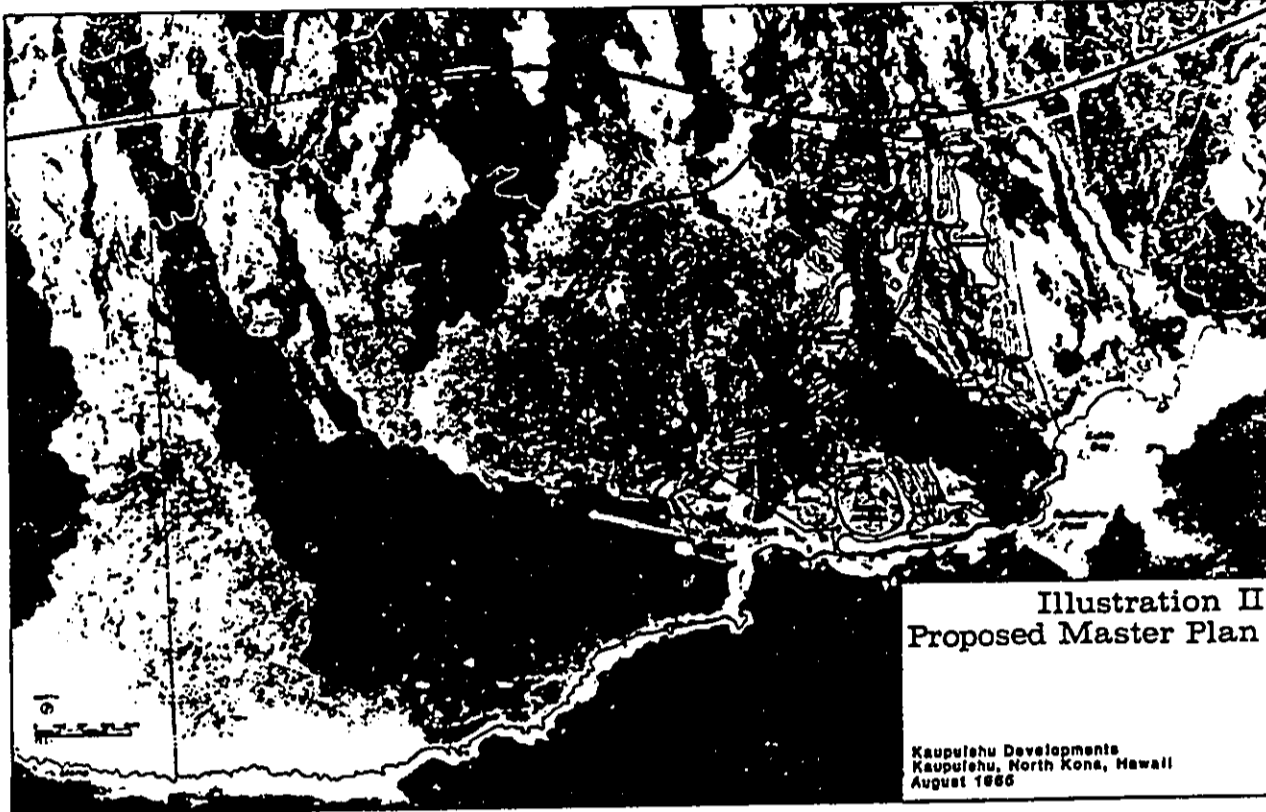


Illustration II shows the proposed development concept. Of the 585 acres, about 185 acres would be needed for the hotel, beach club and resort condominium apartments. The other 400 acres would be required for two golf courses, a buffer zone around the Kona Village Resort and other open space.

The focal point of the proposed resort would be a luxury or super-luxury hotel and beach club situated inland of Kumukey Point on a lava rock promontory overlooking Kahuwai Beach to the north and Kukio Bay to the south. Waiakuhi Pond and associated significant archaeological remains would be incorporated into the design and landscaping of the hotel grounds. Present plans include luxury condominium apartments on another shoreline site and among the fairways of two championship golf courses. There would be open space buffers around Kona Village Resort and along Queen Kaahumanu Highway.

Present plans also envisions exclusive use of one of the golf courses by the hotel. In such case, only two hotels in the State would have the distinction of having exclusive use of a golf course, and the subject project would be only one on the Island of Hawaii.

#### IV. STATE OF HAWAII TOURISM

##### A. Visitor Count

From 1950 to 1970, the number of visitors to the State of Hawaii staying overnight or longer increased at a compounded rate of 20 percent per year. The rate of increase slowed to 9.5 percent per year from 1970 to 1979. Activity was essentially flat for 1980 and 1981. Since then, visitor count increased 7.8 percent during 1982, 3.0 percent in 1983 and 11.2 percent in 1984. These trends are shown in Table IV-1.

##### B. Visitor Expenditures

Visitor expenditures are estimated to be the largest source of income to the State, contributing about one-third of the State product. Visitor expenditures have increased from about \$595,000,000 in 1970 to an estimated \$4,582,000,000 in 1984.

##### C. Inventory of Visitor Accommodations

About 90 percent of the visitors to Hawaii staying overnight or longer have been accommodated in hotels, apartment-hotels or condominium apartments rented on a short-term basis.

Most of the State's 65,919 visitor units are located in Waikiki, on the Island of Oahu. This resort district is considered to be the major gateway for the visitor industry in the State.

However, since the early 1960's, the visitor industry has expanded faster outside of Waikiki than within. In February 1970, 62 percent of the State's transient accommodations were located in Waikiki. By February 1985, the share had dropped to 51 percent. Over this period of time, only 44 percent of the new inventory was added inside Waikiki, and most has been added on the neighbor islands.

The 600-unit Maile Court (formerly the Mandarin Tower), the 140-unit Waikiki Beach Tower condominium apartments and the 136-unit Westbury condominium apartments, all in Waikiki, were completed during 1984. Many of these units are likely to be made available for visitor accommodations.

Table IV-1  
VISITOR TRENDS  
State of Hawaii  
1950 - 1984

Year	Overnight and Longer Visitors	Annual Percentage Increase	Westbound Visitors	Eastbound Visitors
1950	46,583	--	N.A.	N.A.
1960	296,517	--	250,795	45,722
1970	1,746,970	14.4	1,326,135	420,835
1971	1,818,944	4.1	1,430,325	388,619
1972	2,244,377	23.4	1,782,737	461,640
1973	2,630,952	17.2	2,067,861	563,091
1974	2,786,489	5.9	2,184,620	601,869
1975	2,829,105	1.5	2,207,417	621,688
1976	3,220,151	13.8	2,551,601	688,550
1977	3,433,667	6.6	2,763,312	670,355
1978	3,670,309	6.9	3,030,999	639,310
1979	3,960,531	7.9	3,139,455	821,076
1980	3,934,504	(0.7)	3,046,132	888,372
1981	3,934,623	0.0	2,974,791	959,832
1982	4,242,925	7.8	3,278,525	964,400
1983	4,368,105	3.0	3,396,115	971,990
1984	4,855,580	11.2	3,721,380	1,134,200

N.A. - Not Available

SOURCE: Hawaii Visitors Bureau, Annual Research Report.

Hotels currently under construction are the 56-unit Seaside Surf all-suite hotel in Waikiki, the 300-room Makana Prince in the Makana Resort on Maui, and on Kauai, the 200-unit Hanalei Plantation overlooking Hanalei Bay, the 300-room Sheraton Princeville in the Princeville Resort and the 350-room Kauai Hilton at Hanalei.

Recently, definitive plans were announced to expand the Westin Maui (previously the Maui Surf) by more than 200 rooms and the Westin Kauai (previously the Kauai Surf) by over 300 rooms. Plans have been announced also for construction of a 375-room hotel at Kaiaka Point in the Kaluakoi Resort on Molokai, a 350-room hotel in the Hapuna Beach Resort adjacent to the Mauna Kea Resort, the 1,260-room Hyatt Regency Waikoloa Hotel in the Waikoloa Beach Resort, 400 to 650 rooms in the Yacht Harbour Plaza adjacent to the Waikiki Yacht Harbour and 600 rooms in the Village Hotel in Kapalua Resort on Maui.

D. Occupancy and Room Rate Trends

The occupancy rate of Hawaii's transient accommodations is a key indication of market conditions. That is, the occupancy rate provides a measure of the market relationships between demand and supply. Table IV-2 shows how occupancies have vacillated from 1970 to 1984 among the visitor facilities on each island. The variability indicates differing conditions for the many resort districts.

Most districts experienced soft market conditions about 1971, as larger amounts of inventory were added relative to smaller increases in visitor arrivals. Then, visitor activity increased relative to new supply, and occupancies increased through about 1978. After that, overall conditions declined. The markets on Oahu and Maui began rebounding in 1981. In 1984, Hawaii and Kauai Counties began to share in the rebound.

As seen in Table VI-3, average room rates in Hawaii have increased continually since 1972 despite fluctuations in occupancies. This probably reflects inflationary effects as well as increasing quality of the transient accommodations.

Table IV-2 PERCENTAGE OCCUPANCY OF HOTEL ROOMS  
State of Hawaii by Island  
1970 - 1984

Year	Waikiki, Oahu	Hawaii	Kauai	Mauai
1970	74.1	68.3	58.0	66.7
1971	58.9	63.5	57.9	70.1
1972	70.0	61.9	67.7	70.6
1973	81.5	62.3	75.9	76.5
1974	82.0	61.2	78.1	74.6
1975	78.3	59.9	77.2	72.3
1976	82.6	57.6	76.8	74.8
1977	81.2	61.0	80.6	76.9
1978	82.1	65.0	83.3	80.4
1979	77.1	62.0	76.5	73.0
1980	71.7	52.7	69.0	66.2
1981	73.9	44.9	62.7	70.3
1982	77.7	44.0	57.5	73.9
1983	76.6	44.7	57.2	75.2
1984	82.6	55.6	63.0	80.5

SOURCE: Hawaii Visitors Bureau, Annual Research Reports, 1970-1980; Pannell Kerr Forster, 1981-1984.

Table IV-3

HOTEL OCCUPANCY AND  
AVERAGE DAILY ROOM RATES  
State of Hawaii  
1972 - 1984

Year	Occupancy (%)	Average Daily Room Rate
1972	70.2	\$ 19.80
1973	78.1	21.56
1974	78.4	24.12
1975	75.2	27.43
1976	76.8	29.52
1977	76.7	34.28
1978	80.6	38.49
1979	73.7	44.41
1980	67.8	47.28
1981	68.2	49.73
1982	70.5	51.87
1983	70.3	55.58
1984	76.0	59.25

SOURCE: Pannell Kerr Forster

#### E. Selected Visitor Characteristics

From 1970 through 1984, many characteristics of Westbound visitors destined to Hawaii, even after excluding the effects of the Military Rest and Recuperation (R&R) program, have changed. For example, after increasing to 47 percent during the mid-1970's, the percentage of persons traveling on organized tours in 1984 decreased to 19 percent, the lowest level since the mid-1960's; party size has increased continually and in 1984 reached 1.84 persons; median age declined to where it is approximately 40 years; slightly fewer stayed less than seven and more stayed 7-12 days, but the average stay has changed very little; and pleasure travel appears to be increasing.

The share of westbound arrivals from the U.S. Mainland dropped from 98.1 percent in 1970 to 86.7 percent in 1982, but rebounded to 90.0 percent in 1984.

The percentage of first time visitors dropped from 67.2 percent in 1970 to 49.6 percent in 1983, marking the first year in which first time visitors represented less than half of the westbound visitors. By 1984, the percentage of first time visitors had risen again above the one-half mark, reaching 52.7 percent.

The proportion of visitors whose occupations were professional, technical, business, managerial and officials has increased sizeably, as has the proportion of retirees.

A significant change has also occurred in the type of accommodations being used. In 1984, 26.0 percent of respondents indicated they intended to stay in a "Condominium" or "Hotel and Condominium", up from 0.8 percent in 1970 who indicated they intended to stay in a "Rented Home or Apartment". The percentage staying in all other categories of accommodations dropped, including those staying with friends and relatives.

Finally, the median family income of visitors has increased consistently over the years, in part reflecting inflationary effects. The estimated median family income of visitors in 1982, the latest data available, was \$39,000, more than double the \$18,300 estimated for 1970.

#### F. Hawaii Visitor Industry Forecast

It is difficult to forecast trends and economic activities which grow at the startling rates experienced by the Hawaii visitor industry until 1979, and then level off for two years before increasing again. There are, however, several factors which appear significant regarding past growth, and likely to influence future prospects, including:

1. Economic growth on the U.S. Mainland.
2. High employment levels, resulting in high levels of disposal income.
3. Overall population growth.
4. General increases in vacation and leisure time.
5. Economic expansion in the Far East.
6. Greater interest in long distance travel.
7. Gains in transportation technology.
8. Greater fare competition.

During the 1960's, all of these factors favored long distance travel, and Hawaii shared in the benefits of these trends.

However, in the 1970's, economic conditions became more cyclical. Sharp increases in crude oil prices contributed to high inflation rates as well as the cost of long distance travel. As a result, the trend of visitor arrivals in Hawaii became more variable, and in 1980 and 1981 was essentially flat.

The slowdown in visitor activity generated several responses. A major promotional program was initiated, and the State Government approved a supplemental appropriation of about \$1,000,000 for increased industry promotion and advertising in 1982. Further, the marketing efforts of the Hawaii Visitors Bureau (HVB) have become more active. Airline deregulation has resulted in greater fare competition as well as route competition, and additional carriers now provide service to Hawaii. All of these factors helped boost the number of overnight visitors to the State eight percent for 1982 over 1981 and three percent in 1983. In 1984, there was a sizable of 11.2 percent increase, the first double digit gain since 1976.

In December 1984, the Governor's Tourism Congress convened to raise and discuss tourism-related issues, and to propose actions to be taken by both the public and private sectors. The Congress expanded the awareness of the important economic role that tourism plays in Hawaii, the implications of world-wide competition for visitor expenditures and the need for Hawaii to increase its funding for tourism promotion and marketing. Among the propositions submitted to the Congress for voting, one, approved by 84 percent of the delegates, called for the Legislature to increase State funding for tourism promotion to between \$10,000,000 and \$20,000,000 per year. This compares with the historical HVS advertising budget of about \$400,000 per year. Also, 96 percent of the delegates supported attracting longer-staying and higher-spending visitors. And, 60 percent of the delegates supported a proposition to raise about \$20,000,000 annually for a Tourism Promotion and Protective Fund by raising the State General Excise Tax and then refunding a portion to State residents so that the tax increase would be incurred by visitors. Finally, 82 percent of the delegates agreed that future growth of tourism should be proportionally greater on the neighbor islands.

Following the Congress, a number of bills were introduced in the Legislature to raise additional funds for tourism promotion. Although none of the specific bills passed, the Legislature approved additional funds from General Revenues for tourism promotion and marketing. Moreover, the call for additional funds for tourism promotion and marketing is increasing. As a result, we believe that in the near future, major new funding will be made available for tourism promotion and marketing, and that Hawaii will become increasingly effective in competing not only for more visitors but also for more higher-quality visitors who stay longer and spend more in the State.

The State has prepared population and employment projections upon which it has based a number of its plans, and which it recommends for planning purposes. The "M-F" projection is based upon the estimate that the number of overnight and longer visitors would increase at the rate of 5 percent per year from 1980 to 1985, 4 percent per year from 1985 to 1990, 3 percent per year from 1990 to 1995, and 2 percent per year from 1995 to 2000. Current activity indicates that the slowdown in 1980 and 1981 was offset by a very rapid recovery, and that the State forecast for 1985 appears reasonable. With additional funding and aggressive tourism marketing, we

believe that the State forecasts to 2000 are also achievable. Although the projects shown in Table IV-4 are our own, they closely match the State projections.

Occupancy levels usually reflect the relationship of demand to supply. In light of a forecast of increased visitations relative to supply, occupancy rates appear to be headed for further increases. Pressures resulting from increased demands are measured in terms of price levels. That is, as market pressures increase, average room rates should continue to gain.

Thus, the combined forces of continually increasing demand and lack of corresponding new supply will create additional pressures in the State transient accommodations market, resulting in both increased occupancies and higher average daily room rates.

Resort multifamily units have been utilized increasingly as transient accommodations since construction of hotel rooms has not been sufficient to meet rising demand, and as visitors seek alternative types of accommodations.



Table IV-4 FORECAST OF OVERNIGHT VISITORS  
State of Hawaii  
1980 - 2000

Year	Westbound	Eastbound	Total
1980	3,046,000	888,000	3,934,000
1985	3,900,000	1,200,000	5,100,000
1990	4,700,000	1,500,000	6,200,000
1995	5,300,000	1,800,000	7,100,000
2000	5,600,000	2,200,000	7,800,000

SOURCE: Ming Chew Associates

A-14

V. COUNTY OF HAWAII VISITOR INDUSTRY

A. Visitor Count

The number of visitors to the neighbor islands in general has increased faster than to the State as a whole due to extensive promotion of neighbor island destinations, more repeat visitors who visited Waikiki initially and who now prefer neighbor island amenities for their return visits, additional recreational facilities to attract visitors, more facilities available to accommodate them, and more recently, direct flights from the U.S. Mainland west coast to Maui, Kona and Kauai.

Table V-1 shows the proportion of westbound visitors to Hawaii staying overnight or longer who indicated their intention to visit the neighbor islands. The proportions shown represent all westbound visitors staying overnight and longer, including those destined to Hawaii and those traveling beyond Hawaii. As seen, the proportion intending to visit the Big Island of Hawaii increased from 37.1 percent in 1970 to a high of almost 40 percent in 1971, before beginning an almost continuous decline to 20.5 percent in 1984. In contrast, the proportion intending to visit Maui increased almost continuously from 37.3 percent in 1970 to 50.3 percent in 1983 and 50.0 percent in 1984. The share of visitors to Kauai on the other hand, generally peaked at 36.0 percent in 1971, and declined to 21.1 percent in 1983 before rebounding to 22.0 percent in 1984.

The HVB provides estimates of Japanese visitors to the State and to the Big Island of Hawaii. Assuming that ten percent of the other eastbound visitors visited the Big Island, we estimate that the percent of total eastbound visitors to the Big Island ranged from 16 to 19 percent between 1977 and 1984.

Applying these factors to the historical levels of tourism to the State resulted in our estimate of visitors to the Big Island shown in Table V-2. As seen, estimated westbound visitors almost doubled from 511,000 in 1970 to 955,000 by 1978, before declining to 702,000 in 1982. By 1984, the number of westbound visitors is estimated to have rebounded to 763,000. The number of eastbound visitors to the Big Island has increased almost continuously from 1977, when the first estimates were made.

Table V-1 ESTIMATED NEIGHBOR ISLAND VISITORS(1)  
State of Hawaii  
1970 - 1984

Year	Estimated Percentages	
	To Hawaii	To Maui To Kauai
1970	37.1	37.3
1971	39.8	42.3
1972	39.2	43.7
1973	36.7	40.6
1974	36.8	42.2
1975	37.3	44.1
1976	34.1	46.4
1977	32.2	48.2
1978	31.5	48.6
1979	28.5	47.0
1980	25.9	47.0
1981	23.6	48.7
1982	21.6	49.3
1983	21.8	50.3
1984	20.5	50.0

(1) Westbound visitors staying overnight and longer, including visitors destined to Hawaii and those traveling beyond Hawaii, and a pro rata share of non-respondents.

SOURCE: Hawaii Visitors Bureau, Annual Research Reports; Ming Chew Associates.

Table V-2 VISITOR ESTIMATES AND FORECASTS  
County of Hawaii  
1970 - 2000

Year	Westbound		Eastbound(1)		Both Directions(2)	
	Percent of State	Estimated Visitors	Percent of State	Estimated Visitors	Percent of State	Estimated Visitors
1970	37.1	511,000	--	--	--	--
1971	39.8	569,000	--	--	--	--
1972	39.2	699,000	--	--	--	--
1973	36.7	759,000	--	--	--	--
1974	36.8	804,000	--	--	--	--
1975	37.3	823,000	--	--	--	--
1976	34.1	870,000	--	--	--	--
1977	32.2	890,000	18	118,000	18	1,008,000
1978	31.5	955,000	19	121,000	19	1,076,000
1979	28.5	895,000	19	156,000	19	1,051,000
1980	25.9	789,000	16	142,000	16	931,000
1981	23.6	702,000	17	163,000	17	865,000
1982	21.6	708,000	17	174,000	17	882,000
1983	21.8	740,000	16	175,000	16	915,000
1984	20.5	763,000	17	193,000	17	956,000
Forecast:						
1985	21	819,000	19	228,000	19	1,047,000
1990	25	1,175,000	21	315,000	21	1,490,000
1995	25	1,325,000	23	414,000	23	1,739,000
2000	25	1,400,000	25	550,000	25	1,950,000

(1) Estimates based upon surveys of Japanese visitors through 1983 and the assumption that ten percent of other Eastbound visitors visit Hawaii County. Estimated to be 17 percent in 1984.

(2) Westbound only until 1977.

SOURCE: Hawaii Visitors Bureau, Annual Research Reports and Japanese Visitor Opinion Surveys; Ming Chew Associates.

The popularity of the Big Island for sightseeing is reflected by selected attendance figures. For example, the Hawaii Volcanoes National Park recorded the largest attendance among attractions in the State in 1984, except for the National Memorial Cemetery in Punchbowl Crater on Oahu. Actually, the Big Island contains three of the State's four national park system facilities: the Hawaii Volcanoes National Park, Puuhonua O Honaunau National Historical Park (City of Refuge) and the Puukohola Heiau National Historical Site. The National Park is greater than the level of tourism estimated to the Island, suggesting that attendance at the park includes multiple visits, visits by local residents, visits by residents of other islands and trips by visitors who decided to visit the Park after arriving in the State.

A number of destination resort areas with self-contained recreation facilities have been developed on the Big Island. These include the Mauna Kea Resort, Mauna Lani Resort and Waikoloa Beach Resort in the Kohala Coast Resort Region, Kona Village at Kaupulehu and Keauhou Resort which is situated south of Kailua-Kona. Limited development has occurred at C. Brewer's Sea Mountain at Ninole.

Although there are only limited recreational facilities in either Hilo or Kailua-Kona, these two areas historically have contained most of the visitor plant facilities on the Island. The next table, Table V-3, shows the distribution of transient accommodations on the Island, and Table V-4 shows occupancy units calculated from average occupancy figures provided by the HVB and Pannell Kerr Forster. From 1970 to 1984, the total number of transient accommodation units in the county increased from 3,486 to 7,511, a gain of 115 percent. Occupied rooms increased only 91 percent during the same period from an estimated 2,182 occupied units in 1970 to 4,159 occupied units in 1984. Meanwhile, tourism to the State in both directions increased by 149 percent, indicating that the County of Hawaii did not achieve its proportional share of growth as measured by occupied rooms.

The table also shows our forecasted capture of the State market to 2000. Although the share of westbound visitors has declined during the last several years, we anticipate that the proportion of westbound visitors to Hawaii County will rebound in 1985, and increase to 25 percent by 1990, and remain at that level to 2000. This assessment reflects anticipated efforts to divert tourism from Waikiki and Oahu to the Neighbor Islands, preference for Neighbor Island amenities by the increasing number of repeat visitors to the State, the recent addition of new visitor facilities on the Island, direct flights from the U.S. Mainland west coast to Kona by United Airlines and its increased promotional efforts to stimulate travel to the Neighbor Islands. The leveling projected in the percentage of westbound visitors attracted is expected to result from increased competition among all neighbor islands. As seen from the table, we expect the number of westbound Big Island visitors to increase from an estimated level of 763,000 in 1984 to 1,400,000 by 2000.

An increasing proportion of eastbound visitors is also expected to visit Hawaii County for the same reasons indicated for westbound visitors. In this case though, Japan Air Lines, the major eastbound air carrier, has increased its promotional efforts to stimulate travel to the Neighbor Islands as a new travel experience. As a result, the number of eastbound visitors to the Island is expected to increase from 193,000 in 1984 to 550,000 by 2000. Combined eastbound and westbound travel to the Island is projected to increase from 956,000 in 1984 to 1,950,000 by 2000.

#### B. Characteristics of Hawaii County Tourism

The Big Island of Hawaii contains a variety of features, many unique, which has made it a very popular place for sightseeing. For example, the Island has the two highest peaks in the State, two of the few active volcanoes in the nation, massive lava fields, the only producing coffee industry in the United States, the largest orchid industry in the country, the largest working ranch in the nation, black sand beaches, white sand beaches, lava rock coastlines, state and national historical parks, rain forests, waterfalls, deserts and a number of historical areas.

In March 1984, Mauna Loa erupted for the first time since 1975. Less than a week later, Kilauea erupted. It had been over 100 years since these two volcanoes had concurrent eruptions.

Table V-3  
DISTRIBUTION OF TOTAL  
TRANSIENT ACCOMMODATIONS (1)  
County of Hawaii  
1970 - 1984

Year	Hilo		Kona		Kohala(2)		Other(2)		County	
	Units	% of County	Units	% of County	Units	% of County	Units	% of County	Units	% of County
1970	1,345	38.6%	1,752	50.3%	-	-	389	11.1%	3,486	100.0%
1971	1,547	36.5	2,306	54.4	-	-	388	9.1	4,241	100.0
1972	1,817	37.9	2,582	53.8	-	-	397	8.3	4,796	100.0
1973	1,782	34.0	3,009	57.5	-	-	443	8.5	5,234	100.0
1974	1,850	34.6	3,055	57.1	-	-	443	8.3	5,348	100.0
1975	2,167	35.9	3,423	56.6	-	-	455	7.5	6,045	100.0
1976	2,130	35.9	3,331	56.1	-	-	468	8.0	5,929	100.0
1977	1,957	32.6	3,543	59.0	-	-	502	8.4	6,000	100.0
1978	1,954	32.1	3,637	59.7	-	-	502	8.2	6,093	100.0
1979	1,954	33.2	3,437	58.4	-	-	498	8.4	5,889	100.0
1980	1,944	29.0	4,193	62.5	483	7.2%	85	1.3	6,705	100.0
1981	1,762	24.6	4,249	59.3	1,078	15.0	78	1.1	7,167	100.0
1982	1,648	22.1	4,397	58.8	1,342	18.0	82	1.1	7,469	100.0
1983	1,194	16.7	4,448	62.2	1,422	19.9	85	1.2	7,149	100.0
1984	1,313	17.5	4,748	63.2	1,365	18.2	85	1.1	7,511	100.0

(1) HVB Visitor Plant Inventory data for February of following year.  
(2) Kohala data included with "Other" until 1980.

SOURCE: Ming Chew Associates

Table V-4  
DISTRIBUTION OF OCCUPIED  
TRANSIENT ACCOMMODATIONS (1)  
County of Hawaii  
1970 - 1984

Year	Hilo		Kona		Kohala(2)		Other(2)		County		
	Units	% of County	Units	% of County	Units	% of County	Units	% of County	Units	% of County	
1970	907	41.5%	1,014	46.5%	-	-	261	12.0%	2,182	100.0%	
1971	847	37.6	1,134	50.4	-	-	269	12.0	2,250	100.0	
1972	1,076	39.7	1,355	50.1	-	-	277	10.2	2,708	100.0	
1973	1,139	38.4	1,529	51.6	-	-	296	10.0	2,964	100.0	
1974	1,101	34.3	1,763	55.0	-	-	342	10.7	3,206	100.0	
1975	1,109	34.3	1,781	55.2	-	-	338	10.5	3,228	100.0	
1976	929	28.9	1,911	59.6	-	-	369	11.5	3,209	100.0	
1977	1,113	30.4	2,167	59.2	-	-	383	10.4	3,663	100.0	
1978	1,094	28.0	2,430	62.2	-	-	385	9.8	3,909	100.0	
1979	1,017	28.0	2,239	61.7	-	-	375	10.3	3,631	100.0	
1980	(3)	731	23.4	1,994	63.9	351	11.2%	45	1.5	3,121	100.0
1981	(3)	734	22.3	2,069	63.0	442	13.5	40	1.2	3,285	100.0
1982	(3)	635	19.2	2,002	60.6	621	18.8	43	1.3	3,301	100.0
1983	(3)	579	16.7	2,122	61.3	718	20.7	44	1.3	3,463	100.0
1984	(3)	709	17.1	2,508	60.3	896	21.5	44	1.1	4,159	100.0

(1) Average of monthly occupancy rates reported by HVB applied to monthly HVB Visitor Plant inventory data.  
(2) Kohala data included with "Other" until 1980.  
(3) Occupancy rates estimated by HVB, Pannell Kerr Forster and Ming Chew Associates.

SOURCE: Ming Chew Associates

Table V-5 OCCUPANCY IN TRANSIENT ACCOMMODATIONS  
County of Hawaii  
1972 - 1985

	(Percent)			Island of Hawaii
	Kona	Hilo		
1972	56%	65%		59%
1973	61	63		62
1974	58	63		60
1975	59	56		58
1976	58	52		56
1977	63	49		58
1978	69	52		64
1979	65	45		58
1980	59	34		51
1981	49	35		45
1982	47	38		44
1983	47	39		45
1984	55	58		56
January	54%	43%		51%
February	74	66		72
March	67	72		68
April	50	60		52
May	51	50		51
June	49	53		50
July	50	65		54
August	52	63		55
September	49	59		51
October	61	51		59
November	58	70		61
December	53	51		52
1985	66%	56%		64%
January	85	77		83
February	73	66		72
March	54	64		56
April	45	51		46
May				

SOURCE: Pannell Kerr Forster

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Beginning in 1981 with the completion of the Sheraton Royal Waikoloa Hotel in the Waikoloa Beach Resort, the share of transient accommodations outside Kona and Hilo, mainly in the Kohala Coast Resort Region, increased sizeably. By February 1983, with the opening of the Mauna Lani Bay Hotel in the Mauna Lani Resort, the proportion of units essentially on the Kohala Coast began to approach that in Hilo. By the end of 1983, as a result of continued removal of units from the Hilo inventory for other uses, the number of transient accommodation units in North and South Kohala exceeded for the first time the number of occupied units in Hilo. In fact, Table V-4 shows that by 1982, the number of occupied units essentially on the Kohala Coast had already approximated the number of occupied units in Hilo.

Much of the visitor plant in Hilo and Kona had been oriented toward group travelers which represented as high as 47 percent of westbound visitors to the State in 1974. By 1984, the share of group travelers had declined to 19 percent.

The seasonality of tourism to the Island can be observed from the monthly occupancy rates shown in Table V-5. Occupancies in Kona have exceeded those in Hilo since about 1975. This trend reversed in 1984 as visitors rushed to Hilo to view eruptions by Kilauea Volcano and Mauna Loa. In 1985, Kona occupancies have been higher than in Hilo. Based upon earlier surveys conducted by the HVB, occupancies for visitor accommodations located outside Hilo and Kona have been generally higher than the island-wide averages.

Almost all visitors to the Island arrive by air. Until recently, Hilo was the State's only other gateway outside of Honolulu served directly by overseas airlines. In January 1983, United Airlines began flying from the U.S. Mainland west coast directly to Maui's Kahului Airport. In September 1983, United began flying directly from the west coast to Ke-ahole Airport, which serves Kona and the Kohala Coast. And, in August 1984, United began direct flights to Lihue Airport on Kauai. General Lyman Field, Ke-ahole Airport and Waimea-Kohala Airport serving Waimea and Kohala, can accommodate the DC-9 and Boeing 737 Interisland jet aircraft. Moreover, General Lyman Field in Hilo is capable of accommodating Boeing 747 and other wide-bodied aircraft. More inter-island flights including those of scheduled commuter airlines serve Kona than the other two airports. Princeville Airways began service to Waikoloa in the July 1984 using an airstrip situated on an abandoned roadway.

VI. MARKET ANALYSIS FOR TRANSIENT ACCOMMODATIONS

The demand for transient accommodations in Hawaii has expanded dramatically due to rapid growth of State tourism. Furthermore, each delineated market segment now has grown sufficiently to support a wide variety of accommodations, as well as recreation and amusement facilities.

Long distance travel is a component of the leisure market, and is dependent upon the availability of large amounts of discretionary leisure time and discretionary income, both of which have been increasing over recent years due to economic growth worldwide (despite short temporary setbacks). Furthermore, population and increasing interest in travel, reduced travel time so that areas considered remote in the past are now readily accessible. Aircraft technology and airline deregulation have also reduced costs, permitting large numbers of persons previously constrained by financial requirements to travel greater distances. By both expanding the geographic dimensions of the market and reducing travel costs, transportation improvements have substantially broadened the market area from which patronage can be drawn.

However, larger market area dimensions have also multiplied the number of tourist destinations vying for travelers and their expenditures; thus, competition for visitors and patronage has intensified. The extent of the competition has increased the difficulty of creating an effective market image to attract visitors from the expanded market area.

The transient accommodations market is highly segmented with each specific segment having different requirements. This allows operators to either focus attention on capturing a narrow segment of the market, or attempt to appeal to all segments, but with a potential loss of efficiency.

Market segmentation also allows facilities catering to different categories of patrons to co-exist in an area so long as each segment is of an economic size. Increasing the amount of facilities in a single locale adds to its cumulative attraction. Increasing the overall attraction of an area increases the likely draw to the area and makes more viable each of the entities operating therein. Thus, variety, quality and quantity of both amenities and facilities are all very important when trying to merchandise transient accommodations to broad market segments.

A. Methodology

Market analysis is accomplished by comparing factors of demand with factors of supply. First, the patterns of historical demand are evaluated, and then Statewide demand projected. State demand is delineated after analyzing the relative attractions of each Island, and its respective resort regions. The current and anticipated supply of competitive facilities is compiled and differentiated to compare with the delineated demand. Differences between supply and demand are used to identify the prospects for new developments.

In order to delineate demand by regions within the State, a current and anticipated inventory of facilities in each competitive resort region is tabulated. Based upon the envisaged "cumulative attraction" of the subject region or proposed project relative to competing regions or projects, subjective estimates of potential market capture are made. Market potential is then determined by measuring imbalances between anticipated supply conditions and delineated forecasts of demand.

B. Supply Factors

Until recently, there were only two large concentrations of transient accommodations on the Island of Hawaii, Hilo and Kona. The Kohala Coast Resort Region, however, in just a few years has become one of the Island's major destination areas, and now exceeds Hilo in terms of the number of transient units available.

1. Hilo Supply

Hilo's role in Big Island tourism historically has been to accommodate overnight visitors beginning or concluding their visit to the Island. Tourism received a boost when General Lyman Field was expanded to handle direct flights from the U.S. Mainland, making Hilo the State's second gateway or departure point after Honolulu. Major stimulation occurred also in 1968 and 1969 when a "hotel row" began developing along Banyan Drive. Since then, nearly all major hotels have also been built there.

The visitor pattern in Hilo consists mainly of sightseeing and a stay of only one night, despite the fact that the Island's most popular sightseeing attractions are within a radius of 30 miles. These sights include the Hawaii Volcanoes National Park,

Kalapana Black Sand Beach, orchid nurseries, macadamia nut factories, Rainbow and Akaka Falls, Boiling Pots and the Lyman Museum.

The major cause of this visitor pattern is probably the lack of the "sun, surf and sand" requisite of Hawaii resort regions. The high incidence of rain-fall, 134 inches per year or almost 0.4 inches average per day, results in a low probability of sunny days for outdoor activity. High quality swimming beaches are also lacking. Hilo is, on the other hand, an aesthetically attractive area with its quaint setting, floral variety and rich vegetation. Nonetheless, by most standards, Hilo does not qualify as a destination resort area.

In fact, with decreasing group travel, Hilo has experienced sharp declines in visitor activity. The number of accommodations has been reduced as a result of conversions to office and other uses. United Airlines recently terminated its direct flights from the U.S. Mainland to Hilo, flying instead directly to Maui, Ke-ahole Airport in Kona and Kauai. The flights from Kona to Los Angeles return through Hilo.

A breakdown of Hilo's visitor plant inventory by price range indicates that the largest proportion of rooms, 60 percent, are priced in the published rate range of \$50 to \$74 per night for superior room, double occupancy.

## 2. Kona Supply

Kona's tourism role traditionally has been to accommodate sightseeing vacationers and those desiring rest and relaxation. It also served kamaainas who sought a reprieve from the pace of Honolulu. As such, most of the accommodations were rather modest. Passive recreation was promoted and the amount of active recreation facilities was limited. Few of the transient accommodations contained a full range of resort amenities.

As tourism expanded, the character of the visitor to Kona, and Kona itself, changed. Recently, destinations such as Keauhou Resort and Kona Village Resort have developed outside Kailua Town. Keauhou Resort contains more active recreational amenities and more extensive entertainment.

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Keauhou itself now contains 39 percent of all transient accommodations in Kona. A new shopping center, resort houselot subdivision and golf course extension have just completed construction.

There is a broad spread of accommodations with published prices ranging from under \$30 per night for double occupancy, to an estimated \$140 to \$280 per night room rate at the Kona Village Resort (where actual prices range from \$260 to \$400 for double occupancy including all meals on the full American plan). Most of the recent developments contain more amenities than the older ones and are also priced higher. The largest proportion, 48 percent, of the hotel accommodations have published rates of \$75 to \$99 per night for double occupancy. Apartment hotels indicate a similar pattern except that the largest proportion, 39 percent, is in the \$50 to \$74 range. Together, 93 percent of the accommodations in Kona have published rates of \$30 to \$99.

## 3. North and South Kohala Supply

The supply of transient accommodations in North and South Kohala consists, essentially, of those contained in the resorts located in the Kohala Coast Resort Region.

Even though it contains the world renown Mauna Kea Resort which began operations in 1965, the entire Kohala Coast Resort Region is only beginning to be fully recognized as a major destination resort region.

The Region has the lowest recorded rainfall in the State and therefore, the highest proportion of sunny days. It has white sand beaches with calm swimming water, attractive views of the ocean and the four major land masses on the island including both Mauna Kea and Mauna Loa. Haleakala on the island of Maui can also be seen. These characteristics of "sun, surf and sand" have led to the recent development of Waikoloa Beach Resort and Mauna Lani Resort, both in very close proximity to each other and to the Mauna Kea Resort. The Sheraton Royal Waikoloa Hotel began operations in late 1981, and the Mauna Lani Bay Hotel opened in February 1983.

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Table VI-1  
SUMMARY OF PRIMARY TRANSIENT  
ACCOMMODATIONS BY PRICE RANGE (1)  
County of Hawaii  
1985

District or Region	Units (2)	Less Than \$30	\$30- \$49	\$50- \$74	\$75- \$99	\$100- \$149	\$150- \$199	\$200+	Estimated Average Published Rate
Hilo	1,134	-	458	676	-	-	-	-	\$ 53
Percent of total	19%								
Kona	3,328	57	428	1,149	1,531	63	-	100	\$ 76
Percent of total	57%								
Kohala	1,296	25	27	40	-	-	543	661	\$173
Percent of total	21%								
Ka'u, Volcano	83	13	-	37	-	33	-	-	\$ 58
Percent of total	1%								
Total	5,841	95	913	1,902	1,564	63	543	761	\$ 93
Percent Distri- bution	100%	2%	16%	32%	27%	1%	9%	13%	

(1) Published rates for double occupancy superior for hotels and one-bedroom units for apartment, townhouses per night, rates may apply to studio units or cottages which were only type available.

(2) Includes projects which are HVB members or which are managed by HVB members.

SOURCE: Ming Chew Associates

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All of the hotel rooms in the three resorts on the Kohala Coast are in or above the luxury category with published rates of about \$150 and above.

4. Summary of Accommodations

Table VI-1 summarizes the number and location of transient accommodations on the Big Island by price range. Projects which are HVB members or which are managed by HVB members contain a total of 5,841 units. More than half of these units are located in Kona. The next largest concentration is in North and South Kohala, followed closely by the number in Hilo.

All of the units in Hilo have published rates between \$30 and \$74, whereas the most prevalent range in Kona is between \$30 and \$99. For Kohala, the predominant range of published room prices is \$150 and over with the largest number in the \$200+ category. Moreover, the Kohala Coast Resort Region contains 92 percent of the units on the Island with published room rates over \$150. The relative rates are indicative of the character of the areas and the general images these major areas have created for themselves.

C. Demand Factors

In prior chapters, visitor forecasts were made for the State and delineated into projections for Hawaii County. As shown earlier, State tourism is projected to grow at the rate of 3.4 percent per year from 1984 to 2000, and County tourism at 4.6 percent per year during the same period.

Underlying these projections, particularly the higher County growth rate, is the assumption the Kohala Coast Resort Region will continue to experience substantial resort development. The addition of resort facilities will enhance the competitive posture of the Region relative to other parts of the Island, and of the Island relative to others in the State. The Region itself must compete directly with other State resort regions, just as the Mauna Kea Beach Hotel has for a number of years.

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Table VI-2 DISTRIBUTION OF NEIGHBOR ISLAND  
TRANSIENT ACCOMMODATIONS BY  
MAJOR RESORT REGIONS  
State of Hawaii  
1985

	Transient Accommodation Units(1)	Golf Courses (2)
<u>Hawaii:</u>		
North and South Kohala (3)	7,365	4
Kona	4,748	1 (27-holes)
Other (including Hilo)	1,398	5 (two 9-hole)
Total	7,511	
<u>Maui:</u>		
West Maui (Lahaina, Kaanapali, Napili)	8,262	4
Kihei-Wailea-Makena	4,679	3
Other (Including Kahului)	574	2
Total	13,515	
<u>Molokai:</u>	627	2 (one 9-hole)
<u>Kauai:</u>		
Wailua-Kapaa	2,221	1
Poipu	1,675	1
Hanalei	833	1 (27 Holes)
Other (Including Lihue)	928	2 (one 9-hole)
Total	5,656	

(1) As of February 1985.  
(2) Open to the public.  
(3) Mainly the Kohala Coast Resort Region

SOURCE: Ming Chew Associates

Thus, in order to delineate our County demand forecasts, we evaluated the potential attraction of the Kohala Coast Resort Region relative to other regions in the State.

1. Comparison of Region With Other State Regions

Although a large number of areas in the State have relatively large concentrations of resort amenities, we have limited our comparison mainly to neighbor island, master planned resort communities with controlled environments, and the Kona resort region on the Big Island. Kona was included although it lacks swimming beaches since it is the most potentially competitive area on the Island.

From Table VI-2, it can be seen that the major neighbor island resort regions competing with the Kohala resort region are Maui and Kona.

Of the neighbor islands, Maui contains the largest number of transient accommodations, accounting for about one-half of the inventory not on Oahu. West Maui alone, from Lahaina to Kapalua, contains 8,262 units, or more than on either the Island of Hawaii or the Island of Kauai. The resort region from Maalaea to Makena also has extensive facilities. Much of the attraction of Maui has resulted from the quantity, quality and diversity of activities and amenities including extensive sandy beaches and golf courses, as well as over a decade of coordinated promotion of Maui as a distinct resort destination area.

The second largest resort region on the neighbor islands is Kona on the Island of Hawaii. However, except for the number of boat harbors, the amount of recreational amenities such as golf courses in this region is relatively limited, particularly in relationship to the inventory of accommodations.

At present, North and South Kohala contain about 1,365 transient accommodations. Almost 900 of these units have been added within the last four years with the construction of Waikoloa Beach Resort and Mauna Lani Resort. Each of these resorts also added a championship golf course to the two that already existed, giving this area four championship courses in close proximity, as many as now exists in the West Maui resort region.

Table VI-3  
FORECAST OF TRANSIENT  
ACCOMMODATION DEMAND  
County of Hawaii  
1984 - 2000

	1984	1985	1990	1995	2000
<b>Westbound:</b>					
Visitors (1)	687,000	737,000	1,058,000	1,192,000	1,260,000
Average Stay (2)	4.2	4.5	5.0	5.5	6.0
Average Party Size	2.1	2.1	2.1	2.1	2.1
Occupied Rooms	3,800	4,300	6,900	8,500	9,800
<b>Eastbound:</b>					
Visitors	193,000	228,000	315,000	414,000	550,000
Average Stay	0.3	0.4	1.0	1.4	1.8
Average Party Size	1.6	1.6	1.6	1.6	1.6
Occupied Rooms	100	200	500	1,000	1,900
<b>Local:</b>					
Visitors	120,000	150,000	250,000	375,000	475,000
Average Stay	1.5	1.5	1.6	1.6	1.6
Average Party Size	1.7	1.7	1.7	1.7	1.7
Occupied Rooms	300	400	600	1,000	1,200
<b>Total:</b>					
Visitors	1,000,000	1,115,000	1,623,000	2,125,000	2,285,000
Average Stay	3.1	3.3	3.6	4.0	4.3
Average Party Size	2.0	2.0	2.1	2.0	2.0
Occupied Rooms	4,200	4,900	8,000	10,500	12,900

(1) Staying in transient accommodations.  
(2) Average stay in nights.

SOURCE: Ming Chew Associates.

Combining this popular sport with a large number of tennis courts, excellent swimming beaches, good boating and diving facilities, and nearby marinas will enhance the recreation orientation of this destination area. Other recreation will include trail riding and equestrian activities, hunting, skeetshooting and even skiing on Mauna Kea. A polo field has been proposed at Waikoloa Village. Passive recreational and educational activities include inspecting petroglyphs at Waikoloa and Puako, traversing the King's Trail, visiting Puukohola Heiau National Historic Site, Lapakahi State Historic Park, King Kamehameha's birthplace and other historic sites along the coast and in Waimea. Sightseeing in other parts of the island is facilitated by the high-speed belt highway to Hilo and the Hawaii Volcanoes National Park, or to Kona and the airport at Keahole.

Thus, the prospects are very good that the available "sun, surf and sand", complementary accommodations and recreational facilities, good accessibility and luxury and "super-luxury" quality of the three existing beach resorts will combine to make the Kohala Coast Resort Region one of the most attractive and certainly the highest quality destination area in the State.

2. Forecast of Island Demand

Tourism forecasts for the Island were converted to projections of transient accommodations demand by applying a 90 percent factor to westbound visitors to estimate the number staying in transient accommodations, estimating the average stay for westbound and eastbound visitors, and finally the average party size to obtain the average nightly occupied room demand.

Table VI-3 shows these results delineated by westbound, eastbound and intrastate travelers. As seen, total room demand in terms of occupied units was estimated to be 4,200 units in 1984. Compared to the reported visitor plant inventory of 7,511 units, the overall occupancy of the island of Hawaii for 1984 would have been about 56 percent. The demand is projected to increase to 4,900 occupied units by 1985, 8,000 units by 1990, 10,500 units by 1995 and to 12,900 units by 2000.

3. Delineation of Island Demand by Sub-area

The pattern of occupancy in visitor facilities for different sub-areas was analyzed to aid in allocating the projected island-wide demand. Although total visitor plant inventory reflects the level of building activity in each sub-area, the trends in occupied units more adequately reflects the competitive position of each resort district.

The relative role of Hilo has been declining since at least 1970. Until about 1980, this decline was offset by a corresponding increase by Kona. In general, the relative role of all other areas, including the Kohala Coast, was stable from 1970 until 1980. Since 1981, however, the relative position of the Kohala Coast has increased rapidly. By the end of 1983, the number of both total and occupied units in North and South Kohala, mainly the Kohala Coast Resort Region, exceeded the number in Hilo.

Table VI-4 shows our projections of both occupied room and total room demand by resort region for the Island.

We project that the demand for occupied units in Hilo will increase from 709 units in 1983, to 1,200 by 2000. Nonetheless, we anticipate that Hilo's relative market position will continue to decline. Assuming a 70 percent occupancy rate, the demand for total units is projected to increase from 1,000 in 1984 to 1,700 in 2000, compared to the current inventory of 1,313 units.

The demand for occupied units in Kona is expected to reverse the decline that began in 1978. The relative share of occupied units in Kona will continue to decline though, as Kohala is projected to gain very rapidly both in terms of the number of occupied units and market share on the Island.

As seen in Table VI-4, the demand for transient accommodations in Kohala is projected to increase from 3,600 units in 1984, to 8,000 in 2000. In North and South Kohala, it is projected to increase more rapidly from 1,300 units in 1984, also to 8,000 in 2000.

Table VI-4  
PROJECTION OF TRANSIENT  
ACCOMMODATION DEMAND BY RESORT REGION  
County of Hawaii  
1984 - 2000

Occupied Units:	Hilo	Kona	Kohala	Other	Total
	County	County	County	County	County
1984	709	2,508	896	44	4,157
1985	800	2,900	1,100	100	4,900
1990	900	3,800	3,100	200	8,000
1995	1,000	4,800	4,400	300	10,500
2000	1,200	5,600	5,600	500	12,900
Estimated Total Demand at 70% Occupancy:					
1984	1,000	3,600	1,300	60	5,960
1985	1,100	4,200	1,600	100	7,000
1990	1,300	5,400	4,500	300	11,500
1995	1,500	6,800	6,300	500	15,000
2000	1,700	8,000	8,000	700	18,400
Visitor Plant Inventory:					
February 1985	1,313	4,748	1,365	85	7,511

SOURCE: Hawaii Visitors Bureau, Visitor Plant Inventory, February 1985; Ming Chew Associates.

In general, it appears that Hilo and Kona are currently over-supplied at present, and that demand in North and South Kohala is about balance with supply.

D. Estimated Marketability of Transient Accommodations

1. Demand

Projections in the preceding section reflect that net demand would exist in North and South Kohala for another 200 units by the end of 1985, 3,100 units by 1990, 4,900 units by 1995 and 6,600 units by 2000.

We believe that most of the demand will be satisfied in the Kohala Coast Resort Region, mainly within Waikoloa Beach Resort, Mauna Lani Resort and the lands being developed by Mauna Kea Properties, Inc. Waikoloa can be categorized as a luxury resort, whereas the Mauna Kea and Mauna Lani Resorts could be classified as "super-luxury" resorts. These distinctions are due in part to the image that has been promoted, types and quality of facilities developed, development densities and clientele attracted. Published room rates at Waikoloa are also lower than at the "super-luxury" resorts.

Although increased demand will have to be accommodated throughout North and South Kohala, the largest portion would probably be attracted to the Kohala Coast Resort Region. Due to the lack of other facilities outside the coastal area, we estimate that 70 to 90 percent of the projected new demand in North and South Kohala would likely be accommodated in Waikaloa, Mauna Lani and Mauna Kea Properties' projects.

The subject proposed project at Kaupulehu is envisioned to be relatively comparable to these other luxury and super-luxury resorts in the Kohala Coast Resort Region. As mentioned earlier, its topographic and climatic conditions, proposed ambience and potential market are sufficiently similar that the Kaupulehu project is likely to develop an association more with the resorts in the Kohala Coast Resort Region than with those in Kona.

Geographically, the subject site would have the advantage of being the first major resort encountered by visitors to Kohala who arrive through Ke-ahole Airport. As a gateway project to the Kohala Coast Resort Region, the proposed development would enjoy enhanced visibility, as well as be benefitted by closer proximity to the airport and easier access to the activities and facilities in Kona.

The subject project also has an established locational identity by being adjacent to the small, but attractive Kona Village Resort. This resort which has operated for 20 years achieves room rates comparable to those achieved at the super-luxury Mauna Kea Resort and Mauna Lani Resort. In fact, its return-guest ratio is probably one of the highest in the State. And, just as the case at Mauna Kea, the long period of operations and high return-guest ratio suggest the prospects for pent-up demand to acquire resort properties in the vicinity. Thus, some increment of pent-up demand probably already exists for properties at the proposed site.

Notwithstanding the potential from these market elements, we believe that the real prospects of the proposed Kaupulehu project are directly related to the competitive posture it takes relative to the existing luxury and super-luxury resorts in the region.

To aid in establishing an effective competitive posture, discussions have been held with Princess Hotels International to be the operator of the proposed resort hotel. Princess is a subsidiary of Lomrho PLC, one of the United Kingdom's largest international companies with sales of 2.4 billion British Pounds in 1984 and an employment of about 150,000 persons world-wide. Prior to purchase by Lomrho, Princess Hotels was owned by D.K. Ludwig, often reported to be the world's wealthiest individual. Lomrho acquired Princess as a cornerstone of its expansion into North America, intending to build upon its market awareness and reputation for excellence. Currently, Princess operates resort hotels in Acapulco, Bermuda and the Bahamas, and is involved with hotel projects being developed in Florida and in Scottsdale, Arizona.

Discussions with a representative of Princess Hotels International indicated that the firm's philosophy is for its properties to be complete destinations within themselves. Further, it is Princess' objective that its properties be recognized a the best in each location in which it operates. This would be reflected in terms of achieving the highest room rates, occupancies and the perception of offering excellent value for price, having a high guest return factor and finally, being considered a good hotel to work for by its employees.

It appears that Princess Hotels has achieved these very lofty objectives in the areas in which Princess now operates.

In fact, many of its properties have distinguished themselves. For example, the Acapulco Princess Hotel & Club de Golf has set the standard for super-luxury, beach resorts for many years. Its large atrium was the inspiration behind the now-famous atriums incorporated into the Hyatt Regency hotels. Its large swimming pool was the inspiration behind the now-famous pool at the Hyatt Regency Maui. Yet, despite the numerous copies, the Acapulco Princess is still noted as one of the finest beach resorts in the world.

In formulating our market demand analysis, we have assumed that an organization with the reputation, track record and marketing and operating capability as Princess Hotels International would be involved in the planning, development and operations of the proposed subject project at Kaupulehu.

We believe that an operator as effective as we envision Princess Hotels to be, could be successful in establishing a solid position in the Kohala Coast Resort Region. In addition to the attributes already described, we understand that Princess would want one golf course exclusively for the use of hotel guests. In such case, the proposed project would be only one of two resort hotels in the State with an exclusive golf course. The other will be the Westin Kauai. Nonetheless, the Kaupulehu could have this advantage over the other resorts in the region.

Considering that the other resorts, however, have been in operation some time, they have already established market identities and perceived images. By the time the proposed project at Kaupulehu is developed, those identities and perceived images will have been reinforced even more. Thus, it is likely that the subject proposed project, even with an operator as effective as Princess Hotels, would capture a smaller share of the overall regional demand than would Mauna Kea, Mauna Lani or Waikoloa.

Nevertheless, we project that with Princess as an operator, the subject Kaupulehu project could attract 10 to 20 percent of the Kohala Coast Resort Region transient accommodations demand. This would result in an estimated demand at Kaupulehu of 310 to 620 units by 1990, 490 to 920 by 1995 and 660 to 1,300 units by 2000.

Moreover, since the project is in relatively close proximity to Kona, it might also attract as much as five percent of the demand projected for Kona. This could add an additional increment of demand at the site of 35 units by 1990, 105 units by 1995 and 160 units by 2000.

Thus, the total projected demand for transient accommodations at the subject Kaupulehu project of 345 to 655 units by 1990, 595 to 1025 by 1995 and 820 to 1460 units by 2000.

## 2. Anticipated Supply

The most recent major addition to the supply of transient accommodations on the Kohala Coast has been the 351-room Mauna Lani Bay Hotel, completed in February 1983.

The 80-unit Mauna Lani Terrace, super-luxury low-rise condominium apartments, adjacent to the Mauna Lani Bay Hotel was completed in December 1983. Also, one unit of the 23-unit, first increment of the 40-unit ultra-luxury The Villas at Mauna Kea near the Mauna Kea Beach Hotel was completed in 1983, and the remainder of the first increment in 1984. We anticipate that a few of the Mauna Lani Terrace units and a few of the Villas at Mauna Kea units will be made available for transient use. Construction has commenced on the 66-unit first increment of the luxury 114-unit

Shores at Waikoloa on an 11.4-acre site in Waikoloa Beach Resort next to the golf clubhouse, and on the first 116 units of the Super-luxury Mauna Lani Point on a 30-acre site surrounding Fairway 5 of the championship Francis H. I'i Brown Golf Course in Mauna Lani Resort.

The Estates at Mauna Kea, is scheduled to be the next project in the Mauna Kea Resort. It would contain an estimated 26 units on about 51 acres and is projected for completion in 1987.

Plans have been announced for the 1260-room Hyatt Regency Waikoloa Hotel on 60 acres in the Waikoloa Beach Resort, with a possible completion date in 1988. Plans have also been announced for the proposed development of Hapuna Beach Resort immediately south and to the east of Mauna Kea Resort. This project would be similar in quality to the Mauna Kea Resort and contain a resort hotel, beach and tennis club, championship golf course and resort residential uses. Present plans anticipate commencement of detailed design in 1986.

#### 3. Occupancy Rates

The preceding demand analysis was based upon an overall occupancy of 70 percent among all transient accommodations, including both hotel units and resort multifamily units. In arriving at this average rate, we have estimated that hotels would operate at slightly higher occupancy rates, and multifamily units would operate at somewhat lower rates. Multifamily unit buyers tolerate lower than economic occupancy rates since many of the purchases are influenced by tax-benefit considerations.

#### 4. Room Rates

Room rates will be a function of competition, the image and the relative attraction of the project, locational features, and type and quality of facilities developed.

Earlier discussion of the transient accommodations market in the Kohala Coast Resort Region indicated that the preponderance of the inventory was characterized as luxury or super-luxury. The Sheraton Royal Waikoloa Hotel is characterized as a luxury project compared to the super-luxury Mauna Kea

Beach Hotel and the Mauna Lani Bay Hotel. Due to the geographic positioning of the proposed Hapuna Beach Resort, we anticipate that its quality would be at least that of a luxury resort and probably be closer in quality to its neighbor, the Mauna Kea Resort.

Table VI-1 on Page 34 had shown that almost all of the rooms in North and South Kohala have published daily room rates of \$150 or more for double occupancy, superior rooms. The \$150 to \$199 category is used here to indicate the luxury category, and includes the 543 rooms in the Sheraton Royal Waikoloa Hotel. The \$200+ category indicates the super-luxury category, and includes 310 rooms in the Mauna Kea Beach Hotel and 351 rooms in the Mauna Lani Bay Hotel. Although not geographically located in the North or South Kohala Districts, the Kona Village Resort which is adjacent to the subject proposed project also achieves average room rates in \$200+ category.

With the predominant share of rooms in the luxury and super-luxury categories, much of the product marketing will be directed toward similar market segments. With the aggregate promotional effort directed at a relatively narrow market segment, we believe that basic demand for luxury and super-luxury product will be expanded. Until recently, we estimate that tens of thousands of dollars had been spent annually to advertise the area through the efforts of one hotel. During the last few years, millions of dollars have been spent by the resorts and hotels. We estimate that millions of dollars soon will be expended annually to promote the Kohala Coast Resort Region. This concentration of promotional programs and marketing effort will likely modify the historical patterns of tourism activity on the Big Island. In the future, we anticipate that a larger segment of the Big Island's market will consist of the luxury and super-luxury components, largely destined to the Kohala Coast. This shift in market characteristics began with the completion of the Sheraton Royal Waikoloa Hotel and has been accentuated by each major development since.

Thus, it is likely that a disproportionate share of the future market potential would be the luxury and super-luxury components.

Given the marketing and operating goals of Princess Hotels, we envision that the resort hotel developed at the subject Kaupulehu site would be in the super-luxury category and achieve room rates in the \$200+ category.

#### VII. MARKET ANALYSIS FOR RESORT MULTIFAMILY UNITS

##### A. Market Indicators

Resort multifamily units serve a number of purposes and are purchased for a number of motives. They may be used by the owner as a primary residence, used on a short-term basis as transient accommodations, rented on a long-term basis to year-round residents, or used occasionally as a second or vacation home by owners and their guests. These possible uses in turn, are influenced among other things by such factors as the location of the project, the character of its surroundings, and how the project is promoted and sold.

It is likely that resort multifamily units could be made available for short-term rental purposes. Since there is a general lack of housing in the Kohala Coast compared to the relatively rapid rate of economic activity, some of the units would likely be utilized by full-time residents, too.

In general, the composite of these typical uses are reflected in historical multifamily unit sales data. However, this particular analysis is complicated by the lack of historical data in the immediate market area. Multifamily projects developed outside the existing coastal resorts are not directly comparable to properties within the resorts.

The experience of resort multifamily unit sales in Kona is not directly comparable either, due to the different characteristics of the Kona resort district. For example, Kona does not possess white sand beaches or extensive golfing activities, and in general has more passive visitor activities than does the Kohala Coast.

Resort projects on Maui appear to be somewhat more comparable in terms of beaches, climate and recreational amenities. On the other hand, even though there are three master-planned resorts on Maui and one more under construction, they are not located essentially adjacent to each other so that the planning, development, character, and aesthetics of the entire resort region can be controlled, as on the Kohala Coast.

Despite these differences, the limited data in the Kohala Coast Resort Region and the sales experiences in Kona and on Maui provide indicators that have aided us in formulating our conclusions.

1. Kohala Sales Activity

(a) Mauna Lani Terrace

This fee simple project fronting an old Hawaiian fishpond and a newly created lagoon, consists of 80-units on a 13.3-acre site, resulting in an average development density of 6 units per acre.

Prices at Mauna Lani Terrace were from \$275,000 to \$345,000 for the 18 one-bedroom units, \$355,000 to \$555,000 for the 54 two-bedroom units and \$705,000 to \$895,000 for the 8 three-bedroom units. The average unit price initially was about \$450,000.

Sales began in August 1982 and construction was completed in 1983. By July 1985 almost all had been sold. Two resales have occurred, at prices slightly higher than their original prices.

A buyer analysis indicated that most of the purchasers were California residents. About 80 to 85 percent of the buyers had visited Kohala before and were familiar with the area, suggesting that many had been guests at the Mauna Kea Beach Hotel.

(b) The Villas at Mauna Kea

The Villas at Mauna Kea consists of a 40-unit leasehold one-story project on a 29.9-acre site surrounded by fairways of the Mauna Kea Beach Golf Course and overlooking the Mauna Kea Beach Hotel. Its development density is 1.3 units per acre. Sales of 23 units in the first increment began in early 1983, and by the end of the year, all had been sold. By July 1985 about half of the units in the second increment had sold. Prices of the two-bedroom units ranged from \$800,000 to \$1,250,000 and the four-bedroom unit in the first increment was priced at \$1,225,000. The average price in increment 1 was about \$975,000. Prices ranged from \$850,000 for a two-bedroom unit in increment 2 to \$1,450,000 for a four-bedroom unit. The average price in increment 2 was \$1,050,000.

(c) The Shores at Waikoloa Beach Resort

Sales of the first 66-unit increment of the 114-unit The Shores at Waikoloa Beach Resort began in January 1984. By July 1985 over half of the initial increment had been reported sold or reserved.

The project will occupy an 11.4-acre fairway site and be located near the golf clubhouse.

Prices range from \$175,000 for a one-bedroom unit to \$560,000 for three-bedroom duplex units. The average price of units in the first increment is about \$310,000.

(d) Mauna Lani Point

Sales and construction have begun on 55 units in the first increment of this 198-unit super-luxury condominium apartment developed on a site which surrounds Fairway 5 of the Francis H. I'i Brown Golf Course. Its quality is to be similar to that of Mauna Lani Terrace. Prices for the 17 one-bedroom units range from \$360,000 to \$480,000, for the 35 two-bedroom units from \$530,000 to \$640,000 and for the 3 three-bedroom units from \$790,000 to \$890,000, all fee simple. The average unit price for the first 55 units is \$545,000.

By July 1985, eight units had been sold.

(e) The Estates at Mauna Kea

This very high-quality, low-density, one-story leasehold project, currently in the design stage, is proposed for development within the Mauna Kea Resort. Planned are 4 detached and 22 duplex units on a site containing 51.6 acres. Selling prices are expected to be higher than prices for the Villas.

In addition to these projects, preliminary plans have been announced for two retirement home projects in Waikoloa Village.

Resort homes usually develop in proximity to hotels, as return visitors often choose to retire in the locale or to at least acquire property for



Table VII-1  
PERCENT OF MULTIFAMILY UNITS  
IN TOTAL VISITOR PLANT INVENTORY  
OF SELECTED RESORT REGIONS  
State of Hawaii  
1970-1985

	West Maui	Kihei-Makena	Kona	North and South Kohala
1970	21%	47%	1%	0%
1975	42	75	9	5
1980	48	62	15	11
1985	51	80	42	8

SOURCE: Hawaii Visitors Bureau, Visitor Plant Inventory  
(February of indicated years); Ming Chew Associates

Table VII-2  
PERCENT OF MULTIFAMILY UNITS  
IN TRANSIENT USE  
OF SELECTED RESORT REGIONS  
State of Hawaii  
1970-1985

	West Maui	Kihei-Makena	Kona	North and South Kohala
1970	50%	98%	28%	0%
1975	64	47	26	18
1980	52	44	21	21
1985	62	59	53	32

SOURCE: Hawaii Visitors Bureau, Visitor Plant Inventory (February  
of indicated years); Ming Chew Associates

their own use. Because of their ease of maintenance and relative security, multifamily units have become a very popular means of responding to this type of demand. Although the Mauna Kea Beach Hotel has operated since 1965, no luxury units had been offered for sale in the Kohala Coast Resort Region until 1982.

Thus, pent-up demand existed in the region. In fact, it is our opinion that Mauna Lani Terrace and the Villas at Mauna Kea were absorbed mainly by pent-up demand generated by the multiple return guests of the Mauna Kea Beach Hotel.

2. Multifamily Unit Activity  
in Other Resort Regions

Due to the limited availability of multifamily unit activity in the Kohala Coast Resort Region, market activities and conditions in other resort regions were studied in order to aid in estimating the Kohala Coast market potential. The three other regions investigated were Kona, West Maui (Lahaina to Kapalua) and Kihei-Makena (Maalaea, Kihei, Wailea and Makena).

First, the visitor plant inventory (that is, the inventory of accommodations available to visitors for transient use) in North and South Kohala and the other three resort regions was delineated into hotel units and multifamily units. The results, presented in Table VII-1, show that the proportion of multifamily units in the inventory of transient accommodations has increased steadily in West Maui and Kona. By 1985, this proportion appeared to be approaching 50 percent as an equilibrium level. On the other hand, the proportion of multifamily units in Kihei-Makena was relatively higher in 1970, and appears to be reaching an equilibrium level higher than in Kona or West Maui.

North and South Kohala are just beginning to include multifamily units as a significant part of their inventory of transient accommodations.

Table VII-2 shows the trends in the proportion of multifamily units in each resort region available for transient accommodations. This proportion has generally ranged between 50 and 60 percent in West Maui. In Kihei-Makena, the proportion has dropped to between 40 and 50 percent, before increasing to

59 percent in 1985. The proportion of multifamily units in Kona used for transient accommodations has vacillated, but since 1980, has trended upward and appears to be leveling at about 50 percent. In Kohala, the share of multifamily units in transient use has increased, continually, and by 1985 was 32 percent.

B. Projected Demand for Resort Multifamily Units in North and South Kohala

The proportion of multifamily units in the visitor plant inventory and the proportion of total multifamily units used as transient accommodations were projected for North and South Kohala based upon the preceding analyses. These projections were then applied to the projections of total transient accommodations made earlier.

Our analysis indicated that the share of multifamily units trended toward 50 percent for both Kona and West Maui, and we estimated that the visitor plant mix in Kohala would approach about the same level.

However in 1985, the proportion in Kohala was only eight percent on the basis of total transient accommodations and 10 percent on the basis of estimated transient units actually needed. We project that the share of multi-family units would increase gradually to 20 percent in 1990, 30 percent in 1995 and 40 percent in 2000. These factors were applied to projected total demand for transient accommodations to delineate the demand for hotel units and multifamily units.

We project that the proportion of multifamily units used as transient accommodations would increase to about 50 percent in 1985, and remain at that level to 2000. That is, we estimate that beginning in 1985, the number of multifamily units projected to be needed for transient accommodations would be about half of the total multifamily units. Thus, the total projected number of multifamily units would be two times the number needed for transient accommodations. These results are shown in Table VII-3.

The table also shows the projected net demand in excess of the actual February 1985 inventory. As seen, we estimate that by the end of 1985, there would be an unmet demand for transient accommodations relative to the February 1985 supply of 300 units. We have delineated this to a demand for 200 hotel and 100 multifamily

Table VII-3 FORECAST OF MULTIFAMILY UNIT DEMAND NORTH AND SOUTH KOHALA County of Hawaii 1985-2000

Gross Demand Forecast	Delineation of Projected Transient Accommodations Demand				Projected Total MF(1)	
	Total Trans. Units	Hotel Units	% Hotel	MF Units	% MF in Trans. Use	Projected Total Units
1985	1,700	90	1,500	10	200	400
1990	4,500	80	3,600	20	900	1,800
1995	6,300	70	4,400	30	1,900	3,800
2000	8,000	60	4,800	40	3,200	6,400
Actual Units in 1985(2)	1,400		1,300		100	400
Net Demand Forecast(3)						
1985	300		200		100	0
1990	3,100		2,300		800	1,400
1995	4,900		3,100		1,800	3,400
2000	6,600		3,500		3,100	6,000

(1) Multifamily  
 (2) February 1985, rounded.  
 (3) Gross demand forecast, less actual units in February 1985.

SOURCE: Ming Chew Associates

Table VII-4  
**FORECAST OF HOTEL AND MULTIFAMILY UNIT DEMAND  
 PROPOSED PROJECT AT KAUPULEHU**  
 Kohala Coast Resort Region  
 County of Hawaii, State of Hawaii  
 1990-2000

Net Increase From 1985(1)	Projected Transient Accommodations Demand		MP Units For Other Uses	Total MF Units For Trans. Accom. and Other Uses
	Hotel Units	MP Units		
1990	300-700	200-100	100	200
1995	600-1,100	400-300	200-300	400-600
2000	800-1,500	500-300	300-600	600-1,200

units. Thereafter, projected net new demand for both types of transient accommodations would continue to increase.

C. Projected Demand for Multifamily Apartment Units in Proposed Project at Kaupulehu

1. Number of Units

Earlier, we estimated that the proposed project at Kaupulehu should capture 10 to 20 percent of the potential demand for transient accommodations in North and South Kohala. We estimate also that this factor would be applicable for both hotel and multifamily unit demand. In addition, we estimated that about five percent of the demand projected for Kona could also be captured.

Applying these capture rates to the North and South Kohala demand projections and adding in the increment from Kona produces the results shown in Table VII-4.

2. Price of Units

Our projections of achievable prices for resort multifamily units in the proposed project at Kaupulehu have been based largely on the prices achieved for properties in the three existing resorts. Table VII-5 shows selected characteristics of these projects.

In general, the properties in the Mauna Kea Resort are the lowest in height and density, smallest in number, largest in area and even though they are leasehold projects, are by far the highest in price. We believe that the very high prices have been achieved as a result of the very exclusive image Mauna Kea Resort has developed during its many years of operations.

Mauna Lani Terrace is a relatively low density fee simple project which fronts a lagoon and old Hawaiian fishpond. It contains eighty units, and has an average density of 6.0 units per acre. The project contains 1-, 2-, and 3-bedroom units with an overall average unit size of 1,800 square feet, including lanais. The overall average selling price was about \$450,000. Mauna Lani Point has roughly similar characteristics, with 55 units in the first increment selling for an average price of \$550,000.

(1) February 1985.  
 (2) Estimated to be 10 to 20 percent of North and South Kohala transient accommodations demand plus five percent of Kona demand, rounded.

SOURCE: Ming Chew Associates -59-

Table VII-5

SELECTED RESORT MULTIFAMILY  
PROJECT CHARACTERISTICS  
Kohala Coast Resort Region  
County of Hawaii, State of Hawaii

Project	Frontage	Height	Density un./ac.	Number of Units	Average Size Sq.Ft.(1)	Average Price
<u>Mauna Kea Resort</u>						
The Villas	Golf Fairway 1-Story		1.3	40	4,000	\$1,000,000(LH)
The Estates(2)	Golf Fairway 1-Story		0.5	26	4,700	\$1,500,000(LH)
<u>Mauna Lani Resort</u>						
Mauna Lani Terrace	Lagoon 3-Story		6.0	80	1,800	\$450,000
Mauna Lani Point	Golf Fairway 2-, 3-Story		6.0	198	1,800(3)	\$550,000(3)
<u>Waikoloa Beach Resort</u>						
The Shores	Golf Fairway 3-Story		10.0	114	2,000(3)	\$310,000(3)

- (LH) - Leasehold  
(1) Includes lanai and deck areas.  
(2) Preliminary data.  
(3) Increment 1.

SOURCE: Ming Chew Associates

The Shores at Waikoloa Beach Resort occupies a fairway site and will contain 114 1-, 2-, and 3-bedroom units and have an average density of 10.0 units per acre. The overall average size of the units will be about 2,000 square feet and the average price for units in the first increment is about \$310,000.

Purchasers of resort properties usually have visited the locale of their purchase a number of times before actually buying. Thus, many prospective buyers at Kaupulehu may have to be attracted initially by the proposed hotel, and then desire to return to the project as a result of their prior favorable experiences. Alternatively, prospective buyers who may have been attracted to the Kohala Coast Resort Region by other facilities or for other reasons, would have to be attracted to the subject resort or to a specific project due to its perceived favorable comparison with the other alternatives available.

A proposed major attraction of the Kaupulehu project is a distinctively attractive hotel operated by a similarly distinguished hotelier such as Princess Hotels International. As indicated earlier, Princess sets as its marketing and operating goal to be recognized as having the best facilities and operations, as well as the highest room rate and highest occupancy in its locale. In the Kohala Coast Resort Region, Princess must achieve these goals in competition with the existing super-luxury hotels, Mauna Kea Beach Hotel and the Mauna Lani Bay Hotel. It would also be competing with the proposed Hyatt Regency Waikoloa super-resort which is scheduled to begin construction very soon. Notwithstanding the potential competition, the formidable performance record of Princess Hotels indicates that its prospects for achieving its goal are reasonable.

Although we envision that the proposed resort at Kaupulehu could be competitive with Mauna Kea and Mauna Lani Resorts, the market position of Mauna Kea is securely established as a very exclusive resort. Further, we estimate that an attraction such as a properly developed Princess Hotel with its traditional wide range of features and amenities plus a golf course for exclusive use,

Table VII-6

FORECAST OF MULTIFAMILY DEMAND  
RESORT AT KAUPULEHU  
Kohala Coast Resort Region  
County of Hawaii, State of Hawaii  
1990-2000

	1990		
	Higher-Quality	Mid-Quality	Lower-Quality
Net Unit Demand (1)	50	100	50
Average Unit Price (2), 1985 \$	\$425,000-	\$325,000-	\$250,000-
	475,000	375,000	300,000
Average Unit Size, Sq. Ft.	2,200	1,800	1,400
Average Density, Units/Acre	4	5	6

	1995		
	Higher-Quality	Mid-Quality	Lower-Quality
Net Unit Demand (1)	100-150	200-300	100-150
Average Unit Price, 1985 \$	\$425,000-	\$325,000-	\$250,000-
	475,000	375,000	300,000
Average Unit Size, Sq. Ft.	2,200	1,800	1,400
Average Density, Units/Acre	4	5	6

	2000		
	Higher-Quality	Mid-Quality	Lower-Quality
Net Unit Demand (1)	150-300	300-600	150-300
Average Unit Price, 1985 \$	\$425,000-	\$325,000-	\$250,000-
	475,000	375,000	300,000
Average Unit Size, Sq. Ft.	2,200	1,800	1,400
Average Density, Units/Acre	4	5	6

(1) In Excess of February 1985 Actual Supply.  
(2) Leasehold Price.

SOURCE: Ming Chew Associates

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could position the proposed resort at a market level higher than Waikoloa Beach Resort and about at the level of Mauna Lani Resort.

In addition, because of the different features of the proposed multifamily project sites, particularly their relationships to the oceanfront and proposed beach facilities, we have delineated our demand estimates into three categories: higher-quality, mid-quality and lower-quality. For purposes of our analysis, and as an example, we would categorize the Mauna Lani Terrace as a mid-quality project in the context of the luxury and super-luxury image envisioned for the whole Kohala Coast Resort Region. Smaller units with slightly higher densities would be considered low-quality, particularly those located some distance from the oceanfront.

Larger, beach-frontage units would be considered higher-quality.

Since the Kaupulehu project would be on lease land, we have made a downward adjustment of about 25 percent from projected fee simple prices.

Table VII-6 shows our forecast of multifamily demand for the proposed resort at Kaupulehu delineated by relative quality, as well as estimated market prices and selected characteristics. The prices are in terms of 1985 dollars.

VIII. MARKET ANALYSIS FOR RESORT SUBDIVISION HOUSELOTS

Resort subdivision houselots are part of the variety of choices available to potential buyers seeking to purchase resort properties. Just as with resort multifamily properties, resort houselots respond to the market demands both for vacation homes and investment properties, and for permanent residences. Moreover houselots may be improved with houses shortly after purchase, or they may be held for many years before being improved.

Historically, a relatively small portion of resort property buyers choose a houselot or pre-constructed house and lot and we forecast that an increment of this demand would exist at Kaupulehu. There may already be pent-up demand resulting from exposure of the property to prior guests at Kona Village Resort. However, most would likely be generated by attractions created within the resort, mainly the proposed hotel.

Although present development plans for the resort do not include houselot subdivisions, the option for doing so should not be precluded since it could offer additional product variety and marketing flexibility.

IX. MARKET ANALYSIS FOR GOLF COURSE

The capacity of a golf course is determined by numerous factors, including design layout and how course operations are managed. The latter item may be based upon the desired image of character of the course. This, in turn is a function of player comfort and pace of play, the course condition and the quality of maintenance without interfering with the enjoyment of play and, how the course relates to associated activities. The character of a course is exemplified by the Francis H. I'i Brown Golf Course in the Mauna Lani Resort and the Mauna Kea Golf Course in the Mauna Kea Resort. These courses are well-maintained and operated to enhance the exclusive, leisurely and luxurious ambience of the respective resorts. In contrast, the character of the municipal Ala Wai Golf Course near Waikiki is one of accommodating as many golfers as possible, as a type of public service.

In many respects, it is the character of a golf course that determines its capacity.

Also, resort golf course activity in Hawaii exhibits monthly variations which reflect the seasonal patterns of golfing visitors who arrive mostly during winter months when adverse weather conditions prevent them from playing at home. Variations also occur for different days during the week, caused by local residents playing mostly on weekends due to weekday work schedules. Thus golf course capacity must be considered in the light of weekend and peak season activity.

There are three resort championship golf courses in the Kohala Coast Resort Region. The Mauna Kea Golf Course opened in conjunction with the Mauna Kea Beach Hotel in 1965. Then in 1981, both the Waikoloa Beach Resort Golf Course and the Francis H. I'i Brown Golf Course in the Mauna Lani Resort began operations. The start of play at the Waikoloa course coincided with the opening of the Sheraton Royal Waikoloa. On the other hand, play at Mauna Lani preceded by two years, the opening of the Mauna Lani Bay Hotel.

Since the Sheraton Royal Waikoloa and Mauna Lani Bay Hotels have operated for only a few years, it is difficult to draw definitive relationships between their resort activities and demand for golf rounds. It has been possible, however, to identify such relationships from the more extensive experience of the Mauna Kea Golf Course.

A. Mauna Kea Golf Course

Table IX-1 shows the annual number of rounds played on the Mauna Kea Golf Course from 1978 through 1984. As seen, the number of rounds declined steadily from 1978 through 1982, before rebounding slightly in 1983. Prior to 1978, we understand that activity had been relatively steady at slightly over 51,000 rounds per year.

Interestingly, the decline in annual rounds followed almost exactly the decline in the number of westbound visitors intending to visit the Island of Hawaii, except for 1980 and 1981. During these two years, the decline in westbound intended visitors was greater. This suggests that the pattern of play and possibly activity at the hotel were more stable than the county-wide visitor industry in general in 1980 and 1981. Although the number of westbound visitors intending to visit the Island began increasing in 1982, play at Mauna Kea continued declining. This was due to completion in 1981 of the golf courses at both Waikoloa Beach Resort and Mauna Lani Resort. In 1983, both the number of rounds of golf at Mauna Kea and the number of westbound intended visitors increased.

Even though more play was experienced prior to the opening of other resort golf courses on the Kohala Coast in 1981, representatives of Mauna Kea have indicated that for the image and character desired of the golf course, the number of annual golf rounds should not exceed 45,000. If play at Mauna Kea continues to follow the pattern of westbound intended Island visitors, which we believe it will, the course should be at its maximum desired level of play by about the end of 1985.

Once the Mauna Kea Golf Course reaches its maximum desired level of play again, we anticipate that operating policies of the course may change to restrict the number of rounds so that use of the course would be more comfortable and enjoyable for owners and guests at the Mauna Kea Resort.

Assuming that Mauna Kea activity will soon increase to its desired maximum level of 45,000 per year, and generally stabilize at about that level, it would amount to 145 annual golf rounds per room at the Mauna Kea Beach Hotel. Due to the golf course reputation developed over a number of years, many guests are at the Mauna Kea Resort largely for golf. Therefore, we believe that the ratio of golf rounds per room at the Resort is unusually high.

Table IX-1  
MAUNA KEA GOLF COURSE ACTIVITY  
MAUNA KEA RESORT  
Kohala Coast Resort Region  
County of Hawaii, State of Hawaii  
1978 - 1984

Year	Annual Number of Rounds	Annual Rounds Per Room(1)	Average Daily Rounds
1978	51,100	165	140
1979	47,600	154	130
1980	47,500	153	130
1981	43,700	141	120
1982	38,800	125	106
1983	39,700	128	109
1984	40,300	130	110

(1) At the Mauna Kea Beach Hotel

SOURCE: Mauna Kea Beach Hotel; Ming Chew Associates

B. Forecast of Resort Golf Demand at Kaupulehu

Discussions with a representative of Princess Hotels International indicates that each of its resorts either has an integral golf course, or is near a course that can be used by its guests. Moreover, golf is considered a major element in its package of attractions.

Since it appears that golf is likely to be promoted, demand may be relatively comparable to that experienced at Mauna Kea. Whereas demand at Mauna Kea is projected to be 145 annual golf rounds per hotel room, we estimate that demand at Kaupulehu would be about 15 percent less, or about 125 annual rounds per hotel room.

Thus, projected hotel demand would generate golf demands of about 25,000 to 75,000 annual rounds in 1990, 50,000 to 100,000 in 1995 and 62,000 to 112,000 annual rounds in 2000.

Multifamily and other residential units would also generate golf activity, but probably not as much as hotels. Assuming golf activity generated by non-hotel units to be about one-fourth of that generated by hotel units in the type of resort envisioned, additional demands would be generated for 6,000 annual rounds in 1990, 12,000 to 19,000 in 1995 and 19,000 to 38,000 rounds in 2000.

Combined, the total projected golf demand at Kaupulehu would be 31,000 to 81,000 annual golf rounds in 1990, 62,000 to 119,000 in 1995 and 81,000 to 150,000 annual rounds in 2000.

So that the golf courses at Kaupulehu reflect the very high quality envisioned for the entire proposed resort, we estimate that play would be limited to about 45,000 rounds per year for each course.

This standard results in a demand for 0.7 to 1.8 courses in 1990, 1.4 to 2.6 courses in 1995 and 1.8 to 3.3 courses in 2000.

Thus, it appears that a course should be available when the first hotel rooms are opened by 1990, and a second course should be at least under construction by then. At least two courses should be available by 1995 with a third course underway. The third course would likely be needed by 2000, with even a fourth under development.

These demand estimates are confirmed by the experience of Princess Hotels in Acapulco. Reportedly, for 1,400 hotel rooms and villas, three 18-hole golf courses are insufficient.

Current planning should include provisions to effectively link future golf courses to avoid extensive site revisions when subsequent courses are constructed.



## PROFESSIONAL QUALIFICATIONS OF J. MING CHEW

### BUSINESS BACKGROUND

Principal, Ming Chew Associates, Honolulu, Hawaii  
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 Senior Economic Consultant, Real Estate Research Corporation, San Francisco, California  
 Economic and Project Analyst, Humble Oil and Refining Company, Baytown, Texas

### EDUCATION

M.B.A. (Economics and Finance) 1947 Stanford University  
 B.S. (Chemical Engineering) 1937 Georgia Institute of Technology

### PROFESSIONAL MEMBERSHIPS

American Real Estate and Urban Economics Association  
 Pacific Area Travel Association  
 Member, Past-Chairman, Hawaii Visitors Bureau (HVB) Research Committee, Honolulu, Hawaii  
 Member, HVB Long-Range Planning Committee, Honolulu, Hawaii  
 Member, Council on Research, State of Hawaii  
 Member, Editorial Board, Tourism Research Publications, University of Hawaii at Manoa  
 Former Member, Pacific Area Travel Association (PATA) Research Authority, San Francisco, California  
 Past President, Hawaii Society of Corporate Planners  
 Former Member, Technical Advisory Committee to the Honolulu City Council Planning and Zoning Committee  
 Former Consultant, Environmental Quality Commission, State of Hawaii

### TYPICAL CLIENTS

<p><b>Financial Institutions</b>                  First National Bank of Chicago                  Pioneer Federal Savings &amp; Loan Association                  Standard Finance Company, Ltd.</p> <p><b>Lenders and Investment Groups</b>                  Morgan Stanley &amp; Co., Inc.                  Salomon Brothers                  Waialua Heights Associates</p> <p><b>Government Agencies</b>                  U.S. Department of Commerce                  (Economic Development Administration)                  U.S. Fish and Wildlife Service                  U.S. Department of Transportation                  (Urban Mass Transportation Administration)                  State of Hawaii Department of Planning                  and Economic Development                  City and County of Ohio, Department of                  Transportation Services                  County of Hawaii                  Hawaii Public Housing Agency                  Maui Redevelopment Agency                  City of Chicago, Board of Education</p> <p><b>Individuals and Estates</b>                  Kanehimeha Schools/Bernice P. Bishop Estate                  The Estate of James Campbell                  Arthur Summerfield, Jr.                  Mortgage Bankers/Brokers                  Brooks, Harvey &amp; Co., Inc.                  G.L. Thole Company, Ltd.</p>	<p><b>Builders and Developers</b>                  American Terra Corporation                  Aulic Financial Corporation                  Auto Development Corporation                  Estate of Waikele                  Cooke Land Company, Inc.                  Dillingham Land Corporation                  City Development Co.                  DWA Investment Co.                  Grove Farm Company, Ltd.                  Halekahi Ranch Co.                  Hawaii Island International, Ltd.                  Hawaiian Land Company                  Herbert K. Horita                  Home Properties, Inc.                  Sheridan C.F. Inc.                  George Basco                  Kalahele Investment Corporation                  Kapelua Land Company, Inc.                  Lokahi Pacific                  Kulehua Properties, Inc.                  Maui 100 Partners                  Maui Land and Pineapple Company, Inc.                  Mauna Kea Properties, Inc.                  Mauna Kea Resort, Inc.                  Oloheia Hawaii Corporation                  Panhau Development, Inc.                  Prudential Life Insurance Company of America                  Bruce C. Stark                  Transcontinental Corporation                  Wailea Land Corporation                  John Michael White</p>
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<p><b>Industrial Firms</b>                  Dillingham Corporation                  Lone Star Hawaii, Inc.</p> <p><b>Other Clients</b>                  Ansoni &amp; Associates                  Architects Hawaii                  Ashford &amp; Winslow                  Belt, Collins and Associates                  Chun, Kerr &amp; Dodd                  Damon, Kry, Chur &amp; Booklen                  Duty Free Shoppers Limited                  ED&amp;W, Inc.                  Ezra, O'Connor, Moss &amp; Larkin                  Kobayashi, Watanabe, Sugita &amp; Kawashima                  Kuhlinski Hospital                  Walker Lums Associates                  People for Sustainable Growth                  Real Estate Research Corporation                  Charles R. Sutton and Associates, Inc.                  Donald Wolbrink &amp; Associates, Inc.                  Wendel Smith &amp; Hoods                  Wong &amp; Wong Associates, Inc.</p>	<p><b>Office</b>                  Market, Marketability and Financial Analysis                  Downtown Honolulu and Non-Downtown                  Honolulu Office Buildings                  Marketability and Financial Analysis                  Honolulu Condominium Office Building                  Market Analysis                  Proposed Lihue Office Building</p> <p><b>Retail</b>                  Development Strategy Analysis                  Ala Moana Commercial Properties                  Kawa Retail Market Analysis                  Maui, Hawaii                  Leleia Retail Market Analysis                  Maui, Hawaii                  Market and Financial Analysis                  Waialua Retail and Office Project</p> <p><b>Industrial</b>                  Industrial Market Analysis                  Oahu, Hawaii                  Industrial Diversification Potential                  Konohe, Wisconsin                  Manufacturing Plant Location Analysis                  Los Angeles Area, California                  Mini-Warehouse Market Analysis                  Houston, Texas</p> <p><b>Other Studies</b>                  Real Estate Strategy Study                  Dillingham Corporation                  Analysis of Household Income Growth                  Honolulu, Hawaii                  Analysis of Interest Rate Effects on Ranch Land Marketability                  Houston, Texas                  Economic and Social Impact Analysis                  Downtown Denver Peripheral Parking System                  Center City Transportation Project                  (U.S. Department of Transportation)                  Forecast of Intra-City Demographic Patterns                  for School Facilities Planning                  City of Chicago, Department of Education                  Analysis of Fuel Shortage Impact on the Hawaii                  Tourist Industry                  Market and Feasibility Analysis                  Proposed Hawaii World Trade Center                  Aloha Tower Complex, Honolulu, Hawaii                  Senior Area Impact Analysis                  Honolulu Area Rapid Transit                  Analysis of Real Estate Market Opportunities                  Island of Maui, Hawaii                  Analysis of Proposed Development Plans                  Oahu, Hawaii</p> <p><b>Expert Witness</b>                  Various State Land Use Commission Petitions                  Various General Plan, Zoning and                  Special Management Area Permit Hearings                  US Bankruptcy Court</p>
<p><b>SELECTED STUDIES CONDUCTED</b>                  Economic and Community Analyses                  Economic Demographic and Selected Land Use Forecasts                  Maui Community Development Plans                  Economic Projections Element                  State Tourism Study                  Economic and Market Analysis                  Hill Community Development and Downtown Plans                  Market Analysis of Transient Accommodations                  Development Plan for North and South Kona                  Economic and Market Analysis                  Proposed Title VII New Community                  New Orleans, Louisiana and Atlanta, Georgia                  Residential                  Market and Marketability Analysis                  Various Condominium and Residential Projects                  Hawaii, Maui, Oahu                  Housing Market Development Strategy Study                  Oahu, Hawaii                  Comparative Analysis                  Selected Hawaii Kā and Waialua Condominiums                  Housing Demand Analysis                  Kula Redevelopment Area                  Housing Master Plan for Kula                  Kula, Hawaii                  Housing and Household Prior Analysis                  Oahu, Hawaii                  Resort and Recreation                  Economic, Market and Marketability Analysis                  Kapelua, Kulehua, Mahukona, Mauna Lani, Princeville,                  Waikoloa and Waialea Resort Communities                  Buyer Characteristics and Attitudes                  Maui Resort Property Owners Survey                  Market Analysis                  Proposed Cultural Park Project, Honolulu, Hawaii                  Visitor Potential Analysis                  Proposed Beijing Hotel, People's Republic of China                  Hotel Market Analysis                  Hong Kong USA Project, Oakland, California</p>	<p><b>Industrial Firms</b>                  Dillingham Corporation                  Lone Star Hawaii, Inc.</p> <p><b>Other Clients</b>                  Ansoni &amp; Associates                  Architects Hawaii                  Ashford &amp; Winslow                  Belt, Collins and Associates                  Chun, Kerr &amp; Dodd                  Damon, Kry, Chur &amp; Booklen                  Duty Free Shoppers Limited                  ED&amp;W, Inc.                  Ezra, O'Connor, Moss &amp; Larkin                  Kobayashi, Watanabe, Sugita &amp; Kawashima                  Kuhlinski Hospital                  Walker Lums Associates                  People for Sustainable Growth                  Real Estate Research Corporation                  Charles R. Sutton and Associates, Inc.                  Donald Wolbrink &amp; Associates, Inc.                  Wendel Smith &amp; Hoods                  Wong &amp; Wong Associates, Inc.</p>

## Ming Chew Associates

Consulting Real Estate Economists

**Specializing in research, analysis and counseling to identify Hawaii and Pacific Area real estate opportunities.**

### Professional Services:

#### REGIONAL ECONOMIC ANALYSIS

Determination of economic, labor and demographic forces creating demands for real estate and land uses.

#### TOURISM RESEARCH AND ANALYSIS

Evaluation of economic development and employment potential of tourism, resort and recreation supply and demand analysis, competitive market strategies and tourism impact analysis.

#### REAL ESTATE MARKET AND FEASIBILITY ANALYSIS

Measurement of real estate supply and demand factors for primary and recreational housing, retail, office and industrial markets.

#### REAL ESTATE STRATEGIES

Identification of ways to profit from real estate market opportunities and means to minimize risks.

#### LAND USE POLICY

Formulation of alternatives supported by economic and market conditions to accomplish public policy goals and objectives regarding land use.

#### ECONOMIC AND COMMUNITY IMPACT ANALYSIS

Estimation of land use demands and community impacts of projects for governmental permit processing.

#### DEVELOPMENT AND INVESTMENT COUNSELING

Interpretation of highest and best use, including selection of synergistic land and space uses and optimum timing.

#### EXPERT TESTIMONY

Qualified expert witness on regional economic issues, real estate markets and marketability, and community and land use impacts.

#### REAL ESTATE INVESTMENT PORTFOLIO ANALYSIS

Selection of investment projects, and respective mix and timing decisions.

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ANCHIALINE POND SURVEY  
KAUPULEHU, NORTH KONA, HAWAII

FINAL REPORT

Prepared for:

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Prepared by:

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March, 1986

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#### Summary

Eight ponds were identified and examined in an aerial and ground survey of the Kaupulehu Resort Development site, North Kona, Hawaii. Three of the ponds are considered to be typically anchialine in nature, one pond is almost completely filled with leaf litter, one pond is wet only at high tide, and the other three ponds and surrounding areas may be more properly considered wetlands, being typified by complete coverage by dense growths of sedges and grasses.

The flora and fauna of the three typically anchialine ponds (5, 1, 2) includes aquatic flora, encrusting blue-green algae, brackish water snails and shrimp. No evidence of negative impacts due to human activity were seen. The wetland areas were covered by common species of sedges and grasses. No waterfowl were observed in the area during the survey.

The concept master plan for the resort development designates an open space area which will encompass most of the pond and wetland areas. Two of the typically anchialine ponds are located in an area designated for a golf course; the other ponds are located in or near an area designated for open space. Direct impacts on the ponds due to construction of the resort development are expected to be negligible under the present concept plan, since none of the ponds are expected to be filled. Secondary impacts are also expected to be minimal.

D-2

#### Introduction

Kaupulehu Developments proposes to develop a resort adjacent to the existing Kona Village as a self-contained intermediate resort/residential community (Figure 1). This development is to be done in conformance with the Hawaii County General Plan Intermediate Resort designation for the area while adhering to environmentally sensitive design standards.

Several studies (Maciolek and Brock, 1974; OI Consultants, 1985) of the anchialine pond resources of the island of Hawaii have indicated that anchialine ponds are present within the Kaupulehu project boundaries. Anchialine ponds are a relatively unique ecosystem found for the most part only on the Kona coast of the island of Hawaii. Recent impacts due to resort development on the pond resource have increased the level of concern for these ponds on the part of both the public and government agencies. Given this level of concern for a relatively unique and potentially threatened ecosystem, OI Consultants, Inc. was contracted by Kaupulehu Developments to conduct an inventory of the anchialine ponds within the boundaries of the proposed development, to discuss the significance of the Kaupulehu ponds within the context of the Kona coast pond resource, to discuss the impacts of the proposed development on the ponds and to suggest mitigation measures the developer might consider.

#### Methods

A survey of the anchialine ponds located within the proposed Kaupulehu development was undertaken on February 19, 1986. A helicopter overflight at low altitude was made on the morning of the 19th. At this time, ponds and possible ponds were identified and located on a working map of the area. Ponds located from the air were then visited on foot. Tides during daylight hours of February were generally low; during the field survey tides varied between +0.2 and +0.5 feet above low water. As a consequence, the ponds observed were the minimum size to be expected; at higher tides, all water areas would be larger.

The length and width of both the open water area at the time of sampling (low tide) and the approximate extent at high tide was measured for each pond. The maximum and average water depth (at low tide) were also estimated. The species composition and extent of surrounding terrestrial and aquatic vegetation were noted at each pond, as were the presence and relative abundance of aquatic fauna. A portable probe was used to measure water temperature and dissolved oxygen concentrations. Water samples were taken for laboratory determinations of salinity, chlorophyll, nitrate, phosphate, and ammonium. Salinity determinations were made with a refractometer. Chlorophyll determinations were made according to the extraction/fluorometric method of Strickland and Parsons (1972); nutrient analyses were performed on a Technicon AutoAnalyzer system according to Technicon, 1977 (nitrate-nitrite), Solorzano, 1969 (ammonium), and Murphy and Riley, 1962 (phosphate).

Results

The locations of eight ponds located within the Kaupulehu project boundaries are shown in Figure 2. The hypsography, water quality and flora and fauna observed in each pond are summarized in Table 1.

Pond 1 is located in a fold in the lava plates. It is surrounded by growths of kiawe (*Prosopis pallida*) and *Pluchea odorata*. The pond itself is elliptical in shape, and consists of a small open water area (approximately 230 square feet at the time of the survey) covered by a blue-green algal floc, and a larger intermittently wet area of approximately 1,200 square feet covered by grass (*Cladium leptostachyum*) and *Bacopa monnieri*. Maximum water depth at low tide was 3 inches (0.25 feet).

Pond 2 is located nearby, and is formed by a fold in the surrounding lava plates. The actual open water area of this pond is quite small (approximately 3 square feet, 0.25 foot deep) at low tide, and is a barren, rubble-filled depression. The intermittently wet pond area of approximately 760 square feet extends along the lava fold in opposite directions, and the bottom is covered by fine gravel or *Bacopa*.

Pond 3 is located in a dense *milo* (*Thespesia populnea*) grove near the shoreline at the northern end of the project site. The pond is relatively steep sided and covers an area of 1,800 square feet at low tide. The pond is almost completely filled with leaf litter, and at low tide water barely covers the bottom.

Pond 4 is a marsh area located near the shoreline, behind the band of coastal strand vegetation. The marsh is comprised of two distinct areas: a large area (approximately 700 square feet) of organic sediment covered with *Bacopa* and *Scirpus validus*, and a small area (approximately 100 square feet at low tide) of barren lava plate covered with open water.

Ponds 5 and 6 are located on the inland side of a barren lava strip used as a roadway. Pond 5 is surrounded by thickets of kiawe and *pluchea*. The pond is steep-sided, and covers an area of approximately 160 square feet at low tide. The bottom of Pond 5 is partially bare lava with a growth of *Schizothrix* and *Chaetophora*, and partly fine sediment/rubble. The maximum depth of Pond 5 at low tide was 0.5 feet.

Pond 6 is a roughly circular, 960 square foot area of organic sediment covered with a lush growth of *Sesuvium portulacastrum*. No standing water was observed in this pond at low tide; the sediment and vegetation roots may be covered by water at high tide.

Pond 7 is an area of open water located in Waiakui marsh. Waiakui has been surveyed previously (OI Consultants, 1985), and was described as an extensive (51,000 square feet) shallow grassy depression surrounded by kiawe, *milo*, and palm trees. The open

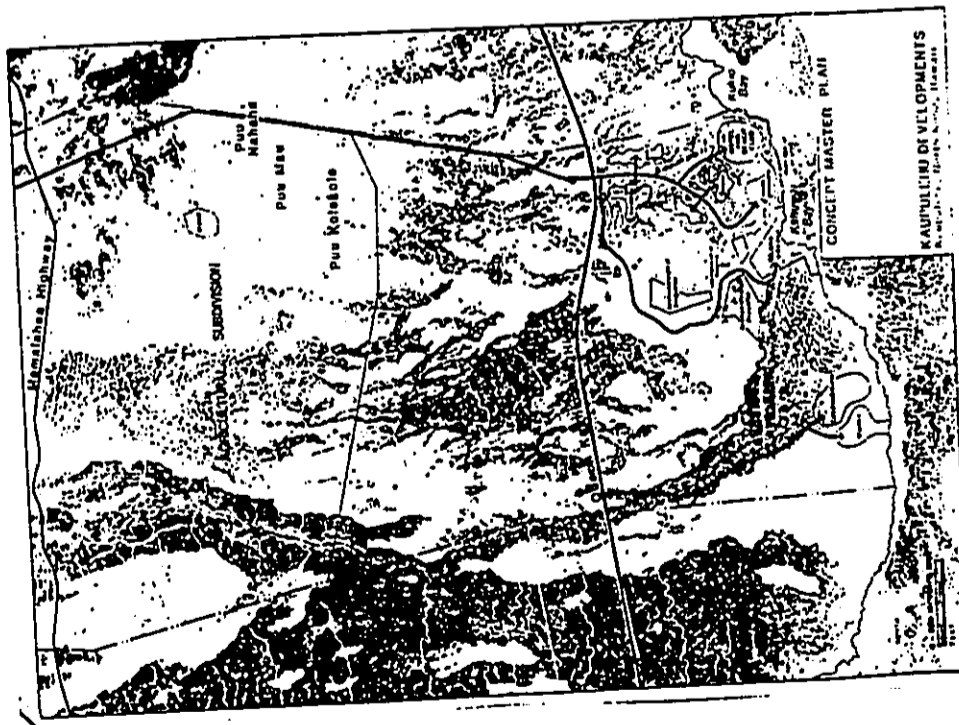


Figure 1. Concept Master Plan, Kaupulehu Developments, Kaupulehu, North Kona, Hawaii.

Table 1. Summary of survey data taken January 19, 1986, at Kaupulehu, North Kona, Hawaii.

PARAMETER	1	2	3	4	5	6	7	8
<b>HYP SOGRAPHY</b>								
Length (ft)	51	76	90	35	16	31	40	100
Width (ft)	24	10	20	23	10	31	40	75
Area (ft <sup>2</sup> )	1224	760	1800	805	160	961	1600	7500
Depth (ft)	.25	.25		.10	.50			.75
<b>WATER QUALITY</b>								
Salinity (ppt)	3	2			3		4	
Temperature (deg C)	24.0	26.2			27.5		21.7	
Dissolved Oxygen (mg/l)	11.7	9.4			11.4		8.0	
Nitrate (uM)	92.0	164.5			163.5		155.0	
Ammonium (uM)	3.05	3.57			4.01		1.70	
Phosphate (uM)	3.68	5.02			4.74		5.27	
Chlorophyll (ug/l)	8.46	1.07			.28		.88	
<b>TERRESTRIAL FLORA</b>								
Sporobolus virginicus	1	2			1		1	1
Scaevola taccada	3	3		2	3		3	3
Pluchea odorata	3	2		3	3		3	3
Prosopis pallida			3					
Thespesia populnea								
Morinda citrifolia								
Sesuvium portulacastrum								
Bacopa monniera	2	3		3	3		2	
Scirpus validus				2				
Cladium leptostachyum	3	2					3	3
Fimbristylis pycnocephala								
Cocos nucifera			1	1			2	
Hibiscus tiliaceus			1	3				
<b>AQUATIC FLORA</b>								
Chaetophora		1			2		3	
Schizothrix	3				2			
Blue-green algal floc			1					
Chara sp.								
<b>AQUATIC FAUNA</b>								
Melania sp.	3	3	3	2	3		1	
Amphipoda	3	1	*	1	2		3	
Halocaridina rubra	2	3	*	2	3		1	
Metabetaeus lohena					1			
<b>Abundance Code</b>								
1 = present								
2 = common								
3 = very abundant								
* = seen in previous surveys								

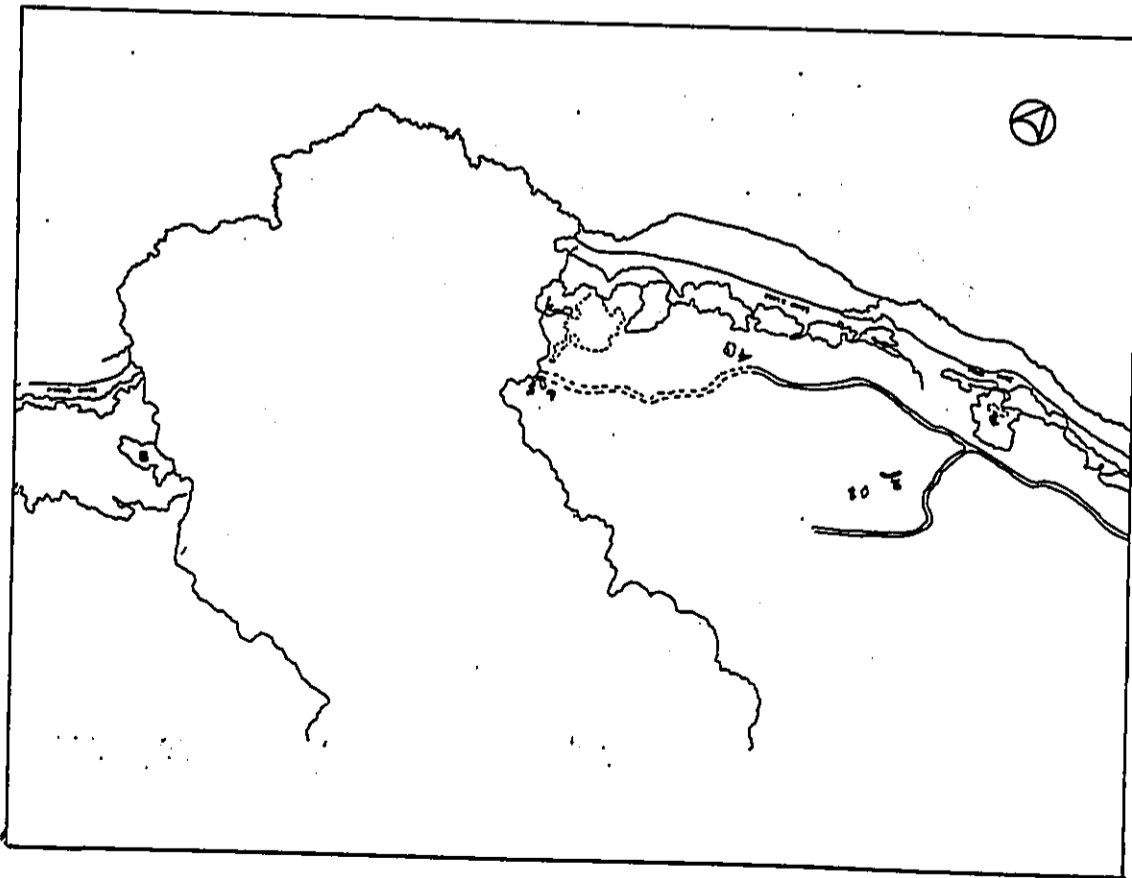


Figure 2. Location of anchialine ponds and wetland areas identified within the Kaupulehu development site, Kaupulehu, North Kona, Hawaii. Scale: 1" = 450'.

water area examined here covered an area of approximately 1,600 square feet and was 0.75 feet deep at low tide. This area was choked with *Chara* sp., an aquatic macrophyte typically found in brackish waters. Much of the *Chara* was covered with a floating mat of *Chaetophora*. The remaining portion of *Waikahi* is covered with a dense growth of grasses (*Scirpus validus*, *Cladium leptostachyum*, and *Fimbristylis pycnocephala*).

Pond 8 is an approximately 7,500 square foot area located on the southern edge of the lava flow at Kumuhehu Point. It has no visible open water area at low tide, and is covered with dense growths of grasses (*Scirpus validus* and *Fimbristylis pycnocephala*).

The five ponds containing standing water at the time of the survey (ponds 6 and 8 had no standing water; pond 3 was barely wet) were found to harbor typical anchialine pond fauna. Snails (*Melania* sp.) were found to be common to abundant in five of these ponds, and present in *Waikahi*. Small red amphipods were abundant under rocks in ponds 1 and 7, common in pond 5, and present in small numbers in ponds 2 and 4. Small red anchialine shrimp, *Halocaridina rubra*, were abundant in ponds 2 and 5, common in ponds 1 and 4, and present in low numbers in pond 7. Both amphipods and *H. rubra* were observed in pond 3 in a previous survey (OI Consultants, 1985) performed at higher tide, but were not seen at the low water levels present during this survey. The less-common anchialine shrimp *Metabetaeus lohena* was observed only in Pond 5. No waterfowl were observed during the field survey.

Water quality samples were taken only in four ponds (1, 2, 5, and 7) where water at low tide was deep enough to sample. Salinity in these ponds ranged from 2 to 4 parts per thousand (ppt). Water temperatures ranged from less than 22 °C to 27.5 °C. Dissolved oxygen levels were high (8.0 to 11.7 mg/l) in all ponds. Concentrations of dissolved nutrients were also high (92.0 to 164.5 µM nitrate; 1.70 to 4.01 µM ammonium; 3.68 to 5.27 µM phosphate). Chlorophyll levels were low in three ponds (0.28 to 1.07 µg/l), but high in Pond 1 (8.46 µg/l), probably reflecting the inclusion of some of the fine green floc found floating and on the bottom of that pond.

### Discussion

Anchialine ponds are features which undergo a natural process of ageing, which changes them from barren lava pools to grasslands with little or no standing water. For the purpose of this study, however, we have considered all the water areas examined to be anchialine ponds, in accordance with the original definition ("pools with no surface connection with the sea, containing salt or brackish water, which fluctuates with the tides"; Holthuis, 1973). The eight ponds found within the *Kaupulehu* study area during this survey present the spectrum of pond evolutionary conditions. Pond 5 is an example of a "young" anchialine pond, with its barren lava edges, lack of aquatic vegetation other than encrusting algae, and brackish water fauna (snails, shrimp, amphipods). The permanently wet areas of Ponds 1 and 2 are similar to the younger anchialine pond state of Ponds 5, while the intermittently-wet areas of these two ponds are older, ageing toward the development of wetland. Ponds 4 and 8 and *Waikahi* marsh are all nearly complete marsh/grasslands, with little exposed water, organic soils, and dominant grass vegetation. *Waikahi* has been classified as a wetland in a vegetation study (Char, 1985) of the *Kaupulehu* site, and ponds 4 and 8 would fit that classification as well. Pond 3 is an example of a pond which is being filled by dead leaves from surrounding terrestrial vegetation. Pond 6 and areas of Ponds 1, 2 and 4 are covered by dense mats of *Bacopa*, a semi-aquatic plant which can tolerate both total submergence and lack of standing water.

Water quality conditions within the four ponds containing water deep enough to sample at low tide in the *Kaupulehu* study area are typical of shallow anchialine ponds found along the Kona coast (OI Consultants, 1985; 1986). The high water temperatures and dissolved oxygen levels are the result of being shallow bodies of water in an area of high insolation. The low salinities and high nutrient levels are the result of the mixing of a small amount of marine water with nutrient-rich groundwater. The influence of groundwater is typically highest at low tide; thus, salinity would likely be higher and nutrient levels lower at higher tidal stages.

Surveys (OI Consultants, 1984a, 1984b, 1984c, 1985; Brock, 1985a) of the anchialine ponds between *Lahupua* (*Mauna Lani* Hotel) and *Kailua-Kona*, examined 411 ponds. Several areas of additional, uncounted ponds were noted but not included in this total. Only two ponds (*Waikahi* and the pond numbered 5 here) were included for the *Kaupulehu* site. Additional ponds are known to exist to the south of *Kailua-Kona* (*Maciolek* and Brock, 1974), and on *Maui* (*Holthuis*, 1973; Wong, 1975). The total number of anchialine ponds in the Hawaiian Islands as of mid-1985 was estimated at 600-650 (Brock, 1985b); grading at the site of the *Waikoloa Beach Resort* has decreased that number by approximately 150 ponds, to a current level of 450-500 ponds. The eight ponds at *Kaupulehu* represent a small (1.6%) portion of the existing pond resource.

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The ponds which are heavily overgrown by grasses (Waiaukuhi including Pond 7, Ponds 4 and 8) may be more properly considered to be wetlands, with potential for water bird habitats. Anchialine pond species (Melania, H. Kubra) have been seen in some areas of these ponds, however. Pond 3 is in the last stages of existence, and will probably soon be completely filled with leaf litter. Pond 6 is apparently wet only during high tide, but may also contain some brackish-water animals at high tide.

Direct and indirect impacts on the anchialine pond and wetland resources within the Kaupulehu site due to resort development are expected to be negligible under present concept plans. No filling of ponds is projected under the Concept Master Plan, so no direct impacts are foreseen. Ponds 1 and 2 are located in an area which the Concept Master Plan identifies as being part of the golf course. These two ponds could be incorporated into the golf course design to add interest while minimizing potential impacts to the ponds. A pond located immediately adjacent to the Waikoloa golf course shows no signs of negative impacts after golf course construction or several years of golf activity (pers. obs.), and it is reasonable to assume that ponds near the golf course at Kaupulehu would also be minimally affected by construction and operation. The remaining six ponds are located within or very near the boundary of an area designated in the Concept Master Plan as "Open Space". As such, direct impacts to these ponds would not be expected to occur. Secondary impacts due to construction would be expected to be minimal.



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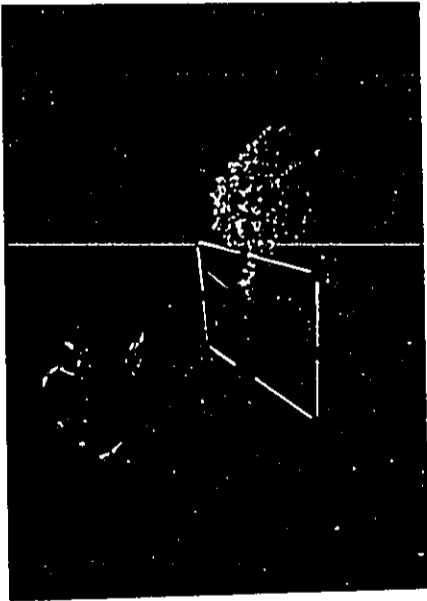
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BASELINE ASSESSMENT  
OF THE OFFSHORE MARINE  
ENVIRONMENT IN THE  
VICINITY OF KAUPULEHU,  
DEVELOPMENTS,  
NORTH KONA, HAWAII



Submitted to:  
BELT, COLLINS & ASSOC.  
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#### INTRODUCTION

Coral reefs and other marine environments are often some of the most valuable aesthetic and recreational features of coastal tropical resorts. On the Big Island of Hawaii, Kaupulehu Developments proposes to develop a resort-residential project on approximately 564 acres makai of Queen Kashiwamano Highway at Kaupulehu, Hawaii. The property extends from Kukio Bay north to Mahevalu Point, and encompasses slightly more than one mile of coastline. One 800-1000 room hotel is planned to be located inland of Kumukehu Point on approximately 60 acres. Adjacent to Kona Village Resort on the south, 50-150 luxury residential condominiums are proposed on approximately 60 acres. Inland of the luxury condominiums and the hotel 350-450 residential condominium units would be situated on approximately 60 acres within the golf course. In addition, two 18-hole golf courses are planned.

Planning for such resort development will certainly focus on maintaining a high level of environmental quality. However, with development comes the potential for undesirable habitat changes and possible irreversible destruction of marine ecosystems. Such processes can be minimized if the proper information is assembled early on in the development scheme. Environmental data can serve to identify areas that may be particularly susceptible to man-induced stresses, or particularly resistant to such stresses. Also, a solid quantitative data set

can serve as a baseline from which actual changes that may result from construction can be ascertained. Once these relationships are identified remedial action can be applied to eliminate the stress factors causing environmental change. With such management practices optimal utilization of marine resources may occur, while at the same time preserving a high level of environmental integrity. Therefore, a comprehensive baseline assessment of the offshore marine environments is a useful tool in providing the information to evaluate the potential for impacts to the areas offshore of Kaupulehu.

The determination of environmental impact is an implicit requirement of several federal, state and county laws. For example, at the federal level, the 1972 Federal Water Pollution Control Act (PL 92-500) calls for protection of the marine environment by assuring a sufficient level of water quality to allow continued propagation of the various components of the marine ecosystems and to insure that the quality of the marine environment is adequate for human recreation. The water quality management plans for the State of Hawaii (the 208 Plan) are in part modelled after PL 92-500. Both call for protection of the shoreline and marine ecosystems. The Hawaii State Coastal Zone Management Act of 1977 (Act 188) as outlined in Chapter 205-A, Hawaii Revised Statutes, also contains language to promote water quality, protect and preserve coastal ecosystems from disruption and to minimize adverse impacts.

The 208 plans for the state and the counties have been incorporated into the Department of Health (DOH) water quality standards and are contained in Chapter 54 of Title II.

Administrative Rules, entitled "Water Quality Standards". The basic intent of the regulations is to establish a classification of state waters and habitats and set out detailed water quality criteria designed to protect their use and to propagate fish and wildlife.

Water quality criteria are particularly useful in terms of evaluating problems dealing with human health, i.e. coliform bacteria counts or high levels of nutrients which may cause eutrophication of the water. However, in terms of environmental impact to ecosystems, water quality criteria are only indirect measures and ecological relationships are based on an imperfect understanding of cause and effect. Also, water quality chemical parameters such as nitrate, ammonia, total phosphorus, etc. may vary widely in time and space especially in nearshore and estuarine ecosystems. Often environmental impact to nearshore coral reef ecosystems is more closely related to physical disturbance from high waves than water quality parameters per se. Finally there are numerous sampling problems associated with water quality criteria and measurements are usually time consuming and costly. Recognition of these problems has prompted the DOH to establish an alternative standard by which to evaluate environmental impact particularly with respect to benthic (bottom dwelling) communities. The DOH regulations provide that water quality standards will be considered met if time series surveys of benchmark stations indicate no relative changes in relevant biological communities. This policy is consistent with the basic intent of the regulations, that is, it serves as a means to

directly evaluate environmental impact. For this reason the use of benthic communities as indicators of environmental stress is the basic premise applied in the design of the present study. The scientific validity of this approach is further discussed below.

#### OBJECTIVES

The purpose of the study is three-fold:

- 1) To establish quantitative baseline information to accurately depict relevant marine communities within the area of potential impact and in natural areas (controls) outside the probable zone of potential impact.
- 2) To establish permanent baseline stations or "benchmarks" in order to allow monitoring of the same stations in the future.
- 3) To evaluate the potential for impact of the proposed development.

A specific objective of the proposed study is to establish quantitative baseline information to accurately depict the community structure of the indigenous marine populations inhabiting the areas listed above. Marine community structure can be defined as the abundance, diversity, and distribution of stony and soft corals, other attached benthic fauna and flora such as algae and sponges, motile benthos such as echinoderms, molluscs, and crustacea, and pelagic species such as reef fish and sea turtles. This information will serve to identify any living marine resources that may be of significant commercial or recreational value, or that represent rare or unique ecological features that may be especially susceptible to human-induced

stress.

Another provision of this baseline survey is to establish permanent benchmark stations. These benchmark stations will allow for future sequential quantitative monitoring of representative areas for the purpose of accurate determination of any impact on the marine community that may result from development.

This assessment will be implemented in such a manner that it can serve as the framework for a continuing biological monitoring program, if such a program is deemed necessary, for compliance with Chapter 54 of Title II, Administrative Rules, "Water Quality Standards". To briefly summarize, these regulations provide that water quality standards will be considered met if time-series surveys of benchmark stations indicate no relative changes in "relevant biological communities". In this context, the most useful biological communities for direct evaluation of environmental impacts are benthic (bottom dwelling) communities. Because benthos are generally long-lived, immobile, and intimately affected by exogenous input of sediments and other potential pollutants, these organisms must either tolerate the surrounding conditions within the limits of adaptability or die. As members of the benthos, stony corals are of particular importance in nearshore Hawaiian environments. They contribute a large portion of the reef biomass and their skeletal structures are vital in providing a complex of habitat space, shelter, and food for other species. Since corals serve in such a keystone function, coral community structure is considered the most

"relevant" group in the use of reef community structure as a means of evaluating past and potential impacts associated with land development. For this reason, and because alterations in coral communities are easy to identify, observable change in coral population parameters is a practical and direct method for obtaining the information that is required to meet existing environmental regulations.

In order to accomplish the third objective it is first necessary to evaluate the adaptation of nearshore benthic communities to natural stress (sedimentation, wave scour, etc.). Since impacts caused by the development are superimposed on natural effects, it is necessary to estimate cause and effect by comparing the existing community structure of stations subjected to varying degrees of natural and man-induced stress to the conditions that would exist if the development proceeds.

#### METHODS

All field work was carried out on May 11-13, 1985, and was conducted from a 19 foot boat using scuba gear. Several methods were employed in the collection of qualitative and quantitative data. Qualitative reconnaissance surveys covering the entire area fronting the development parcel were conducted by slowly towing a diver behind a small boat. These surveys were useful in making relative comparisons between areas, identifying any unique or unusual biotic resources, and providing a general picture of the physiographic structure and benthic assemblages occurring throughout the region of study. Following the preliminary

survey. four quantitative transect sites were selected offshore of the development area (see Fig. 1). In addition a control site was selected at a location south of the development parcel. The control sites serves as a reference station for subsequent time-series surveys to identify if observed changes are the result of man-induced or natural environmental perturbations. All site locations were accurately determined and recorded using a hand-bearing compass and triangulation sightings of distinguishable landmarks. At each site, line transects were conducted at depths of approximately 10, 20, and 50 feet. These depths correspond to the three generalized major Hawaiian reef zones.

Transects were 150 feet long and were oriented parallel to the shoreline in areas deemed to be representative of community structure. The ends of each transect were permanently marked for possible future monitoring studies by pounding steel contractors stakes into the substrate. The transecting method employed uses a replicating technique; information was recorded both photographically and by visual estimation in-situ. A nylon surveying tape was laid out over the reef surface parallel to depth contours between two marker stakes. An aluminum quadrat frame with dimensions of one meter by two-thirds meter was sequentially placed over ten random marks on the transect tape so that the tape bisects the long axis of the frame. At each quadrat location a color photograph recorded the segment of reef area enclosed by the quadrat frame. In addition, a diver with knowledge of the taxonomy of resident species visually estimated the percent cover and occurrence of organisms and substrata types

within the quadrat frame. Following the period of field work, quadrat photographs were projected onto a grid enabling units of bottom cover for each species and bottom type to be calculated. This information was combined with the in-situ cover estimates and the combined assessment provided the data base for the benthic community structure analysis.

The practical advantages of photo-transects are numerous: most species can be easily and accurately identified from transparencies, and the transparencies provide a permanent record for subsequent time-series comparisons. Also, photo-quadrat sampling is rapid and efficient with respect to time and data collected - an important consideration under conditions where underwater time is restricted by cost, depth and exposure.

Quantitative assessment of reef fish community structure was conducted in conjunction with the benthic surveys. As the transect tape was being laid along the bottom, all fishes observed within a band approximately four meters wide along the transect path were identified to family and species and enumerated. Care was taken to conduct the fish surveys so that the minimum disturbance by divers was created, ensuring the least possible dispersal of fish.

#### RESULTS AND DISCUSSION

##### Shoreline Area

The shoreline of the major portion of the Kaupulehu Development parcel from Kahawai Bay to Kukio Bay is composed of

two main structural features. From Kona Village to the northern edge of the section of the 1801 lava flow that is on the property the shoreline is composed of a basaltic ledge of pahoehoe lava (see Plate 2). This intertidal platform is flooded in places to form tide pools. However, none of these pools appeared to be separated from the ocean on a permanent basis so they do not constitute unique or rare habitats. At the seaward edge of the lava shoreline the bottom slopes gradually to the offshore bench described in the next section. Shoreward of the lava bench, a coarse, steeply sloping white sand beach stretches from Kahawai Bay to Kumukehu Point. Much of the beach is occupied by the burrows of ghost crabs (see Plate 3). A solid growth of beach naupaka (Scaevola lobelia) extends to the beach berm along the entire length of shoreline. One curious and rather unusual occurrence found just to the north of the prehistoric lava flow at the southern border of the property is a small mangrove swamp. Located several meters inland of the beach berm, the dense stand of American mangroves (Rhizophora mangle) appears to indicate a fairly large supply of surface groundwater (see Plate 4). The extensive development of these plants and the thick deposits of plant material in the pond located in the center of the mangrove thicket indicate the permanence of the surface water (see Plate 5). A single water sample taken from approximately 1 foot below the surface of the pond had a salinity of 1 ppt (part per thousand). Since normal ocean water has a salinity of 36 ppt, at least the upper layers of the mangrove pond can be considered slightly brackish.

The southern sector of the property shoreline is bounded by

a prehistoric lava flow. This lava flow enters the water along approximately the southern quarter of the property forming Kumukehu Point. The shoreline along this stretch of coast is a very rocky sea cliff of jagged lava boulders (see Plate 6).

#### Offshore Marine Environments

Four stations offshore of the Kaupulehu Development and one control station to the south were selected for quantitative transect surveys (see Fig. 1). At each station 3 depth regions were transected: one within the shallowest near-shore zone (10'); one at a mid-depth where reef growth is well-established (20-30'); and one near the seaward boundary of deep reef growth (50-60'). Figure 2, Table 1, and Appendix A summarize the transect coral community structure off Kaupulehu. It can be seen that the same general pattern exists at all stations with regard to coral community structure. Cover is lowest at the near-shore transect, intermediate at mid-depths, and highest at the deep reef. However, even though this general pattern is consistent throughout all stations, there are some important differences between stations.

The major difference in physiographic makeup between the stations is that Station 1 is essentially unique when compared to the other four stations. This area is located off the small parcel of land just to the north of Mahealu Point. At this site the nearshore surge zone is composed of large basaltic boulders that are essentially barren of all attached fauna (see Plate 7). Moving seaward from the boulder zone, the bottom becomes a

limestone encrusted basaltic pavement. Small encrustations of corals occur on this pavement, but due to the shallowness of the water (10-15') and the high degree of wave stress that impact the nearshore zone, corals are kept to small flat encrustation (see Plate 8). Coral cover in this zone is low (13%) but is higher than at all the other shallow transects located off the development parcel. Seaward of the basalt platform, the reef structure assumes the standard configuration that is found off much of west Hawaii. At depths of from 25 to 60 feet, the major reef-building zone is divided into two separate areas. In the shallower region, the dominant coral is Porites lobata which has sturdy hemispherical or encrusting growth forms capable of withstanding the impact of storm wave stress (see Plate 9). At depths greater than 35 feet the dominant bottom cover is a combination of P. lobata and another species Porites compressa. The latter species assumes colony growth forms of long thin fingers that are attached at their bases to form dense thickets. At deeper reefs off west Hawaii, where destructive energy from breaking waves is low, this species is usually the dominant coral species (see Plates 10, 11, and 12).

At station 1 the Porites compressa-lobata zone extends to depths of 65 feet where coral mounds occur on the sandy bottom (see Plate 11).

This pattern of coral abundance represents the general scheme of reef structure found throughout much of the Hawaiian Islands. The unique feature of Station 1 at Kaupulehu however, is the compressed horizontal distance over which all three major

zones occur. It is less than 100 yards between the shoreline and the deep limit of coral growth.

The reef structure at stations 2-5, located to the south is strikingly different than at Station 1. This difference is primarily due to a very broad flat bench-like structure that extends offshore from Kahuwai Bay to Kukio Bay. This flat bench appears to be a result of a prehistoric lava flow that has since been drowned. In some areas the bench is exposed basalt covered with a thin veneer of calcium carbonate (limestone) (see Plates 13, 14). In other areas the deposition of calcium carbonate is fairly thick as evidenced by the extensive boring activity of several species of sea urchins (see plates 17 and 18). In areas where boring activity is highest (Station 3), the reef surface takes on a honeycombed appearance and the density of sea urchins, especially Echinometra mathaei, is on the order of 30 per square meter.

Coral cover everywhere on the offshore bench is low as evidenced by the transect data (Fig 2, Table 1). At the three shallow transects of stations 2, 3, and 4 coral cover was only 6, 2 and 5% respectively. In general, the corals that did occur were all small colonies, either of Porites lobata or Pocillopora meandrina. The low coral cover is indicative of high environmental stress, most likely in the form of wave energy. The very shallow depth of the reef bench exposes it to high levels of concussive force by breaking waves. Wave stress is generally considered to be the dominant force in shaping Hawaiian coral communities and the environmental setting at Kaupulehu does not seem to be an exception to this scheme.



The design of the reef survey was such that no cryptic organisms or species living within interstitial spaces of the reef surface were enumerated. Since this is the habitat of the majority of mollusks and crustacea detailed species counts were not included in the transecting scheme. No dominant communities of these classes of biota were observed during the reef surveys at any of the study stations.

#### Reef Fish Community Structure

Reef fish community structure was largely determined by the topography and composition of the benthos. Transect results are presented in Table 2 and Appendix C. Station 1 was the richest of the areas in terms of both number of species and number of individuals. The fish community at this area was quite similar to those encountered along most of the Kona coast. In the deeper areas, small herbivorous surgeonfish (Zebrasoma flavescens, Acanthurus nigroiris, Ctenochæetus strigosus) were abundant. Many larger planktivorous damselfish (Abudefduf abdominalis, Chromis verator) were encountered at the high-relief seaward edge of the reef ledge, as were some snappers. Many squirrelfish were seen in holes at this site. The overall richness of the fish fauna at this locality was largely a result of the many species of butterflyfish, wrasses, surgeonfish, and goatfish encountered along the transect. The shallow area of Station 1 differed in having a lower overall number of species and individuals probably due to the high degree of wave stress and low relief of the area. Small surgeonfish were not quite as abundant. Larger surgeonfish

The outer edge of the reef bench is marked by a sharp ledge and cliff 10 to 15 feet high. The walls of the cliff are frequently undercut with caves and crevices and the base of the cliff is marked by an area of large basaltic boulders. The coral communities seaward of the ledge and cliff are very similar to the deep Porites lobata-compressa zone described for Station 1.

The distinctive structure of the basaltic platform offshore of Kaupulehu also has implications to the susceptibility of the area to environmental stress, both natural and induced by man. The coral community transect data at Station 1 showed a very rich biota very close to the shoreline. Therefore, any land-derived material entering the coastal region would be immediately exposed to areas of high coral cover. In contrast, off stations 2-5, material entering the marine environment from the shoreline would be exposed only to the environments on the platform for a horizontal distance of several hundred yards. This area is characterized by low abundance of live coral cover, as well as reef fish. The shallow depth of the bench results in a highly stressed environment from natural sources, predominantly waves. Therefore, the reef areas that are located in the regions where they would be the most susceptible to impacts from the Kaupulehu development, should any impacts occur, are already highly stressed. The region where coral and associated community development is optimal due to sufficient depth as to be out of the high impact zone, is so far removed from the possible on-shore sources of impact that any effects would be greatly diluted.

(Acanthurus xanthurus, A. mata) were also seen in the shallower areas.

Stations 2, 3, and 4, located on a submerged carbonate-basalt platform, were fairly similar to each other in terms of fish abundance. At the deeper transects which were conducted seaward of the shelf edge, vertical reef development was not as pronounced as at Station 1. As with Station 1, small herbivorous surgeonfish were abundant in deeper water. However, the numbers of both species and individuals tended to be lower at the shelf stations; this is likely a consequence of these sites having less vertical relief. The intermediate depth transects were conducted along the top of the shelf; the fish community at these sites was similar to that seen in deeper water but the diversity tended to be lower as a result of both fewer species and number of individuals. This is probably a consequence of the relatively flat topography of this biotope.

The shallowest transects at stations 2-4 were characterized by their very depauperate fish fauna. The majority of fish seen were triggerfish and large surgeonfish (Acanthurus mata, A. xanthurus). The overall absence of fish in this biotope is almost certainly attributable to the scarcity of holes, ledges or other refuges.

The deep transect at Station 5 compared favorably with those from similar depths at the other stations. The shallow transect, however, was considerably richer than those encountered at the other shelf stations. This is probably a result of the slightly deeper nature of the shelf at Station 5 and the physical environment being more favorable to reef fish.

#### CONCLUSIONS

The ultimate purpose of this report is to provide estimates on the degree of environmental impact that might occur as a result of construction of the Kaupulehu Development based on the data gathered during the course of this baseline survey.

Implementation of the proposed action would involve substantial grading, vegetation removal, new construction and other changes to the existing environment on several hundred acres of land. As a result, the potential exists for impacts to the offshore marine environment. Based on the descriptive and quantitative data characterizing these environments contained in the baseline survey it is possible to predict what impacts, if any, might occur as a result of proposed development. With regard to the aquatic resources, the major potential impact parameters would be: 1) increased sedimentation from wind or runoff as a consequence of grading; 2) changes in groundwater discharge, especially with respect to nutrient loads from sewage-laden irrigation and golf course fertilization; 3) shoreline modification including changing coastline access; and 4) changes in runoff.

Below, each of these factors is treated in turn followed by a summary section which addresses the potential for impacts to the Kaupulehu environment as a whole.

#### Increased Sedimentation

In most cases in Hawaii the greatest potential cause for

impact to the marine environment as a result of nearshore development practices is increased sediment loads delivered to the nearshore environments. The offshore environment at Kaupulehu does not appear to be subjected to any level of natural sedimentation from land runoff. However sediment could be transported as wind-bourne dust or runoff during the period when ground cover is removed during grading. Wind-blown dust generated during construction of golf courses at other resorts has reportedly been a major problem. With regard to the offshore communities, increased sedimentation is generally regarded as one of the most important water quality characteristics, especially in connection with the ecology of corals. However, several factors indicate that increased sedimentation does not appear to be a likely source of environmental alteration for the development scenario at Kaupulehu. The main reason for this is that the ground cover of a majority of the land to be graded is raw lava that has not been weathered to any appreciable extent and has little or no soil cover. When moved and crushed by bulldozers a smooth surface of cobbles 1 to 4 inches in size results. In addition, only a fraction of the wind-blown material would be carried in a westerly direction toward the ocean. As the size distribution of the wind-blown fraction would probably be in the silt-clay range, it would be expected that this material would remain in suspension for some time once it entered the water column, and therefore it is unlikely that any measurable settlement at all would occur anywhere in the nearshore marine environment.

Likewise, for several reasons it is not expected that runoff

during construction would increase oceanic sediment loads. The climate of the Kaupulehu region is one of the driest in the Hawaiian Islands; therefore substantial rainfall during construction is rather unlikely. However, in the event of heavy rainfall, the porous nature of the lava fields is such that sheet flow carrying suspended sediment toward the ocean is highly unlikely. Rather, most rainwater that enters the ocean as runoff appears to do so following percolation through the surface rock layers to the water table and subsequent groundwater extrusion at the shoreline. Such groundwater flow would not have the effect of transporting sediment to the ocean since the basal rock acts as a filter. Therefore it appears that a major effect of rain during the period of grading might be to significantly decrease the amount and distribution of airbourne dust--a circumstance that would have to be considered a beneficial side effect.

Several other scenarios around the Hawaiian Islands can also be drawn upon to estimate the potential for impact from sedimentation at Kaupulehu. In particular, a study conducted at Princeville, Kauai (Grigg and Dollar, 1980) compared the reef environments off the completed phase of the resort with the environments off pristine coastline. The hypothesis tested during this comparison was that increased runoff during construction caused some modification of the coral reef environments offshore. However, results of the survey showed that if anything, the coral environments were better developed off of the existing Princeville development that was subjected to

increased runoff than off the unperturbed parcel. Even though the development activities might have temporarily increased suspended sediment loads, this increase would have been insignificant in comparison to the natural sediment loads to which the reef communities are already pre-adapted. Therefore, the hypothesis was rejected that developmental alteration of land for Princeville construction could result in offshore impacts to the marine environment.

In addition, while it is generally accepted that sedimentation is a major source of impact on coral reefs throughout the world, several studies show that Hawaiian reefs may be significantly more resistant to heavy sediment loads than other reef areas. Results of surveys conducted at French Frigate Shoals (Dollar and Grigg, 1981) following the inadvertent grounding of a freighter and subsequent dumping of 2000 tons of a fine-grained mineral clay indicated that there was no damage to the reef corals and associated communities except where the organisms were actually buried by clay deposits for greater than a two week period. Another study, conducted in Hilo Bay (Dollar, 1985) where natural sediment loads are very high, resulting in extremely turbid conditions, reported that the dominant bottom cover consisted of nearly solid living coral - a condition rarely found under even the most "optimal" conditions.

#### Increased Nutrient Loading From Irrigation and Fertilization

Since the Kaupulehu Development plans will undoubtedly call for fertilization of the golf course(s) and irrigation with

treated sewage effluent, the potential for impacts to the aquatic ecosystem exists due to high rates of nutrient loading. When subjected to substantial increases in nutrients, the response of marine and freshwater systems is termed eutrophication, which is the increased growth of a portion of the community. The overall result of this process is a degradation of environmental quality. In the past coral reefs in some areas of Hawaii, primarily Kaneohe Bay and off Sand Island on Oahu, have been severely damaged in this manner by sewage impacts.

At Kaupulehu, it is not anticipated that such impacts will ever occur for several reasons. Most importantly, the unrestricted circulation of the offshore zone by tides, current, wind, and wave action promotes rapid dilution and water exchange. Residence time of a parcel of water at any one location on the reef zone is probably on the order of hours, so buildup of any materials is unlikely. Another reason that the marine environment will probably show no effects as a result of golf course irrigation is that much of the nutrient load is taken up by the vegetation on the golf course. Other chemical processes including cation exchange, fixation and adsorption on the soil, and leaching will also lessen the nutrient load that could potentially reach the marine environment through groundwater runoff. Another factor that accounts for the lack of potential for impact is the secondary level of sewage treatment of all development effluent. Studies done at several of the ocean discharges on Oahu that intentionally discharge much greater volumes of secondary sewage into marine environments indicate there is no detrimental effects whatsoever due to the

boundaries where marine systems have been adversely affected by runoff to date. It is expected that this would remain the case. However, if analyses indicate that the proposed changes in land use and drainage patterns might result in substantial changes in water quality, additional field surveys will be conducted to determine the best location for the discharge of drainage and to assess the significance of expected water quality with respect to marine community structure.

Shoreline Modification

There are currently no plans for direct alterations of the shoreline area under the proposed plans. As such any alterations due to development would come about via the indirect mechanisms discussed in the previous sections. However, one aspect of shoreline modification, that of increased access, will undoubtedly occur as a result of development. The conclusions of the marine biological survey conducted in 1983 at the Mauna Lani Resort state that it appears that reef fish populations are depressed along the shoreline especially with respect to species highly desirable for eating. Observations by long-time residents indicated increased numbers of both pole and spear fishermen with the opening of the Mauna Lani Resort. Similar changes in land use and access will undoubtedly occur at Kaupulehu.

Summary

In conclusion, for the purpose of gaining some perspective on the potential for impact to the marine ecosystem, it may be useful to consider Hawaiian reef communities as a whole and where they fit in a global perspective. Corals are considered

discharge. In fact, the impacts that have been reported all can be considered beneficial since they result in increased fish populations, apparently in response to increased particulate food and shelter due to the outfall structure.

The negative effects of sewage impact on open ocean reefs that have been reported in Hawaii all have been due to point source discharge of raw sewage over a time span of years. Since there appears to be no provisions which would allow raw sewage to enter the marine environment under any of the Kaupulehu Development plans for even the shortest length of time, it can be concluded that there does not appear to be any potential for impact to the marine environment.

Potential for impact to the marine environment due to pesticides and herbicides also seem to be nil. It has not been found necessary to utilize pesticides on golf courses in Hawaii, and only very small applications of herbicides are periodically made to the greens. Such small quantities do not appear to be of a magnitude great enough to leach through the soil and lava, be carried to the ocean via groundwater extrusions and then bioaccumulate to the point of producing a noticeable effect.

Storm Runoff

Changes in storm runoff patterns have the potential to affect the quality of coastal waters and the marine biota that live within them. At this time no estimates exist of how drainage patterns might be changed as a result of the development master plans. There appeared to be no areas within the Kaupulehu

"keystone" species in that they contribute to the actual structure of the reef, thereby creating a complexity of habitat space, shelter and food for other species groups. As benthic (bottom dwelling) organisms, corals must also tolerate the surrounding water conditions within the limits of adaptability or die. For these reasons, coral communities are the most "relevant" group in evaluating past and potential impacts associated with land development. Hawaiian coral reefs are among the northernmost in the world, and as such are subjected to greater extremes in temperatures than most other areas. In addition, Hawaii is located in a very isolated position in the center of the Pacific, and is "upstream" of the major centers of coral evolution in the Indo-Pacific. As a result the Hawaiian coral fauna is extremely low in number of species; there are only about 35 Hawaiian coral species compared to upwards of 200 on most reefs located at lower latitudes and nearer to continental areas. This can be interpreted to mean that Hawaiian reefs are composed of a few highly resilient species that are able to withstand a relatively great range of fluctuating environmental parameters. These qualities of resiliency may also pre-adapt the community as a whole to changes in environmental conditions induced by the activities of man. The findings mentioned above of very little impact associated with a seemingly disastrous clay-spill is evidence of the high degree of tolerance to short term fluctuations that Hawaiian communities seem to possess.

With regard to the Kaupulehu Development plans, the potential for direct impact as a result of development to the

offshore communities appears to be very small. None of the developmental activities appear to have the potential to induce large changes in physio-chemical water quality parameters. In addition, as described in the RESULTS section, much of the offshore reef area adjacent to the development property is composed of a very barren bench-like structure. The advantage of such a naturally occurring environment is that it is already subjected to stresses that are probably much more influential than the incremental changes that could result from any development activity. Therefore, the environments are especially pre-adapted to any potential development associated impacts, should such impacts occur. If such changes did occur through some unexpected event related to development activities the resulting alterations to marine community structure would probably be negligible. Tolerance to such changes appears to already be part of the physiological range of the community. Observations of the response of marine ecosystems to such shoreline development as Princeville, on Kauai, Kaanapali on Maui, Kailua-Kona on Hawaii and even Waikiki on Oahu substantiate the overall conclusion that the marine environment is capable of withstanding shoreline development activities without suffering any loss in quality.

With the exception of the Humpback Whale, which is occasionally sighted offshore during the winter months, no rare or endangered species were observed within the Kaupulehu coastline. Green sea turtles (*Chelonia mydas*), which are currently listed as a "threatened" species, are frequently

observed within offshore areas. It is currently prohibited by law to take these turtles, and as long as this regulation is enforced, it does not appear that any activity within the development plans will affect their behavior or abundance. The mangrove swamp represent a rather unique environment on the west coast of Hawaii since such communities are usually found in estuaries and not on dry coastlines.

It can be concluded that as long as the normal reasonable steps are taken in construction practices, and the maintenance procedures for the golf courses remains as planned, there should be no adverse impacts to the marine environments. However, the baseline marine biological studies were implemented in such a way that replicate surveys conducted in subsequent years can show actual changes in marine community structure. Regardless of how unlikely, there is always the potential for an unexpected event. If any development practices cause changes in physical-chemical parameters which lead to changes in environmental integrity, these effects could be quantified through time-series surveys. Therefore, it is recommended that Kaupulehu Developments utilize the bench-mark stations to the fullest by incorporating into their long-range plans subsequent marine surveys. If and when development increments near the shoreline commence, it would appear to be a prudent action to initiate a monitoring program at that site during the activity. With such an ongoing program, it would be possible to quickly pinpoint any detrimental processes as they happen and remedy the situation before significant or irreversible environmental damage occurs.

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- Dollar, S. J. and R. W. Grigg. 1981. Impact of a kaolin clay spill on a coral reef in Hawaii. Marine Biology 65:269-76.
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Table 1. Summary of coral community structure transect data for marine environment off Kaupulehu Development.

STATION	DEPTH	% CORAL COVER	# CORAL SPECIES	CORAL SPECIES DIVERSITY	SEA URCHINS	TOTAL #
1	10	13.2	4	.495	5	5
	20	33.8	3	.614	25	25
	45	89.4	2	.692	9	9
2	10	6.0	2	.686	41	41
	20	50.4	6	.453	57	57
	60	60.8	2	.668	16	16
3	10	2.2	4	.823	116	116
	20	10.6	4	.870	43	43
	55	49.4	3	.692	35	35
4	10	5.0	3	.680	53	53
	20	29.5	5	.455	48	48
	50	48.4	2	.661	21	21
5	10	18.8	5	.797	84	84
	30	39.8	4	.678	31	31
	55	69.0	2	.643	25	25

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Legend

Abbreviations of all species and substratum types used in Appendices are listed below:

Coral Species

- PL = Porites lobata
- PC = Porites compressa
- PM = Pocillopora meandrina
- MV = Montipora verrucosa
- MP = Montipora patula
- LP = Leptastrea purpurea
- PV = Pavona varians
- CO = Cyphastrea ocellina

Substratum Types

- BA = basalt
- LS = limestone
- SA = sand
- RU = rubble



APPENDIX A. Percent cover of benthic species and substrata types.

Station	Depth	FL	PC	PM	MP	MV	PV	CO
1	10	12.1	.9					.1
	20	24.6	9.0			.2		
	45	47.0	42.4					
2	10	3.4	2.6					
	20	45.4	1.0	1.9	.2	1.7	.2	
	60	23.6	37.2					
3	10	.4	.1	1.6				.1
	20	6.7	.2	3.2		.5		
	55	19.5	30.0	.2				
4	10	4.0	.6			.3		
	20	26.1	.4	1.7	.1	.4	.3	
	50	18.1	30.3					
5	10	14.3	2.5		.2	1.4	.4	
	30	29.1	9.8	.6		.2	.1	
	55	23.7	45.3					

APPENDIX A (CONT.) Percent cover of reef substrata.

Station	Depth	LS	BA	RU	SA
1	10	44.6	38.8		
	20	66.2			
	45	7.6			3.0
2	10	93.9			
	20	31.0	18.6		2.1
	60	26.8	2.1	10.3	
3	10	90.6	7.2		
	20	8.5	80.9		
	55	4.3	8.8	37.5	
4	10	9.3	85.7		
	20	6.6	61.9	2.0	
	50	27.4	22.8	1.4	
5	10	41.4	39.8		
	30	31.5	28.7		
	55	19.9		1.0	10.1

APPENDIX C. Reef fish abundance estimates on transects off Kaupulehu. Symbols corresponding to abundance estimates are: R = 1 - individuals per transect, C = 4 - 9 individuals per transect and A = more than 10 individuals per transect.

STATION	1			2			3			4			5		
	10	20	45	10	20	60	10	20	50	10	20	50	15	30	55
MURAENIDAE (Moray Eels)															
<i>Lycodontus meleagris</i>															
<i>L. flavicarinatus</i>															
AULOSTOMIDAE (Trumpetfish)															
<i>Aulostomus chinensis</i>															
FISTULARIDAE (Cornetfish)															
<i>Fistularia petimba</i>															
HOLOCENTRIDAE (Squirrelfish)															
<i>Plaesoo sammara</i>															
<i>Myripristis berndti</i>															
LETHINIDAE (Emperorfish)															
<i>Monotaxis grandoculis</i>															
LUTJANIDAE (Snappers)															
<i>Aprion virescens</i>															
<i>Aphareus frenatus</i>															
<i>Lutjanus fulvus</i>															
MULLIDAE (Goatfish)															
<i>Parupaneus porphyreus</i>															
<i>P. bifasciatus</i>															
<i>P. multifasciatus</i>															
CHAETODONTIDAE (Butterflyfish)															
<i>Forcipiger</i> spp.															
<i>Chaetodon auriga</i>															
<i>C. reticulatus</i>															
<i>C. milleria</i>															
<i>C. ornaticaudus</i>															
<i>C. multivittatus</i>															
<i>C. quadrimaculatus</i>															
CIRRHITIDAE (Hawkfish)															
<i>Parracirrhites forsteri</i>															
POMACENTRIDAE (Damsel fish)															
<i>Abudefduf abdominalis</i>															
<i>Plectro. johnstonianus</i>															
<i>Chromis verator</i>															
<i>C. vanderbilti</i>															
<i>C. hanui</i>															
<i>C. agilis</i>															
POMACANTHIDAE (Angelfish)															
<i>Centropyge luetteri</i>															

APPENDIX B. Macroinvertebrate species occurrence - Kaupulehu Development

Sea Cucumbers

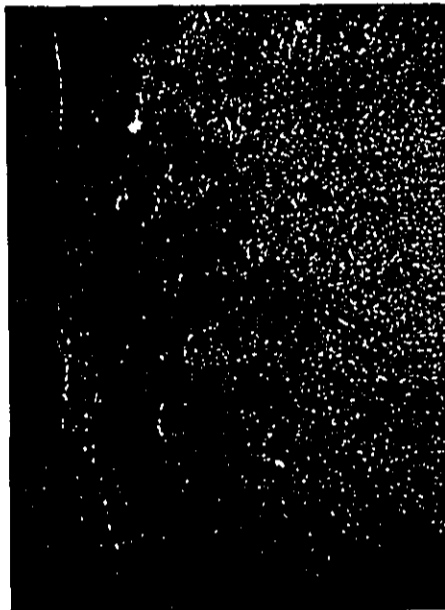
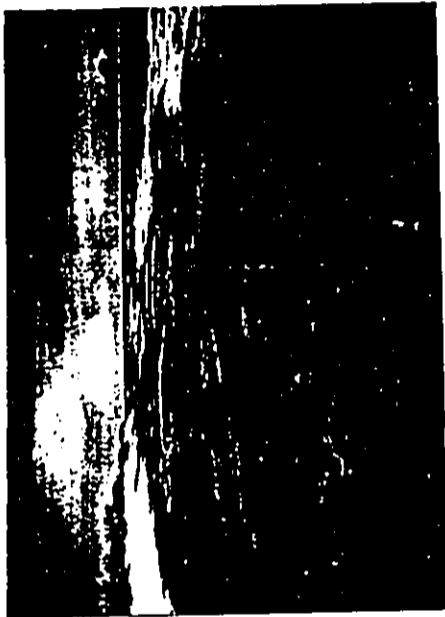
*Actinopyga mauritiana*  
*Holothuria atra*

Sea Urchins

*Diadema paucispinum*  
*Echinometra mathesi*  
*Echinometra oblonga*  
*Echinostrephus aciculatus*  
*Echinothrix calamaris*  
*Echinothrix diadema*  
*Heterocentrotus mammillatus*  
*Tripneustes gratilla*

Starfish

*Linckia multiflora*  
*Linckia guildingii*  
*Ophiacoma* spp.



PLATES 2 & 3. Top photograph shows typical shoreline at Kaupulehu. Pahoehoe lava bench separates the sand beach from the waterline along the entire property that is not covered by raw lava. Tide pools on the lava bench appear to exchange water on a daily basis with the rise and fall of the tide. Bottom photograph shows burrows of ghost crabs that occupy much of the beach.

APPENDIC C. (cont.)

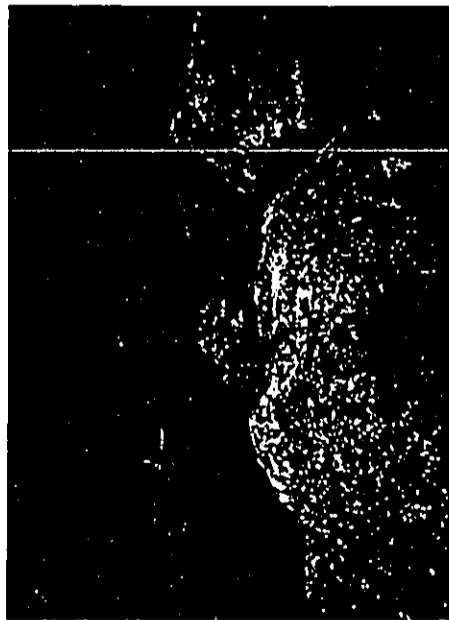
LABRIDAE (Wrasses)														
<i>Thalassoma duperrey</i>	C	C	C	A	R	R	C	C	C	A	A	C	A	C
<i>T. ballieu</i>		C	C											
<i>Gomphosus varius</i>	C			C										R
<i>Cheilinus unifasciatus</i>			R		R			R						
<i>Labroides phthirophagus</i>			R									R	R	R
<i>Coris gaimard</i>		R						R						
<i>C. flavovittata</i>								R						
SCARIDAE (Parrotfish)														
<i>Scarus sordidus</i>		C	R				C	C		R				
<i>S. perspicillatus</i>		R												
<i>S. psittacus</i>			R											
Juvenile <i>Scarus</i>	A	A								C	A			R
ACANTHURIDAE (Surgeonfish)														
<i>Acanthurus mata</i>							A							C
<i>A. xanthopterus</i>	R													
<i>A. leucopareus</i>	R		C											
<i>A. achilles</i>	C	C	R						R					
<i>A. sandvicensis</i>	C	C	R				C	R		R			C	
<i>A. nigrofuscus</i>	A	C	A				A			R			C	
<i>A. nigroris</i>	A	C	A				A			R			C	
<i>A. olivaceus</i>	A	C	A				A			R			C	
<i>Ctenochæetus strigosus</i>	A	A	A				A	C	R	R			A	A
<i>C. hawaiiensis</i>		R	R				R	C	R	R			A	A
<i>Zebrasca flavescens</i>	A	A	A				R	C	R	R			A	A
<i>Naso lituratus</i>		C					R	R		R			A	C
<i>N. hexacanthus</i>		C												C
ZANCLIDAE (Moorish Idols)														
<i>Zanclus cornutus</i>		C					R	C	R	R			R	C
SCORPAENIDAE (Stonefish)														
<i>Scorpaenopsis diabolus</i>														R
BALISTIDAE														
<i>Rhinecathus rectagulus</i>							R		C				R	R
<i>Sufflamen bursa</i>			R				C		R	R			R	R
<i>Melanichthys vidua</i>			R				R	R	R				R	C
<i>M. niger</i>	R									R			A	C
POMOCANTHIDAE (Filefish)														
<i>Pervagor spilisona</i>	A	A	A	A	A	A	A	A	A	A	A	A	A	A
TETRAODONTIDAE (Puffers)														
<i>Arothron meleagris</i>									R					
CANTHIGASTERIDAE (Sharpnose puffers)														
<i>Canthigaster jactator</i>														R



PLATES 4 & 5. Top photograph shows clump of mangrove trees (Rhizophora mangle) located just north of the prehistoric lava flow at the southern border of the Kaupulehu property. Bottom photograph shows tangle of roots in the interior of the mangrove swamp and the standing water which appears to be a permanent feature of the area.

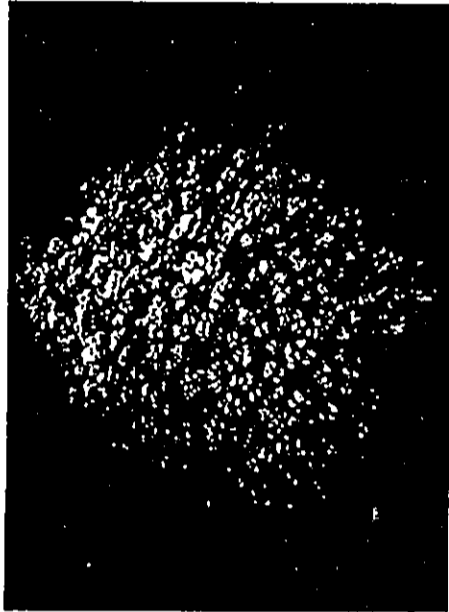


PLATE 6. Shoreline off the prehistoric lava flow at the southern end of the Kaupulehu property. Jagged lava cliffs extend to the water-line along the entire lava flow.

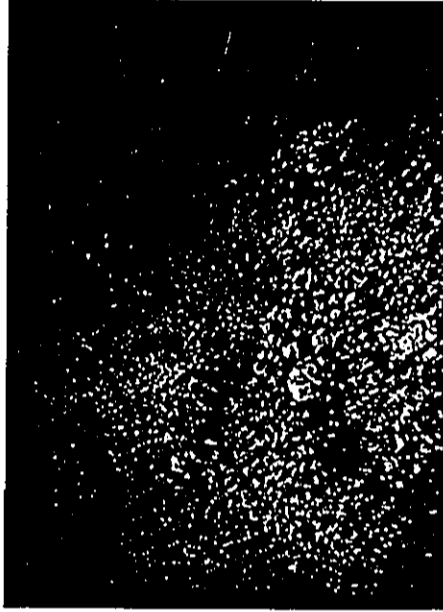


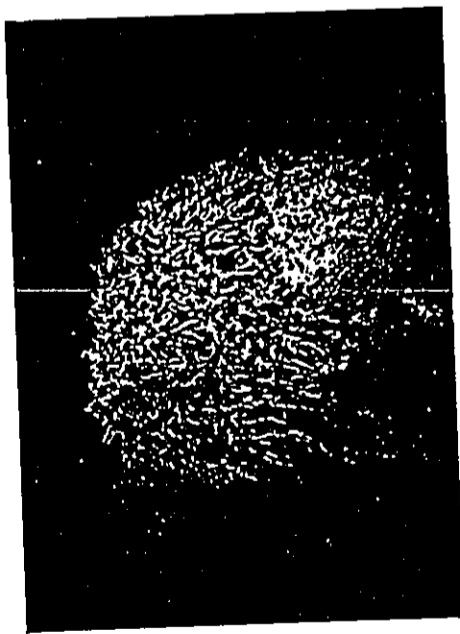
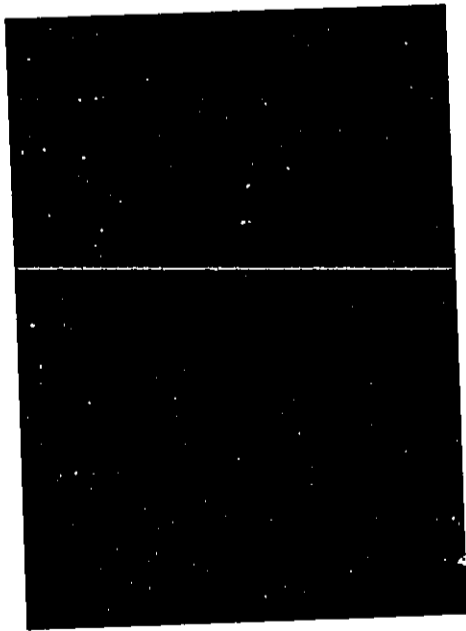
PLATES 7 & 8. Boulder-covered bottom just offshore of Station 1 located to the north of Kona Village. Boulders are devoid of almost all macrofaunal growth due to high stress from breaking waves. Water depth is approximately 4 feet. Bottom plate is typical quadrat photo from the shallow transect at Station 1.

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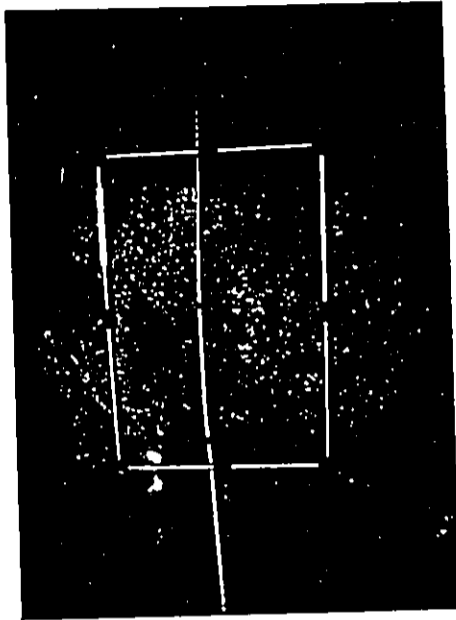
PLATES 9 & 10. Top plate shows a large hemispherical colony of Porites lobata located in the reef-building zones off Kaupulehu. Water depth is approximately 40 feet. Bottom plate shows thickets of Porites compressa interspersed with round colonies of P. lobata. Such thickets comprise the densest regions of coral cover within the depth range of 40 to 60 feet.





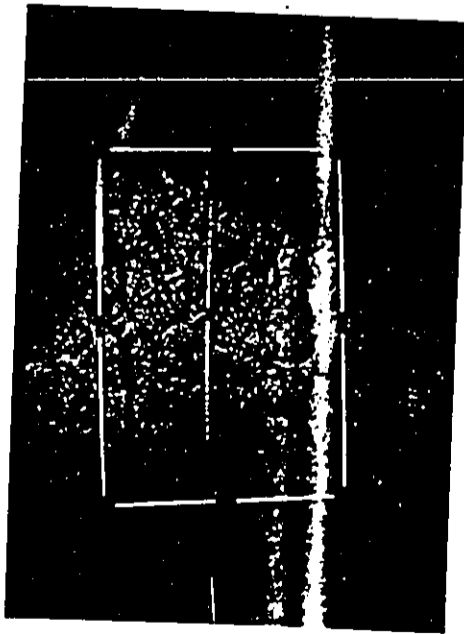
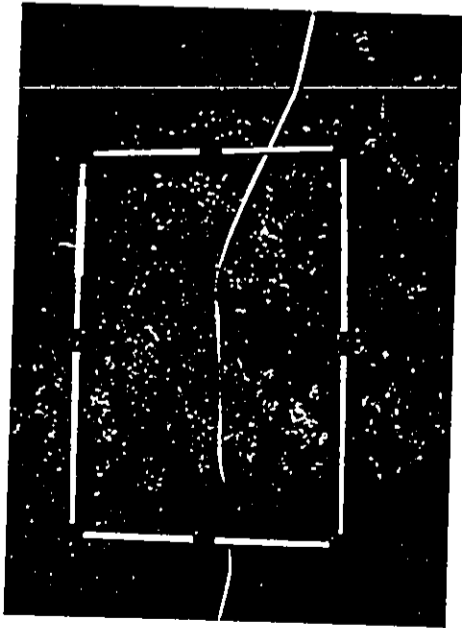
PLATES 11 & 12. Mounds of P. compressa growing on sandy bottom at a depth of 60 feet at Station 1. Bottom plate shows mat of P. compressa encrusting a basalt boulder in the deep reef zone.

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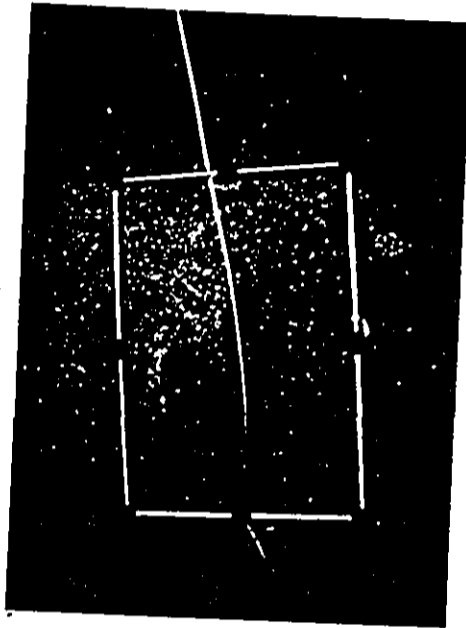


PLATES 13 & 14. Oblique view of the limestone encrusted basalt bench that typifies the nearshore environment off Kaupulehu at Stations 2, 3, and 4. Round dark objects are sea urchins (Tripneustes gratilla). Water depth is approximately 10 feet. Bottom photograph shows typical quadrat at the 10 foot transect at Station 3.

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PLATES 15 & 16. Typical photo quadrats at Station 3. Top plate shows barren lava surface located close to shore at a depth of approximately 10 feet. Bottom plate shows quadrat located at 20 feet on the outer section of the lava bench. Coral cover is appreciably higher on the outer transect.



PLATES 17 & 18. Limestone encrusted reef bench at Station 2 shows the effects of boring sea urchins, primarily of the species Echinometra mathaei. Entire reef in this area has a honeycombed appearance due to the extensive boring activity.

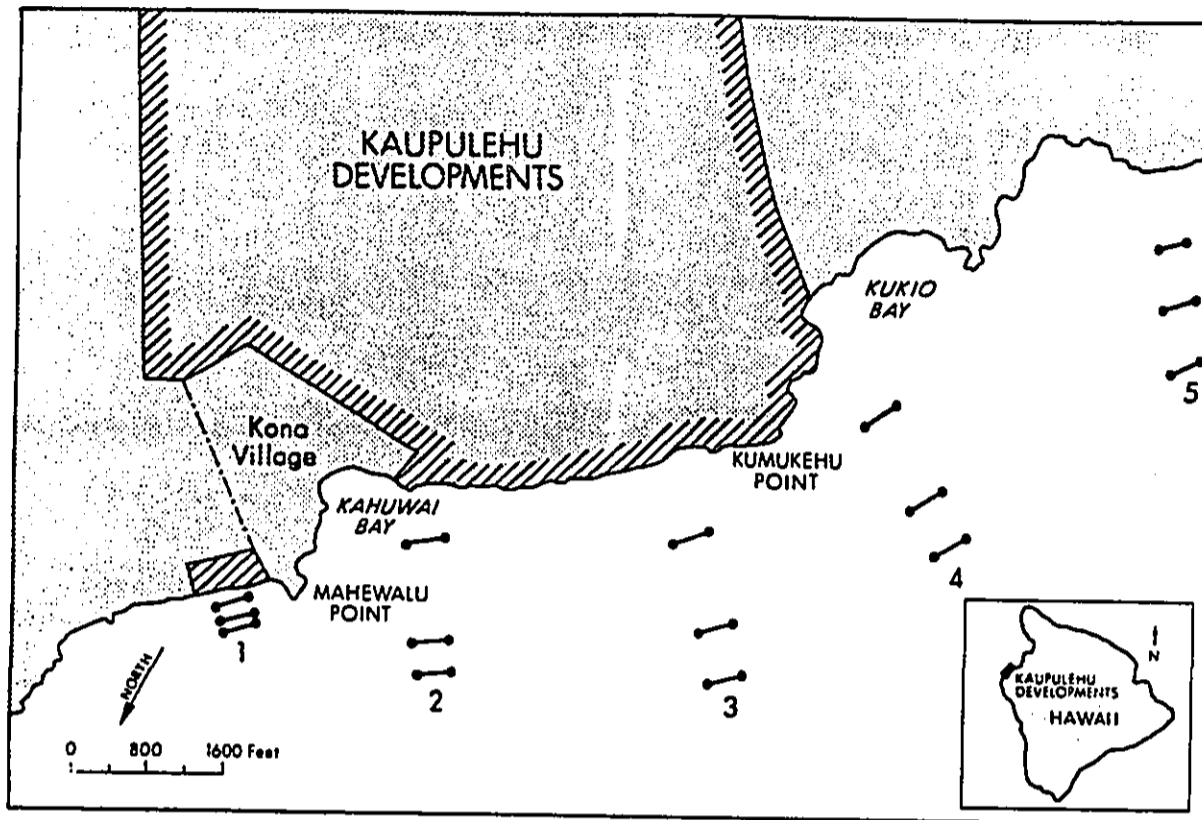


FIGURE 1. Map showing location of Kaupulehu Development on Big Island of Hawaii. Reef transect stations are indicated by numbers, and transect locations by bars.

### PERCENT CORAL COVER - KAUPULEHU

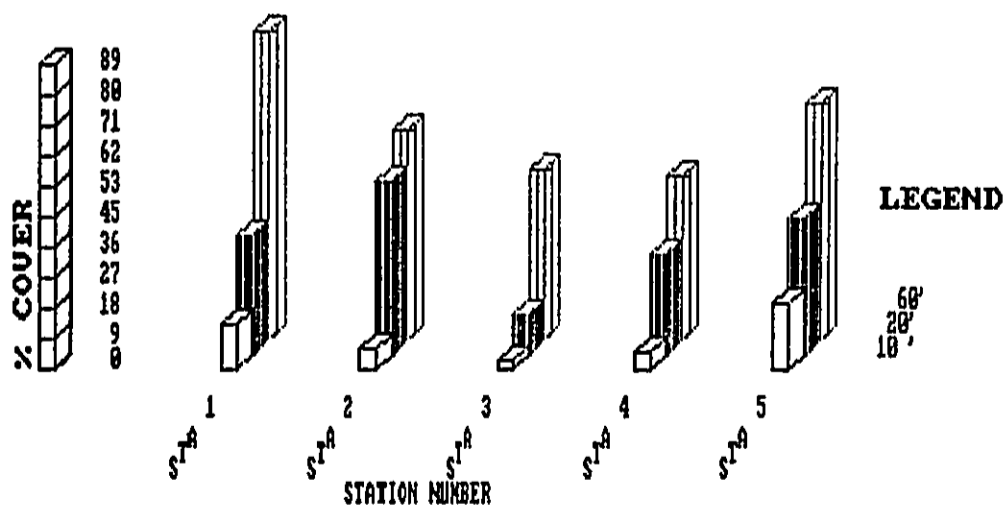


FIGURE 2. Bar graphs showing percent cover of coral on transects off Kaupulehu Development. In all cases coral cover increases with depth. Coral cover is generally lower at Stations 2, 3, and 4 which are located on, or near, submerged lava bench.



### NUMBER OF FISH SPECIES - KAUPULEHU

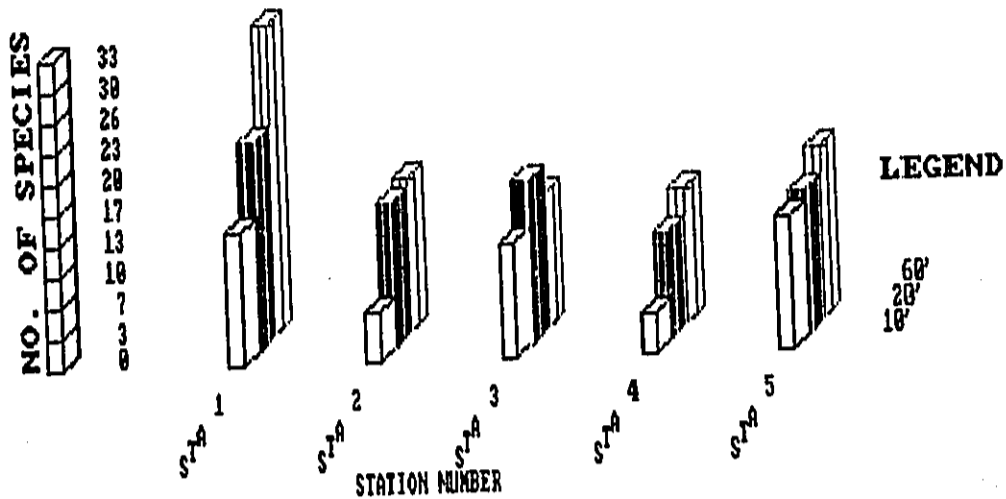


FIGURE 3. Number of fish species on transects off Kaupulehu Development.

### NUMBER OF FISH INDIVIDUALS - KAUPULEHU

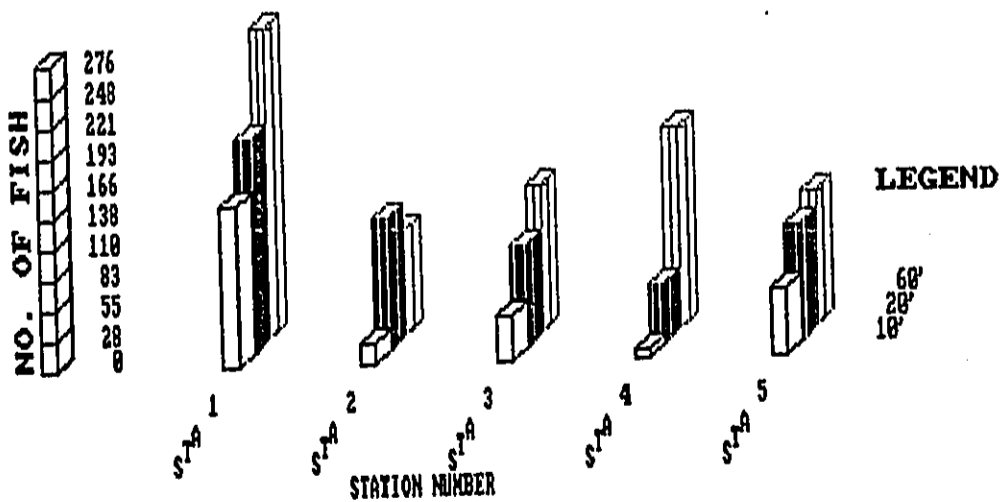


FIGURE 4. Number of individuals of fish on reef transects off Kaupulehu Development.

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BOTANICAL SURVEY FOR KA'UOLEHU DEVELOPMENTS  
KA'UOLEHU, NORTH KONA, HAWAII

by

Winona P. Char

CHAR & ASSOCIATES  
Botanical/Environmental Consultants  
Honolulu, Hawaii

Prepared for

KA'UOLEHU DEVELOPMENTS  
Belt, Collins & Associates (Environmental Coordinators)

May 1985

LIST OF FIGURES

Figure 1. Project area & location of Sesbania arborea (trees 'ohai).

Figure 2. Sesbania arborea flowers.

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6

INTRODUCTION

Ka'upulehu Developments, Inc. proposes to develop a resort-residential project on approximately 564 acres of land located below the Queen Ka'ahumanu Highway at Ka'upulehu, Hawaii. Most of the land is zoned State Conservation District and before the project can be implemented a boundary amendment to State Urban District is required. Belt, Collins and Associates is coordinator for the Environmental Impact Statement (EIS) which will be prepared and later submitted to the Land Use Commission along with the legal petition to amend the boundary.

A botanical survey to inventory the flora, describe the major vegetation types, search for rare, threatened or endangered plant species, and identify areas of potential environmental problems or concerns was conducted on 26 April 1985. A team of three botanists was employed to gather the technical data required for this report. This report will be incorporated into the EIS.

METHODOLOGY

Prior to undertaking the survey, a search of the pertinent literature was made to familiarize the investigators with previous studies conducted in the general area.

An intensive walk-through survey method was used. Access into the upper area of the project site was by several unpaved roads which lead to two water tanks which service Kona Village Resort.

Tentative vegetation types were delineated from recent aerial photographs and the project map. These vegetation types were ground checked and correlated with the project area map. Criteria such as structure, composition, and associated plant species were used in identifying and describing each vegetation type.

Species identification were made in the field. Plants which could not be positively identified were collected for later determination in the laboratory and herbarium. Notes were made of species present in each vegetation type. The species recorded are indicative of the season and environmental conditions at the time of the survey. A survey taken at a different season and under varying environmental conditions would no doubt yield slight variations in the species list especially of the annual species. A few of the annual species had already flowered and died when the survey work was initiated. The woody species have been inventoried to a greater degree of reliability.

Specimens collected during this survey will be deposited at the University of Hawaii at Manoa Herbarium (HAW) and at the Bishop Museum Herbarium (BISH).

## RESULTS

Seventy species of higher terrestrial plants were found on the project area during this survey. Of these 70 plants, 39 (56%) are introduced, 26 (37%) are native, 4 (6%) are of Polynesian introduction, and 1 (1%) is of unknown origin. Among the native plants 15 are indigenous and 11 are endemic to the Hawaiian Islands.

One candidate endangered species, the tree 'ohai (*Sesbania arborea*), was found.

### Vegetation Types

Four vegetation types are recognized within the project area and are discussed below.

#### 1. Scrub vegetation on lava

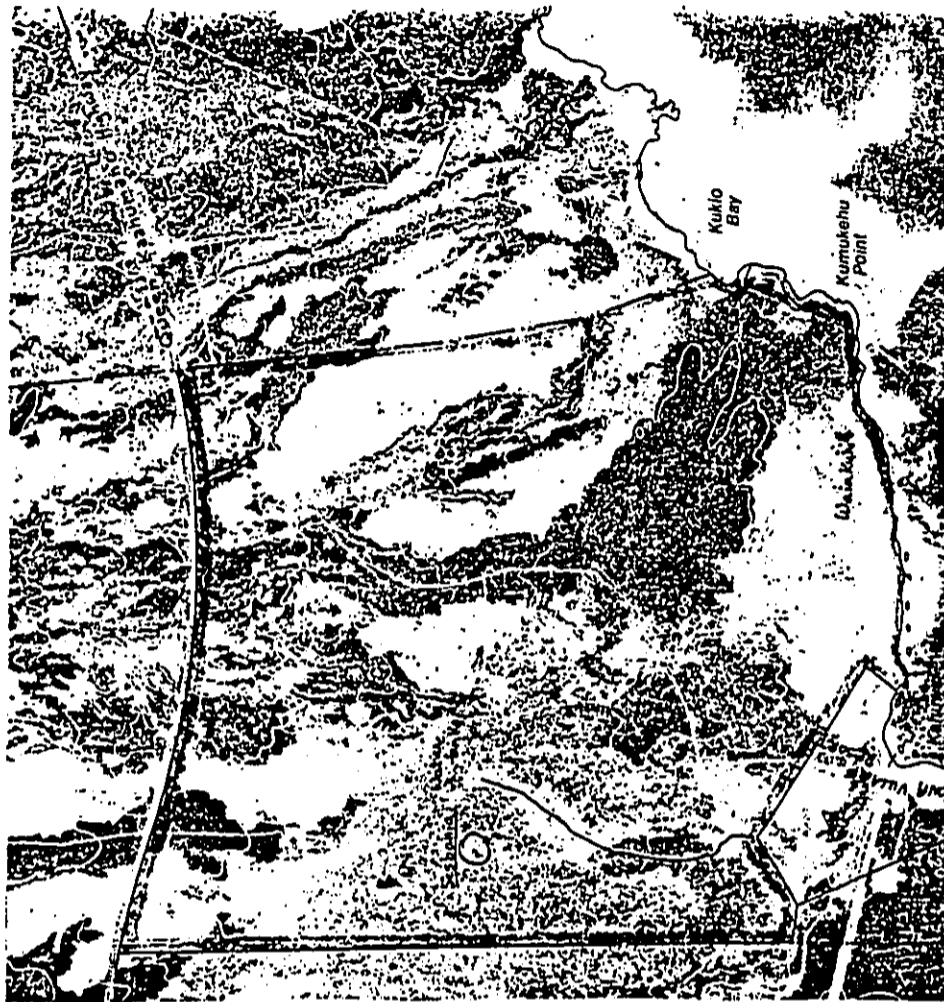
Both 'a and pahoehoe lava flows of different ages are found within the project area; the flows having all originated from Hualalai Volcano. The small, separate portion of the project area near Mahewalu Point is found on the 1801 Ka'upulehu Flow, an 'a flow; there have been no eruptions of Hualalai Volcano since the 1801 flows (Macdonald and Abbott 1970).

'A' flows consist of sharp, angular blocks and rough, scoriaceous fragments of lava; they appear as darker areas on the project map (Figure 1). In dry areas, such as the project site, 'a' flows remain largely bare for many decades or even hundreds of years (Carlquist 1970, Swathers and Mueller-Dombois 1973).

Within the project area a few plants such as 'uhaloa (*Waltheria indica* var. *americana*) and fountaingrass (*Pennisetum setaceum*) may be found on 'a' flows but these plants occur as widely scattered individuals.

Pahoehoe flows of various ages cover the majority of the project area. Pahoehoe flows are highly liquid and when they cool form ropey or sometimes bulky folds. The older flows are heavily oxidized and weathered; they are reddish-brown in color. Vegetative cover on these flows may vary from 10 to 20 percent. On flows which are not quite as old, vegetative cover may vary from 3 to 8 percent.

Vegetation on pahoehoe flows consists of a very open scrub composed of widely scattered, 1 to 3 meter tall kiawe (*Prosopis pallida*) trees and small shrubs of 'illima (*Sida cordifolia*), indigo (*Indigofera suffruticosa*), 'uhaloa, and nehe (*Lipochaeta lanana*) 0.3 to 1 meter tall. Fountaingrass is common. Herbs and other grasses encountered occasionally include *Ageratum conyzoides*, 'ihi (*Portulaca cyanosperma*), pua-kala (*Arenaria glauca*), *Spergularia* sp., *Eragrostis tenella*, and *Panicum* spp.



PROJECT AREA OUTLINED IN YELLOW

FIGURE 1. PROJECT AREA & LOCATION OF *SESBANIA ARBOREA* (TREE 'OHAI)



KAUPULEHU DEVELOPMENTS  
Kaupulehu, North Kona, Hawaii

One individual of the tree 'ohai (*Sesbania arborea*), a candidate endangered species, was found in this vegetation type.

A herd of 16 feral donkeys (*Equus asinus*), the famous "Kona nightingale", was seen on the pahoehoe flows near the water tanks. Feral or wild donkeys are now seldom seen, but at least two populations are established on the island of Hawaii (Toiaich 1969). Nineteen animals were counted from the air in 1964 in the lava fields of the Ka'upulehu-Kiholo area.

#### 2. Kiawe thicket

The kiawe thicket, as well as the strand and wetland vegetation types, occupies only a small portion of the study area near the coast. The kiawe thicket forms a dense, almost impenetrable, tangle of branches and thorns directly behind the strand and around the wetlands areas.

The kiawe trees are denser and taller (6 to 7 meters) here because of the fresh water seepage along the coast. In areas where the thicket is very dense, the ground beneath is heavily shaded and few herbs and grasses are found. In the more open areas of the thicket, such as along the unpaved road which runs through the thicket to the edge of Waiakehi Pond, a greater number of shrubs, vines, herbs, and grasses are found. These include 'uhaloa, pluchea (*Pluchea odorata*), koali-'awahia (*Ipomoea indica*), scarlet-fruited passionflower (*Passiflora foetida*), *Chenopodium* spp., 'alena (*Boerhavia diffusa*), 'ihi (*Portulaca* spp.), *Eragrostis tenella*, and fountaingrass.

A few trees of coconut (*Cocos nucifera*), nilo (*Theaspasia populnea*), Christmasberry (*Schinus terebinthifolius*), and hau (*Hibiscus kiliaceus*) can sometimes be found in the kiawe thicket.

#### 3. Strand

The strand vegetation is found on the sandy area between Waiakehi Pond and Kona Village Resort. Beach naupaka or naupaka-kahakai (*Scaevola taccada*) is the dominant plant and shrubs of naupaka form large patches 1 to 2 meters tall. Low growing plants such as Bermuda grass (*Cynodon dactylon*), 'aki'aki (*Sporobolus virginicus*), and pohuehue (*Ipomoea brasiliensis*) form small to medium-sized mats between the naupaka patches.

A few small trees of tree heliotrope (*Messerschmidia argentea*), coconut, kou (*Gordia subcordata*), and false kamani (*Ternstroemia catappa*) can be found scattered among the naupaka shrubs.

#### 4. Wetlands

Wetlands are defined by Elliott and Hall (1977) as a land area (coastal or inland) where water (fresh, saline or brackish) is the major factor controlling the development of soils and the development of the vegetative cover. Visually it is easily identified by the presence of water-loving plants and water-logged, often organic soils.

There were no large bodies of open water as in the nearby Kuki'o ponds; the Kuki'o ponds contain several which are 2 to 2.5 meters deep (Char 1984).

A few small pools of brackish water about a meter across and 14 to 30 centimeters deep were found in the area near the large 'a'a flow and the unpaved road.

Waiakehi Pond itself is composed of several, adjoining marshy areas. These marshy areas are made up of semi-dry organic muck, although there are a few areas with standing water, 12 centimeters deep. Maki sedge (*Scirpus validus*), 0.5 to 1 meter tall, covers most of the marshy areas. Patches of 'uki (*Cladium leptostachyum*), water hyssop (*Bacopa monnaria*), makaloa (*Cyperus lasvigatus*), and 'ohalo-kai (*Lycium sandwicense*) are occasionally encountered. Along the perimeter of Waiakehi Pond is a thick growth of shrubs and trees. Naupaka-kahakai is found on the seaward edge while hau, pluchea, and Christmasberry are found in the other parts.

A dense stand of American mangrove (*Rhizophora mangle*), up to 20 meters tall, is found on the Kona Village Resort side of the pond. The mangroves are probably growing in an anchialine pond.

#### Endangered Plant Species

No officially listed or recently proposed endangered or threatened plant species were observed within the study area. Of the native species observed, *Sesbania arborea* (tree 'ohai) is the only candidate endangered species. *Sesbania arborea* is listed as a category 1 species. A category 1 plant is defined as one for which the U. S. Fish and Wildlife Service presently has sufficient information on hand to support the biological appropriateness of it being listed as Endangered or Threatened (U. S. Department of the Interior 1980).

The Ka'upulehu plant represents an unusual find as *Sesbania arborea* has never been reported or collected from the island of Hawaii. Large populations are found on the slopes above Kaunakakai on Moloka'i (Deg. & Deg. 1978) and a few plants have been recently reported from Lihau, west Maui.

Even though an intensive search was made of the area, only one individual of the tree 'ohai was found within the project area. The plant had a few flowers (Figure 2) and a number of mature seed pods although no seedlings were found. It appeared healthy and vigorous.

The plant is located about 183 meters (600 ft.) from the water tanks in a northerly direction along a surveyor's transect line (Figure 1); it has been marked with long, blue flagging tape.

#### RECOMMENDATIONS

Although development of the project area will result in the loss of a number of native plants, the same species are also found in similar habitats throughout the North and South Kona areas. Development will not have a significant impact on the total island populations of those species found within the project area.

A golf course is planned for that part of the project area in which *Sesbania arborea*, a candidate endangered species, is found. It is recommended that the golf course be designed so that the area with the *Sesbania* be left intact. The undisturbed area should be no smaller than 30.5 meters (100 ft.) in diameter.

*Sesbania arborea* is an attractive large shrub to small tree and seeds from the Ka'upulehu plant should be collected and grown. The tree 'ohai as well as several other native species with "landscaping use potential" such as noho (*Lipochysta lavarua*), 'ilima (*Sida cordifolia*), *Sida fallax*, *Maespile* (*Capparis sandwicensis*), and puu-kala (*Argemone glauca*) should be used extensively in landscaping for the proposed developments. The native species are adapted to the environmental conditions of the area and will require less water, soil and care. Several places which have used native plants for landscaping include Maui Zoological and Botanical Garden, Wailea Arboretum, and Honolulu Botanic Gardens.

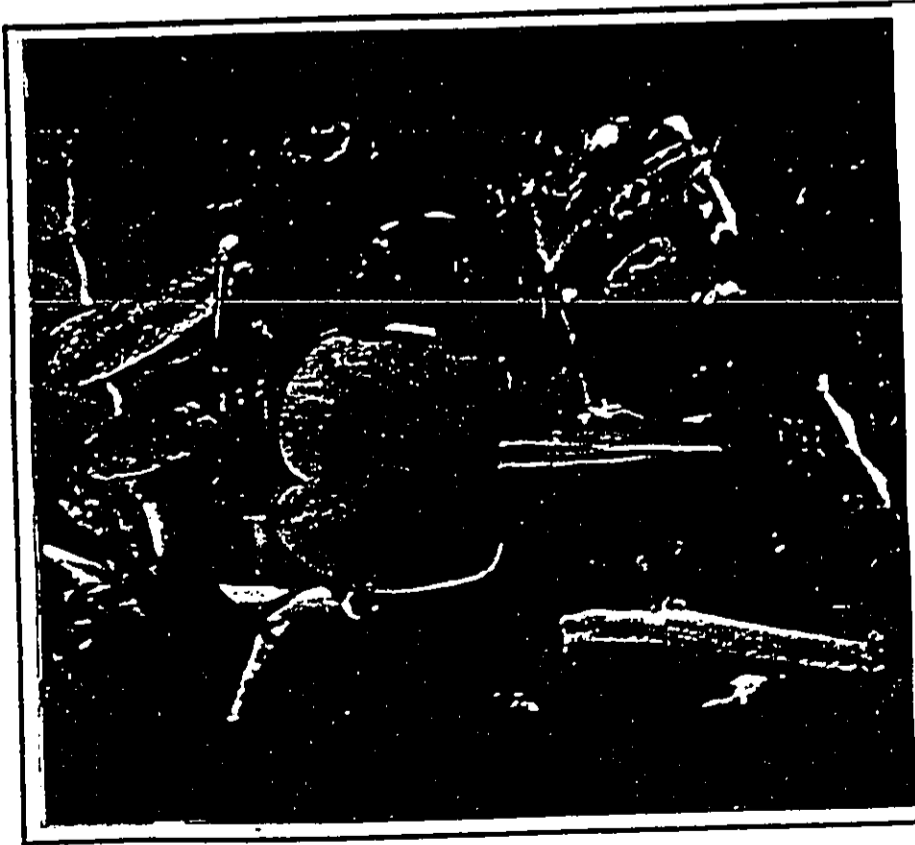


FIGURE 2. *SESBANIA ARBOREA* FLOWERS.  
From plant found in Ka'upulehu Developments Project  
Area, North Kona, Hawaii. Plant 1.4 meters (4.5 ft.)  
tall.

Photo by G. Linney

PLANT SPECIES CHECKLIST

KA'URULEHU DEVELOPMENTS

Families are arranged alphabetically within each of three groups: Ferns, Monocots, and Dicots. Within each family, genera and species are listed alphabetically. Taxonomy and nomenclature of ferns follow Lamouraux's unpublished checklist of ferns; taxonomy and nomenclature of flowering plants (Monocots and Dicots) follow St. John (1973) except where more commonly accepted names are listed. Hawaiian names used in the list are in accordance with Porter (1972) or St. John (1973).

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English or Hawaiian name, when known.
3. Biogeographic status of the species. The following symbols are used:  
 E = endemic = native to the Hawaiian Islands only, not naturally occurring elsewhere.  
 I = indigenous = native to the Hawaiian Islands but also occurring naturally in other geographical areas.  
 P = Polynesian introduction = all those plants brought to the Hawaiian Islands prior to contact with the Western world.  
 X = exotic or introduced = not native to the Hawaiian Islands; brought here by man deliberately or accidentally after Western contact.

4. Presence (+) or absence (-) of a species within each of four vegetation types found within the study area (see text for discussion).

- 1 = Scrub vegetation on lava
- 2 = Kiawe thicket
- 3 = Strand
- 4 = Wetlands

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3	4
<u>PERNS</u>						
<u>NEPHROLEPIDACEAE</u>						
<i>Nephrolepis multiflora</i> (Hook.) Jarrett ex Morton	Swordfern	X	-	-	-	-
<u>CYPERACEAE</u>						
<i>Cladium leptostachyum</i> Nees & Meyen	'Uki, native sawgrass		+	+	+	+
<i>Cyperus laevigatus</i> L.	Kakaloa, 'ehu'ahu		+	+	+	+
<i>Panicum sp.</i>			+	+	+	+
<i>Panicum subgenum Kunth</i>			+	+	+	+
<i>Pennisetum setaceum</i> (Forsk.) Chiov.	Fontainegrass		+	+	+	+
<i>Rhynchoselytrum repens</i> (Willd.) C. E. Hubb.	Natal redtop		+	+	+	+
<i>Sporobolus virginicus</i> (L.) Kunth	'Aki'aki		+	+	+	+
<i>Indet. 1</i>			+	+	+	+
<i>Indet. 2</i>			+	+	+	+
<u>PALMAE</u>						
<i>Coccothrinax L.</i>	Niu, coconut	P	-	-	-	-
<u>AMARANTHACEAE</u>						
<i>Amaranthus viridis</i> L.	Slender amaranth, pokai	X	-	-	-	-

PLANT SPECIES CHECKLIST  
KA'UPULEHU DEVELOPMENTS

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     to the Hawaiian Islands prior to contact  
     with the Western world.  
 X = exotic or introduced = not native to the Hawaiian  
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     or accidentally after Western contact.
4. Presence (+) or absence (-) of a species within each of  
 four vegetation types found within the study area (see  
 text for discussion).  
 1 = Scrub vegetation on lava  
 2 = Kiawe thicket  
 3 = Strand  
 4 = Wetlands

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPES			
			1	2	3	4
<u>FERNS</u>						
<u>NEPHROLEPIDACEAE</u>						
<i>Nephrolepis multiflora</i> (Roxb.) Jarrett ex Morton	Swordfern	X	+	-	-	-
<u>MONOCOTS</u>						
<u>CYPERACEAE</u>						
<i>Cladium leptostachyum</i> Nees & Meyen	'Uki, native sawgrass	E	-	-	-	+
<i>Cyperus laevigatus</i> L.	Makaloa, 'ehu'awa	I	-	-	-	+
<i>Fimbristylis</i> sp.		I	+	-	-	+
<i>Scirpus paludosus</i> A. Nel.	Makai	I?	-	-	-	+
<i>Scirpus</i> sp.		I?	-	-	-	+
<u>GRAMINEAE</u>						
<i>Chloris inflata</i> Link	Swollen fingergrass, mau'ulei	X	+	-	-	-
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass, manienie	X	-	-	+	+
<i>Eragrostis tenella</i> (L.) Beauv. ex R. & S.	Japanese lovegrass	X	+	+	-	-
<i>Panicum nubigenum</i> Kunth		E	+	+	-	-
<i>Panicum</i> sp.		E	+	+	-	-
<i>Pennisetum setaceum</i> (Forak.) Chiov.	Fountaingrass	X	+	+	-	-
<i>Rhynchelytrum repens</i> (Willd.) C. E. Hubb.	Natal redtop	X	+	+	-	-
<i>Sporobolus virginicus</i> (L.) Kunth	'Aki'aki	I	+	+	-	-
Indet. 1		X	+	+	-	-
Indet. 2		X	+	+	-	-
<u>PALMAE</u>						
<i>Cocos nucifera</i> L.	Niu, coconut	P	-	+	+	+
<u>DICOTS</u>						
<u>AMARANTHACEAE</u>						
<i>Amaranthus viridis</i> L.	Slender amaranth, pakai	X	-	+	-	-



SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPES			
			1	2	3	4
<b>ANACARDIACEAE</b>						
<i>Schinus terebinthifolius</i> Raddi	Christmasberry	X	-	+	-	+
<b>ASCLEPIADACEAE</b>						
<i>Calotropis gigantea</i> (L.) R. Br. ex Ait. f.	Crown flower	X	+	-	-	-
<b>BORAGINACEAE</b>						
<i>Gordia subcordata</i> Lam.	Kou	P	-	+	+	-
<i>Messerschmidia argentea</i> (L. f.) Johnston	Tree heliotrope	X	-	+	+	-
<b>CAPPARADACEAE</b>						
<i>Capparis sandwichiana</i> var. <i>zoharyi</i> Deg. & Deg.	Maiapilo, pua-pilo	E	+	+	-	-
<b>CARYOPHYLLACEAE</b>						
<i>Spergularia</i> sp.		X	+	+	-	-
<b>10 CHENOPODIACEAE</b>						
<i>Atriplex semibaccata</i> R. Br.	Australian saltbush	X	-	+	-	-
<i>Chenopodium album</i> L.	Pigweed	X	-	+	-	-
<i>Chenopodium carinatum</i> R. Br.	Keeled goosefoot	X	+	+	-	-
<b>COMBRETACEAE</b>						
<i>Terminalia catappa</i> L.	False kamani	X	-	-	+	-
<b>COMPOSITAE</b>						
<i>Ageratum conyzoides</i> L.	Ageratum, maile hohono	X	+	+	-	-
<i>Emelia fosbergii</i> Nicol.	Red pua-lele	X	+	+	-	-
<i>Lipochaeta lavarum</i> (Gaud.) DC.	Nehe	E	+	-	-	-
<i>Pluchea odorata</i> (L.) Cass.	Pluchea	X	+	+	-	+
<i>Sonchus oleraceus</i> L.	Sow thistle, pua-lele	X	+	+	-	-
<i>Tridax procumbens</i> L.	Coat buttons	X	+	+	-	-
<i>Verbesina encelioides</i> (Cav.) B. & H. ex Gray	Golden crown-beard	X	+	-	-	-
<i>Vernonia cinerea</i> (L.) Less.	Ironweed	X	+	+	-	-

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPES			
			1	2	3	4
<b>CONVOLVULACEAE</b>						
<i>Ipomoea brasiliensis</i> (L.) Sweet	Pohuahue	I	-	+	+	-
<i>Ipomoea indica</i> (Burm.) Merr.	Koali-'awahia	I	+	+	-	-
<i>Jacquemontia sandwicensis</i> Gray	Pa'u-o-hi'i-aka	E	+	+	-	-
<b>CUCURBITACEAE</b>						
<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Watermelon, ipu	X	+	-	-	-
<i>Cucumis dipsaceus</i> Ehrenb. ex Spach	Wild cucumber	X	-	+	-	-
<i>Momordica charantia</i> var. <i>pavel</i> Grantz	Balsam pear, peria	X	+	-	-	-
<b>EUPHORBIACEAE</b>						
<i>Euphorbia hirta</i> L.	Garden spurge, koko- kahiki	X	+	-	-	-
<b>GOODENIACEAE</b>						
<i>Scaevola taccada</i> (Gaertn.) Roxb.	Naupaka-kahakai, beach naupaka	I	-	+	+	+
<b>11 LABIATAE</b>						
<i>Hyptis pectinata</i> (L.) Poit.	Comb hyptis	X	+	-	-	-
<i>Ocimum grattissimum</i> L.		X	-	+	-	-
<b>LEGUMINOSAE</b>						
<i>Cassia lechenaultiana</i> DC.	Partridge pea, lauki	X	+	-	-	-
<i>Indigofera suffruticosa</i> Mill.	Indigo, 'iniko	X	+	+	-	-
<i>Prosopis pallida</i> (Humb. & Bonpl. ex Willd.) HBK.	Kiawe, algaroba	X	+	+	-	-
<i>Sesbania arborea</i> (Rock) Deg. & Deg.	Tree 'ohai	E	+	-	-	-
<b>MALVACEAE</b>						
<i>Hibiscus tiliaceus</i> L.	Hau	I	-	+	+	+
<i>Sida cordifolia</i> L.	'Ilima	I	+	-	-	-
<i>Sida fallax</i> Walp.	'Ilima	I	+	+	+	-
<i>Thespesia populnea</i> (L.) Soland. ex Correa	Milo	P	-	+	+	-

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SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPES			
			1	2	3	4
MORACEAE <i>Ficus microcarpa</i> L. f.	Chinese banyan	X	+	+	-	-
MYOPORACEAE <i>Myoporum sandwicense</i> Gray	Naio	E	+	-	-	-
NYCTAGINACEAE <i>Boerhavia diffusa</i> L.	'Alena	I	-	+	-	-
PAPAVERACEAE <i>Argemone glauca</i> Pope	Pua-kala	E	+	+	-	-
PASSIFLORACEAE <i>Passiflora foetida</i> L.	Scarlet-fruited passionflower	X	-	+	-	-
PORTULACACEAE <i>Portulaca cyanosperma</i> Egler <i>Portulaca oleracea</i> L.	'Ihi Common purslane, 'ihi	E X	+	+	-	-
RHIZOPHORACEAE <i>Rhizophora mangle</i> L.	American mangrove	X	-	-	-	+
RUBIACEAE <i>Morinda citrifolia</i> L.	Noni	P	+	+	-	-
SAPINDACEAE <i>Dodonaea viscosa</i> Jacq.	'A'ali'i	I	+	-	-	-
SCROPHULARIACEAE <i>Bacopa monniera</i> (L.) Wettst.	Water hyssop	I	-	-	-	+
SOLANACEAE <i>Lycium sandwicense</i> Gray <i>Lycopersicon pimpinellifolium</i> Mill. <i>Solanum nigrum</i> L.	'Ohelo-kai Currant tomato Popolo	I X I	- - +	- + -	- - -	+ - -

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SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPES			
			1	2	3	4
STERCULIACEAE <i>Waltheria indica</i> var. <i>americana</i> (L.) R. Br. ex Hosaka	Hi'aloa, 'uhaloa	I	+	+	-	-
VERBENACEAE <i>Lantana camara</i> L.	Lantana, lakana	X	+	-	-	-

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AN AVIFAUNAL AND FERAL MAMMAL SURVEY  
OF PROPERTY PROPOSED FOR A RESORT-  
RESIDENTIAL DEVELOPMENT AT KAUPULEHU,  
HAWAII.

AN AVIFAUNAL AND FERAL MAMMAL SURVEY  
OF PROPERTY PROPOSED FOR A RESORT-  
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INTRODUCTION

This report summarizes the results of a two and one half day (19-21 April 1985) bird and feral mammal survey of approximately 564 acres of property located makai of Queen Kaahumanu Highway between Kukio Bay and just north of Mahewalu Point at Kaupulehu, Hawaii. References to pertinent literature and unpublished reports are also included.

Prepared for

Kaupulehu Developments

by

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The major objectives of the field survey were to document what bird and feral mammal species occur in the area and at what relative densities. Additionally, an assessment of habitat references was to be investigated. If any "endangered" species were discovered on the site special attention was to be directed towards determining their dependence on resources located within the area.

25 April 1985

#### STUDY METHODS AND GENERAL SITE DESCRIPTION

##### METHODS:

Field observations were made with binoculars and by listening for vocalizations while walking along existing paths within the project area. At four sites, three in the forested coastal zone and one in open grassland and lava flow, eight minute counts were made of all birds seen or heard. These counts were conducted twice daily throughout the survey, once before 10 am and again after 4 pm. Information from these eight minute counts plus observations and counts made while walking through all accessible parts of the project site were used as the basis for population estimates and additionally were helpful in determining general distribution patterns and ecological preferences for each species. Observations of feral mammal activity (tracks, scats and skeletal remains) were also noted during the survey. No attempt to trap mammals in order to obtain data density and distribution were made. A special effort to look for the Hawaiian Hoary Bat (Lasiurus cinereus semotus) which is known to occasionally occur in small numbers along the Kona Coast (Tomich

1969, 1974; Bruner 1984 b) was made on the evenings of 19 and 20 April 1985.

##### GENERAL SITE DESCRIPTION:

Weather during the field survey was generally overcast with little or no wind except on the evening of 20 April when a gusty N.E. wind commenced about 4 pm. The habitat on the project site is comprised of five recognizable types: a coastal forest of Kiawe (Prosopis pallida) Milo (Thespesia populnea) and coconut palms (Cocos nucifera); a small grass and mangrove choked coastal wetland with small anchialine ponds; sandy beach with a rocky shelf exposed at low tide; open grassland; and barren lava flows. The latter two habitat types comprise the largest portion of the total project site.

##### RESULTS AND DISCUSSION

##### Resident Indigenous (Native) Bird Species:

Black-crowned Night Heron (Nycticorax nycticorax)

'Auku'u, the Hawaiian name for the Black-crowned Night Heron, are seen in small numbers along the Kona coast (Shallenberger 1977) usually around coastal ponds

where they forage after small fish, crustaceans, mice, and even the eggs and young of other birds (Andrews 1981, Hawaii Audubon Society 1984). This species is the only native waterbird not listed either by the State of Hawaii or the USFWS as Endangered. A single 'Auku'u was recorded on the morning of 20 April as it flew from the wetland at the S. edge of the site. The bird flew in the direction of the ponds at Kona Village Hotel. Incidental observations made at Kona Village Hotel grounds on 21 April revealed six 'Auku'u, three adults and three juveniles, foraging around the fishponds. It is likely that the patch of tall dense mangrove located on the project site acts as a roost and perhaps even a rookery for this species. Certainly other birds notably Common Myna (Acridotheres tristis) and Spotted Dove (Streptopelia chinensis) utilize this grove of trees for roosting as approximately 150 Common Myna and 25 Spotted Dove were counted coming to roost on the evening of 19 April. The present wetland on the project site may offer limited foraging opportunities due to the overgrowth of emergent vegetation. Fecal remains left on rocks around the wetland, however, indicate that birds do use the wetland as these fecal remains contained the small red shrimp common in the anchialine ponds at this site.

No other native resident birds were recorded on the project site, however, Hawaiian Stilt (Himantopus mexicanus knudseni) were observed at the anchialine ponds just outside the project area at Kukio Bay. The present condition of the wetland at Kaupulehu likely precludes extensive use by stilt, more open water with shallow areas for wading would enhance the habitat for stilt and other native waterbirds seen along the Kona coast such as the Hawaiian Coot (Fulica americana alai).

Migratory Species:

Pacific Golden Plover (Pluvialis fulva) - Only one individual was recorded during the survey, a female in breeding plumage. Pacific Golden Plover breed in W. Alaska and E. Siberia and winter in the Pacific as far south as New Zealand. While on the wintering grounds some individuals establish foraging territories that they defend throughout the day. This behavior is imprinted during the first or second year of their life. Each fall as they return from the breeding grounds they reoccupy the exact same territories (Johnson et al. 1981, Bruner 1983). The paucity of plover on the project area is not altogether unexpected as some may have already migrated north, in addition the amount of suitable plover habitat, short grassy lawns

and mud flats, is not presently available at Kaupulehu.

Sanderling (Calidris alba) -

This species also breeds in the arctic and winters in the Pacific. Sanderling forage along sandy beaches, intertidal zones and mud flats. They are non-territorial under most situations (Myers et al. 1981). A total of four Sanderling were seen during the survey.

Wandering Tattler (Heteroscelus incanus) -

Wandering Tattler likewise winter in the Pacific and breed in the arctic. They forage singly along rocky shorelines and around ponds. No detailed banding studies have been conducted on this species in order to determine how site faithful they may be or whether or not they establish winter foraging territories. Recent, 1985, observations by S. Conant (pers. comm.) on Laysan Island indicates that Wandering Tattler might be territorial at least in conditions where foraging opportunities make such behavior profitable and necessary. A total of eight Wandering Tattler were counted along the course of the survey. If these birds were territorial it is likely only two or three birds actually occur at the project site and were recounted each day of the survey.

Not seen during the survey but likely to occur on the project site are Ruddy Turnstone (Arenaria interpres).

Migratory Ducks utilize the coastal ponds in Hawaii for wintering. A pair of Northern Shoveler (Anas clypeata) were recorded at the anchialine ponds at Kukio Bay on 20 April 1985. The absence of sizeable areas of open water at the Kaupulehu wetland likely limits this sites present usefulness for migratory ducks.

Exotic (Introduced) Bird Species:

A total of eleven species of exotic birds were recorded during the survey. Table I describes their relative abundance and general habitat preferences. In species where only male vocalize population estimates often are on the low side particularly in those species where the counts are primarily determined by auditory means. Japanese Whiteeye (Zosterops japonica) and Zebra Dove (Geopelia striata) were the most abundant species. The three Rock Dove (Columba livia) seen flying over the site may not have been feral. Common Myna and House Sparrow (Passer domesticus) were not observed except in the area adjacent to Kona Village Hotel grounds and as noted earlier, myna roosted in large numbers in the mangrove thicket at the south end of the project site. A number of game birds have been introduced over the years to the island of Hawaii (Schwartz and Schwartz 1949, Berger 1972). Populations of these species tend to be very localized. Field surveys by Bruner (1984a,

1984b, 1985) have consistently shown Gray Francolin (Francolinus pondicerianus) to be the most common of the larger game birds along the Kona coast. Other species which, although not recorded, might occur in the area are: Erckel's Francolin (Francolinus erckelii), Black Francolin (Francolinus francolinus) and Japanese Quail (Coturnix japonica). Also not recorded but known from the Kona coast in habitat similar to that at Kaupulehu were Northern Mockingbird (Mimus polyglottos) and Warbling Silverbill (Lonchura malabarica).

Feral Mammals:

Mongoose were recorded on all days of the survey. Visual as well as auditory and scat/track observations indicated a common to abundant status for this species. Observations of rodents were limited to one road killed mouse (Mus musculus). In order to obtain data on abundance and distribution of rodents a long term trapping program would need to be made. Dogs and cats apparently utilize the site as both tracks and scats were found. Evidence in the form of scats, tracks and skeletal remains revealed that Goat (Capra hircus) and Donkey (Equus asinus) occur with regularity at Kaupulehu. Van Riper and Van Riper III (1982) report that Kaupulehu is one of the last areas in Hawaii to still harbor feral donkeys.

The native Hawaiian Hoary Bat occurs sporadically along the Kona coast as evidenced by the sightings and specimens taken at Waikoloa (Bruner 1984c, 1985). Despite attempts on two evenings to observe the bat at Kaupulehu none were seen. This is not to say none have ever occurred or may occur at this site. Too little is presently known about the movements and natural history of this species to draw firm conclusions. It is possible, as was suggested in the Waikoloa study (Bruner 1985), that development and the insect attracting properties of lights might actually serve to encourage use of the area for foraging bats. Only time will tell if this hypothesis is in fact true.

CONCLUSIONS

The project site for proposed development at Kaupulehu has the usual mix of exotic birds that one would expect for this sector of the Kona coast. The absence of Warbling Silverbill, however, was a bit enigmatic. Mockingbirds, on the other hand, have a patchy and localized distribution pattern so it was not as unusual for this species to be absent from the site yet present in other areas of similar habitat along the Kona coast. The limited forested areas on the project site support most of the



bird life. The open grasslands and lava flows are quite depauperate by comparison. The absence of Hawaiian Stilt and other native and migratory waterfowl from the wetlands at Kaupulehu is to be expected given the present overgrown state of the anchialine ponds. The grove of mangrove at the N. end of the wetland serves as a roosting site for large numbers of birds. Nesting may also be occurring at this grove. The low numbers of migratory shorebirds seen may be due in part to time of year (northward migration may have already commenced) and lack of suitable habitat i.e. short grassy fields and mud/sand flats.

Feral mammals noted were those typical of this type of habitat along the Kona coast. The exception was the feral donkey which is now more or less restricted to the Kaupulehu area and a few other localities from S. Kona to Kawaihae (Van Riper and Van Riper III 1982). Although no donkey were actually seen during the survey evidence of their presence in the form of scats and tracks were numerous. Skeletal remains of donkey were also common. No Hawaiian Hoary Bat were recorded. The patchy distribution of this species needs to be investigated. Questions such as how resident are localized populations and how frequently do they move, as well as what features of a habitat are likely to attract bats are details of their natural history that at present are poorly understood.

#### Possible Impact of Development

The landscaping of large areas of presently bare lava and open grassland will undoubtedly create a new and more diversified habitat that will increase the present populations of most exotic species of birds on the property, particularly Common Myna and House Sparrow. The clearing of some of the encroaching vegetation in the wetland may make this area more attractive to waterbirds especially if some shallow wading and mud/sand flats are created. Depending on the size of the eventual wetland and its proximity to development will in large measure determine its final value as a wetland refuge for native and migratory waterbird. The natural anchialine ponds can be made to serve both an esthetic as well as functional role in Hawaii's limited wetland refuges. The presence of Mallard Duck (Anas platyrhynchos) and Common Peafowl (Pavo cristatus), such as occur at Kona Village, does not contribute to maintaining the "natural" beauty of Hawaii. In fact Mallard have been shown to hybridize with the native Hawaiian Duck (Anas wyvilliana), a situation which threatens to disrupt the species integrity of the Hawaiian Duck (Hawaii Audubon Society 1984). It is therefore suggested that efforts be made to create a wetland that would be suitable to native waterbirds. Such a wetland could become a real asset to the natural beauty of the final development scheme.

KEY TO TABLE I

RELATIVE ABUNDANCE = Number of times observed during survey or frequency on eight-minute counts plus walking counts.

A = Abundant (ave. 10+) (number which follows is ave. of all surveys 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 or on only one or two of the count periods. Number which follows is the actual number seen or heard).

HABITAT = Area most frequented. Order of most preferred or utilized begins at left.

G = Grassland (open grassy areas)

K = Kiawe/Milo thickets

E = Edge of roads or other breaks in the vegetation

L = Lava flows (mostly barren)

TABLE I

Relative abundance and habitat preference of exotic birds recorded at Kaupulehu, Hawaii.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*	HABITAT*
Gray Francolin	<u>Francolinus pondicerianus</u>	C = 5.8	G, E, K, L
Rock Dove	<u>Columba livia</u>	R = 3	E
Spotted Dove	<u>Streptopelia chinensis</u>	U = 2.3	K, E
Zebra Dove	<u>Geopelia striata</u>	A = 11.8	K, E, G, L
Common Myna	<u>Acridotheres tristis</u>	U = 2.5	E
Japanese Whiteeye	<u>Zosterops japonica</u>	A = 14.7	K
Northern Cardinal	<u>Cardinalis cardinalis</u>	C = 6.9	K
Yellow-billed Cardinal	<u>Paroaria capitata</u>	U = 1.2	K
House Sparrow	<u>Passer domesticus</u>	R = 4	E
House Finch	<u>Carpodacus mexicanus</u>	C = 6.3	K
Nutmeg Mannikin	<u>Lonchura punctulata</u>	C = 5.8	G, E, K

\* (See page 13 for key to symbols)

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Ms. 020585

AN ARCHAEOLOGICAL RECONNAISSANCE OF  
THE MAKAI PARCEL OF KA'UPULEHU AHUPUA'A,  
NORTH KONA, HAWAII ISLAND

by  
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for  
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February 1985

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INTRODUCTION

This report presents the results of an archaeological reconnaissance of approximately 2,800 acres (1,134 ha) in the ahupua'a of Ka'upulehu, North Kona, Hawaii Island (Fig. 1). The fieldwork was conducted from 10 September through 28 September 1984 by the Department of Anthropology, Bernice P. Bishop Museum, under contract to Barnwell Industries, Inc. The author served as Field Director, and was assisted by Jennie Peterson and Patti Spears.

The objectives of the survey were to:

- (1) locate and record any previously undocumented sites;
- (2) relocate previously recorded sites, noting present condition;
- (3) identify and locate any areas with probable subsurface deposits; and
- (4) recommend appropriate work details for subsequent phases of archaeological investigations.

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Objectives (1) and (3) were met during the fieldwork phase of this project. Relevant data are presented below. Objective (2) was partially met. Sites 50-Ha-D22-1 through 5, 25, 26, 28, 29, 41, 42, 43, and 202 were not field checked due to lack of sufficient time in the field.\* Objective (4) is met by the recommendations section of this report. Recommendations concerning mitigation of probable adverse impacts on cultural resources due to proposed construction activities and/or preservation of selected archaeological sites will be made following subsequent phases of archaeological investigations.

ENVIRONMENT

The survey area is visibly a barren expanse of aa and pahoehoe lava flows. Ka'upulehu is arid, and generally lacking in vegetation. This area is included in what is considered to be the Kekaha area of Kona (the general place name Kekaha is given to those areas that are primarily lava fields in Kona). Kekaha includes all of the coastal area north of Kailua to 'Anaeho'omalu (Kelly IN Rosendahl 1973).

Ka'upulehu is a coastal area, like 'Anaeho'omalu and Kalāhuipua'a, and has several closed or anchialine ponds. These ponds usually contain brackish water. \*Site numbers for Ka'upulehu have been newly designated, refer to Table 1.

water and are used both as sources of potable water and as fishponds. One such anchialine pond is located near the coast in the Waikukui area.

Additional water resources, in the form of wells, exist within the coastal area (Stearns and Macdonald 1946:287). Of the six wells cited within the area, two are listed as "Hawaiian well" and "Ancient Hawaiian well," respectively. The latter is located within the 1800-1801 lava flow. None of these wells were located during the present survey. Efforts made by the author to obtain a map that provided the location of these wells was unsuccessful.

The climate at Ka'upulehu is arid and hot, with constant trades blowing from the south-southwest. Rainfall averages less than 10 in. annually (Ibid). There are no streams or water-courses within the area, however, rainwater does collect in the many pahoehoe lava crevices.

Vegetation within the survey area contains a variety of plant species that are common to lava expanses. The following plants constitute a sample inventory of what was found throughout much of the open area of pahoehoe flows (botanical names were taken from Neal 1965); the aa flows within the survey area were devoid of vegetation: 'Ilias (*Sida fallax*); indigo (*Indigofera suffruticosa*); 'a'ali'i (*Dodonaea*)—only three of these shrubs were noted; puu-kala (*Argemone glauca*); noni (*Morinda citrifolia*); crown flower or giant milkweed (*Calotropis gigantea*); puu-pilo (*Capparis sandwichiensis*); fountain grass glory (*Ipomoea hederacea*); puu-pilo (*Capparis sandwichiensis*); fountain grass (*Pennisetum setaceum*); kiawe (*Prosopis pallida*). Fountain grass predominates in occasional isolated pockets of older pahoehoe flows. Kiawe is sometimes found clustered in these same isolated pockets, but is more common near the coast. *Naupaka-kahakai* (*Scaevola sericea*) and morning-glory covered the coastal grounds. These two creepers usually fringed sizable stands of *kiawe*, and created a formidable barrier between the beach and the barren lava fields.

FIELD METHODS

The survey was conducted by walking transects across the project area, locating sites as we proceeded. The three-person team was spaced

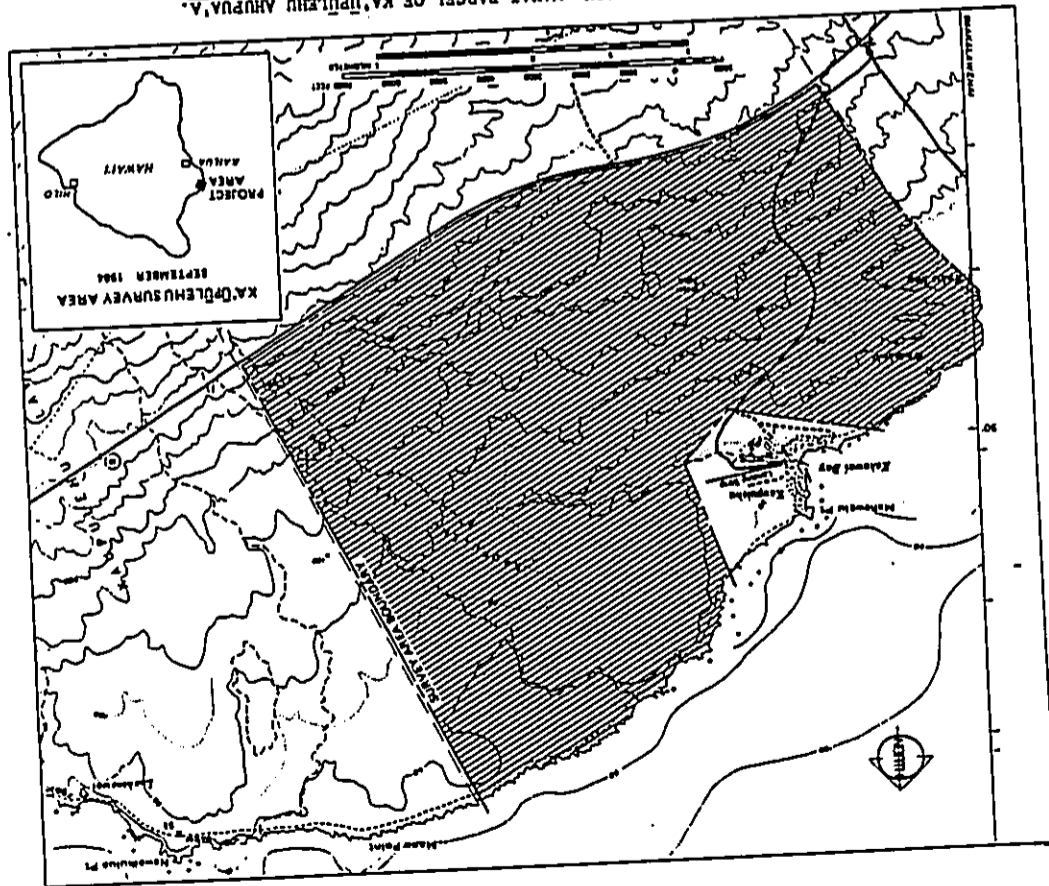


FIG. 1. SURVEY LOCATION, HAKAI PARCEL OF KA'UPULEHU AHUPUA'A.

approximately 30 m apart while walking each transect. Most sites were photographed and sketch-mapped. All sites were plotted on a transparent mylar overlay of an enlarged U.S.G.S. ortho-photo at a scale of 1":400'.

The 2,800-acre area surveyed includes roughly 600 acres of unbroken aa flows. The majority of this area consists of the 1800-1801 Ka'upulehu flow, which can be found on the eastern boundary and on the western edge between Kūki'o Bay and Waikūhi. Although all edges of the flows were surveyed, the interiors were not. With the exception of the sandy coastal areas, which had been surveyed previously, the project area was surveyed completely.

Time allotted for surveying sites recorded by Reinecke (1930) and Soehren (1963) was limited. As Field Director I decided that time allotted for the survey should be spent in those areas not previously surveyed. Therefore, the coastal areas, which have been covered twice previously, were not resurveyed during this project.

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PREVIOUS ARCHAEOLOGICAL WORK IN THE KA'UPULEHU AREA

The earliest archaeological survey in the Ka'upulehu area was conducted by John Reinecke (1930). His investigation included portions of the present survey area, and was intended to document the sites between Kailua, Kona and Kalāhuipua'a, Kohala. Reinecke's manuscript describes the coastal sites found within the area (his numbers 118 through 125). The feature descriptions, unfortunately, do not provide the detail that is required of archaeological work today. Site complexes were often given no more attention than a brief listing of features. These sites were plotted on a map, but only a few were sketched and/or photographed.

Lloyd Soehren, accompanied by Kenneth Emory, conducted a survey of the area for Bishop Estate in 1963. Much of Reinecke's work was duplicated, but Soehren also surveyed portions of the inland area. His notations on the general condition of some of the sites were found to be quite useful in determining the extent of change over time; however, his work, like Reinecke's, does not provide the detail required of archaeological work today. Nineteen of Soehren's sites are included within the present project area.

Francis Ching (1971) and his crew surveyed the present Queen Ka'ahumanu Highway Corridor, Section III, between June and October 1970. The corridor surveyed was 2,000 ft wide and 23 mi. long (Ibid:22). Nineteen sites recorded by Ching (1971) are located within the present survey area, but only ten were relocated during this project.

A state-wide archaeological site inventory was conducted by the State of Hawaii between the years 1971 and 1975. State site numbers were given to seven of the sites within Ka'upulehu ahupua'a. However, I was unsuccessful in trying to recover information regarding sites 50-10-19-4708 and -4709, because there were no site forms for these two sites.

Eric Komori (1981) was the last to conduct a survey within the area. He recorded eleven sites, including eight of Soehren's sites, and one of Reinecke's sites.

In an effort to clarify site numbering within the ahupua'a, all duplicate numbers were eliminated, and sites located by Ching (1971) or assigned State numbers in the state-wide inventory done between 1971 and 1975 were assigned B. P. Bishop Museum site numbers (see Table 1).

SURVEY RESULTS

A total of 204 sites have been located within the makai section of Ka'upulehu ahupua'a (see Map A). Of these sites, 195 are within the present project area, 9 are not. Forty-seven of these sites within the study area were previously recorded. Table 2 describes the sites within the project area; and Table 3 provides their current B. P. Bishop Museum site numbers, along with their corresponding manuscript reference.

During the present survey 151 new sites were documented. Some sites contain only one feature (e.g., an isolated C-shape), whereas others include a complex of features. The distribution of these features by type provides a clear idea of the variation of land use in the area. A distribution of features by formal and functional category is provided in Table 4. A total of 802 features were identified according to 25 feature categories for the newly recorded sites. The following descriptions summarize the major feature categories listed in Table 4.



Table 2  
DESCRIPTIONS OF SITES WITHIN SURVEY AREA

BPHM Site No. 50-Ha-D22-	Site Type	BPHM No. 50-Ha-D22-	Site Type
1	House Site	50	Shelters
2	Enclosure	51	Hidden Scatter
3	Enclosure	52	Trail
4	Enclosure, Salt Pans	53	Enclosure
5	Enclosure, Salt Pans	54	Enclosure
6	Shelter Cave	55	Crescent-Shape Structure
7	Enclosure	56	Shelter
8	Enclosure	57	Pahoehoe Clearings
9	Enclosure	58	Pahoehoe Clearings
10	Enclosure, Cemented Stone Mound	59	Shelter Cave, Pahoehoe Clearings
11	Shelter Cave	60	Hidden Scatter, Pahoehoe Clearings
12	Enclosure, Shelter Cave	61	Shelter Cave, Pahoehoe Clearings
13	Enclosures, C-Shapes	62	Shelter Cave, Pahoehoe Clearings
21	Enclosures, Platforms	63	Shelter Cave, Pahoehoe Enclosures
22	Burial Cave, House Site	64	Modified Ridge Garden
23	Petroglyphs		Modified Ridge Garden
24	Animal Pens		Enclosures
25	Burial Mounds	65	Shelter, Hidden Scatter
26	Trail	66	Shelter
27	Shelter	67	Hidden Scatter & Pahoehoe Clearings
28	Fishpond	68	Shelter Cave
29	Animal Pen	69	Shelter Cave
30	Shelter Cave	70	Shelter Cave
31	Unknown (no State site form)	71	Burial Cist
32	Alignments	72	Isolated Find
33	Alignment, Cairns	73	Modified Ridge Garden
34	Trail	74	Trail
35	Dwelling Cave	75	Shelter/Burial Cave
36	Trail	76	Shelter Cave
39	Circular Enclosure	77	Shelter Cave
40	Trail	78	Trail
41	Historic Wall	79	Pahoehoe Clearings, Petroglyphs, Papamu, Shelters
42	C-Shape Structure		Shelters
43	Platforms, Other Features	80	Shelter/Burial Cave
44	Enclosure, Cairns	81	Pahoehoe Clearings
45	Cairn	82	Burial Cist
46	Enclosures, C-S	83	Shelter Cave
47	Platforms, Other Features	84	Pahoehoe Clearings
48	Shelter Cave	85	Shelter with Pahoehoe Clearings
49	Hidden Scatter		

Table 1  
NEW BISHOP MUSEUM SITE NUMBERS FOR PREVIOUSLY SURVEYED AND NUMBERED SITES IN KA'UPULEHU ARIPIUA'A

New BPHM Numbers 50-Ha-D22-	Old BPHM Numbers 50-Ha-D22-	Reinecke 1930 No.	Soehren 1963 50-Ha-D22-	Ching 1971 50-10-19-	State 1975 50-10-19-	Kono 1981 50-Ha-D-22
1	34	125	1			
2	34	125	2			
3	34	125	3			
4	33	124	4			
5	33	124	5			
6			6			
7	33	124	7			
8	33	124	8			
9	32	123	9			
10	32	123	10			
11	32	123	11			
12	32	123	12			
13	31	122	13			
14	30	121	14			
15			15		4707	
16			16		4707	
17			17		4706	
24			24		4711	
27	28	118				47
28	28	119				
29	29	120			4710	
30					4708	
31					4709	
35				1140		
36				1141		
39				1162		
40				1193		
47			27	1146-1152		
79				1144		
80				1161		
91				1138		
200				1139		
201				1143		
202				1153		
203				1154		
204						



Table 2 (cont'd.)

BPHM Site No. 50-Ha-D22-	Site Type	BPHM No. 50-Ha-D22-	Site Type
159	C-Shape Structure	183	Alignment, Cairn
160	Shelter Cave	184	C-Shape Structure
161	Pahoehoe Clearings	185	Alignment & Cairn
162	Shelter Cave, Cairns	186	Enclosures
163	Shelter Cave, Platform	187	Shelter
164	C-Shape Structure	188	Crescent-Shape Structure, Cairn
165	Shelter Cave, Other Features	189	Ahupua'a Boundary Shrine
166	Enclosure, Shelter	190	C-Shape Structure, Cairn
167	Petroglyphs (Modern)	191	Cairns
168	Circular Enclosure	192	Alignment, Cairn
169	Pahoehoe Clearings	193	Shelter Caves, Petroglyph
170	Alignment	194	Circular Enclosure, Other Features
171	Crescent-Shape Structure	195	Shelter Cave
172	C-Shape Structure	196	Trail
173	Rectangular Depression	197	Hidden Scatter
174	Cairns, Alignments	198	Shelter Cave
175	Crescent-Shape Structure	199	Shelter Cave
176	Shelter Cave, Other Features	200	Trail
177	Walled Clearing	201	Shelter
178	Trail	202	Petroglyph
179	Wall	203	Shelter Cave
180	Historic Wall	204	Shelter Cave
181	Cave Shelters		
182	L-Shape Structure, Cairn		

Table 2 (cont'd.)

BPHM Site No. 50-Ha-D22-	Site Type	BPHM No. 50-Ha-D22-	Site Type
86	U-Shape Structure	125	Trail
87	Pahoehoe Clearings	126	Shelter Cave, Pahoehoe Clearings
88	Shelter Cave	127	T-Shape Structure, Other Features
89	Crescent-Shape Structure	128	Modified Ridge Garden
90	Trail	129	Circular Enclosures
91	Shelter Cave	130	Petroglyphs (Modern)
92	Shelter Cave & Other Features	131	Circular Enclosure
93	Shelter & Other Features	132	Pahoehoe Clearings
94	Enclosures, Alignments	133	Alignment
95	Trail	134	Crescent-Shape Structure
96	Trail	135	C-Shape Structure
97	Shelter Cave	136	Rectangular Depression
98	Trail	137	Cairns, Alignments
99	Shelters, Other Features	138	Crescent-Shape Structure
100	Shelter Cave, Pahoehoe Clearings	139	Shelter Cave, Other Features
101	E-Shape Structures	140	Shelter Cave
102	Shelter Cave	141	Alignment, Cairn
103	Shelter Cave	142	Petroglyphs, Circular Enclosure
104	Circular Enclosure	143	Shelter Cave, Other Features
105	Shelter Cave	144	Trail
106	Shelter Cave	145	Shelter Cave, Other Features
107	Trail	146	Shelter Cave, Other Features
108	Circular Enclosure	147	C-Shape Structure
109	Shelter Cave, Pahoehoe Clearings	148	U-Shape Structure
110	House Platform, Other Features	149	Circular Enclosures
111	House Platform	150	C-Shape Structure
112	C-Shape, Pahoehoe Clearings	151	C-Shape Structure
113	House Platform	152	Trail
114	Burial Cave	153	Cairns
115	Petroglyphs	154	Hidden Scatter, Pahoehoe Clearings
116	Shelter Cave	155	Enclosures
117	Enclosure, Other Features	156	Trail
118	Shelter Cave	157	Crescent-Shape Structure
119	Cairn, Other Features	158	Shelter Cave
120	C-Shape, Other Features		
121	C-Shape, Other Features		
122	Shelter/Burial Cave		
123	Circular Enclosure		
124	Shelter Caves, Pahoehoe Clearings		

Table 4  
DISTRIBUTION OF FEATURES BY CATEGORY

Feature Category	Number
Trails	19
Cairns	87 (56)*
Shelters	10
Shelter Caves	56
Burial Caves	8
Burial Cists	2
Platforms	19
Enclosures	26
C-Shapes	12
U-Shapes	4
Crescent Shapes	6
E-Shapes	1
T-Shapes	1
L-Shapes	2
Alignments	21
Circular Enclosures	12
Shrine	1
Pahoehoe Clearings	450 (1700)*
Modified Ridge Gardens	4
Rectangular Depression	1
Petroglyphs	50
Panama	2
Hidden Scatters	6
Isolated Find	1
Historic Wall	1
<b>TOTAL</b>	<b>802</b>

\*Number of isolated features not given site designations. These figures are based on actual field counts taken during the survey.

Table 3  
SITES PREVIOUSLY RECORDED WITHIN THE SURVEY AREA\*

BPRM Site No. 50-Ha-D22-	Original Reference Number	Reference to Site Descriptions
1 thru 13		Soehren (Ms. 1963:1-12)
21 thru 26		Soehren (Ms. 1963:19-25)
27 thru 29		Reinecke (Ms. 1930)
30	118 thru 120	DNR, Historic Sites Section Files
31	50-10-19-4708	DNR, Historic Sites Section Files
35	50-10-19-1140	Ching (1971:142-143); Rosendahl (1973:31-32)
36	50-10-19-1141	Ching (1971:198-199)
39	50-10-19-1162	Ching (1971:190-191)
40	50-10-19-1193	Ching (1971:202-203)
41 thru 51		Tomori (1981:9, 12, 15, 19, 21)
79†	50-10-19-1146 thru -1152	Ching (1971:220-221)
80†	50-10-19-1144	Ching (1971:142-152)
91†	50-10-19-1161	Ching (1971:142-143)
200	50-10-19-1138	Ching (1971:198-199)
201	50-10-19-1139	Ching (1971:152-153)
202	50-10-19-1143	Ching (1971:220-221)
203	50-10-19-1153	Ching (1971:152-153)
204	50-10-19-1154	Ching (1971:152-153)

\*Total sites previously recorded within the survey area = 47.

†These sites were rerecorded during the present survey.

#### FEATURE CATEGORY DESCRIPTIONS

##### Trails

Two variants of Apple's (1965) "Type A" trails are representative of the 19 trails identified in the survey area. The first type is a steppingstone trail over a lava. However, instead of using waterworn stones for the steppingstones, flat slabs of pahoehoe were used (Fig. 2). This was more common in trails that crossed aa lava flows located more than a mile from any source of waterworn stones. The second type is a visibly worn area across smooth pahoehoe. These were sometimes marked by cairns and, in some cases, waterworn stones.

##### Cairns

These low, stacked piles of stones were the second most numerous feature identified within the survey area. Often this feature was found in association with trails, temporary shelters, pahoehoe clearings or holes, and other cairns, as in Sites D22-137 and -191. Cairns are also incorporated into ahupua'a boundary shrines, as in Site D22-189.

##### Shelters

These features are often small, and are distinguished from other shelters in that they utilize a natural lava outcrop above the ground that has been added to by the construction of a wall segment. Examples of this feature are Sites D22-66, -171, and -187.

##### Shelter Caves

Caves are naturally formed by lava draining out beneath a surface flow. This surface will sometimes collapse and provide an opening to the natural cavern. These caves were used as shelters, as evidenced by midden remains and associated structural remains. Figure 3 illustrates one of the larger shelter caves in the project area, with a paved entry.

##### Burial Caves

The use of caves as sepulchers is a tradition that has remained viable up to the present by some families in the Kona area (L. Lightner, pers. com.).

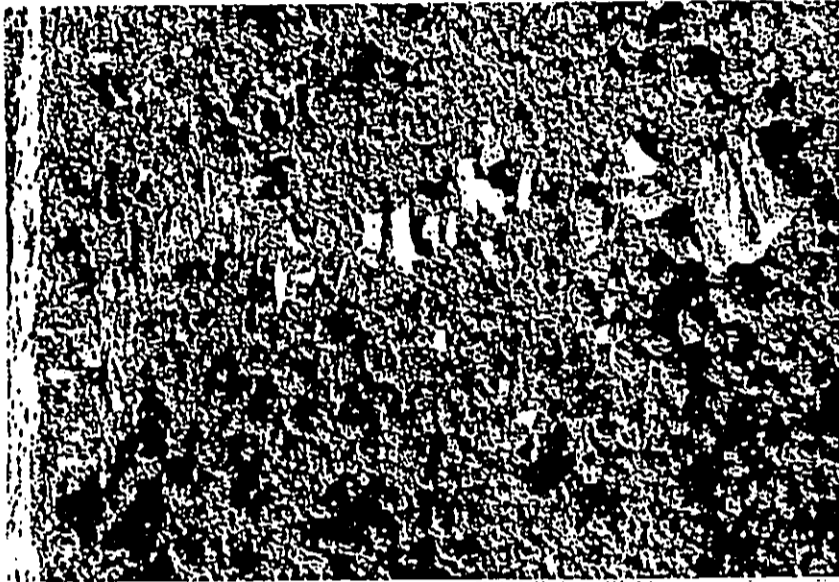


Fig. 2. STEPPINGSTONE TRAIL, SITE 50-Ha-D22-21.  
BPRM Neg. No. HA(a)-602-18.

The possibility exists that these interments contain individuals from a single family group (cf. Barrera 1971:1). At least 76 individuals were interred in this manner within the project area.

#### Burial Cists

Two cists were located, and each contained the partial remains of single individuals.

#### Platforms

Platforms are raised stone structures that are often paved to provide a level surface. It is likely that some of these platforms served as foundations for perishable superstructures. Three such platforms were located within the survey area, and were designated D22-110, -111, and -112. Other platforms are small and are incorporated into sites as internal structural features; Site D22-92 is a good example.

#### Enclosures

This feature type is usually constructed of a low stacked rock wall that forms a discrete area, and that was probably used for a shelter. In most cases these low wall enclosures were temporary structures. The more well-formed and substantially built enclosure walls may designate permanent habitation structures.

#### C-, U-, E-, T-, L-Shape Structures

This category includes temporary structures constructed of stacked rock walls that probably functioned as windbreaks. C-shape structures are the most common type in this category. Figure 4 illustrates a C-shape structure.

#### Crescent-Shape Structures and Alignments

These two feature categories are also considered temporary structures. These features, like those above, were constructed of stacked rock walls. Hidden was not commonly associated with these temporary structures.



FIG. 3. SHELTER WITH PAVED ENTRY, SITE 50-Ha-D22-92.  
BPH Neg. No. HA(a)-603-9.

Circular Enclosures

This feature type, like the other temporary structures, was constructed of stacked rock walls; an example is illustrated in Figure 5.

Shrine

There was one definite shrine (D22-189) within the survey area. This site is likely to have been an *ahupua'a* boundary shrine, based on comparative information (Kirch 1979:17; Marshall Weisler, pers. com.). Other sites within the survey area that may have a religious interpretation are D22-137 and -166.

Pahoehoe Clearings or Holes

This feature is identified by the purposeful displacement of the pahoehoe surface. The surface layer of the pahoehoe flow is first broken, then the natural rubble is cleared to form an area free of pahoehoe blocks; Figure 6 illustrates this feature. Over 2,100 of these clearings or holes were noted within the survey area; Figure 7 illustrates their distribution in relationship to shelter caves. There may be a functional relationship between shelter caves and pahoehoe clearings, however, the type of relationship is unknown at this time.

Barrera (1971:59) identified this feature category within the 'Anaho'omalu survey area. He referred to this feature as an "artificial hole in the pahoehoe lava" (Ibid.:figure 50). Moore and Bevacqua (1972:17) went on to develop a detailed discussion of these pahoehoe holes within the Waikoloa area. They provided the following list of considerations for assessing these features (Ibid.:17-20):

- (1) The holes may be natural.
- (2) The holes may have a cultural function as:
  - (a) Burial areas
  - (b) Agriculture features
  - (c) Storage areas
  - (d) Abrader quarries
  - (e) Construction material.

According to geologists, these features are not natural (Barrera 1971:60; Moore and Bevacqua 1972:17). Moore and Bevacqua are not convinced that the



Fig. 4. C-SHAPE STRUCTURE, SITE 50-Ha-D22-147.  
BPH Neg. No. HA(a)-602-14.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

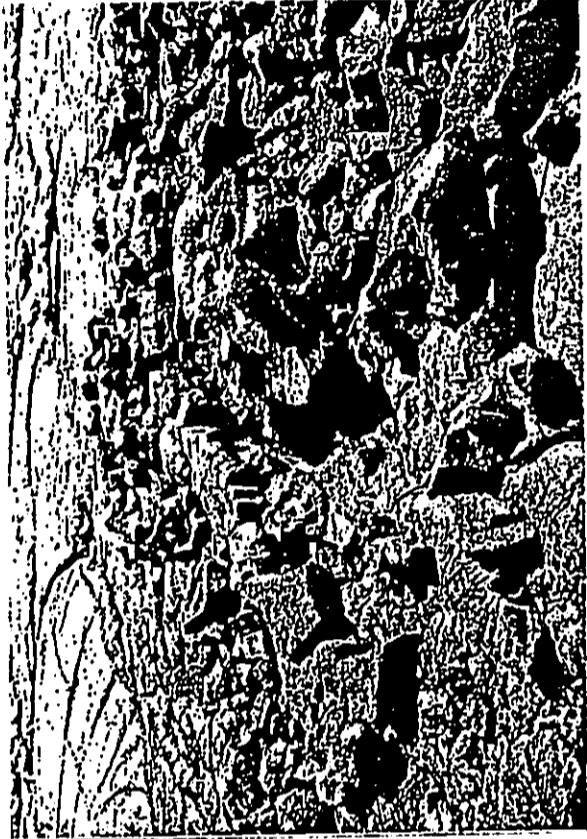


Fig. 6. PAHOEHOE CLEARINGS OR HOLES. BPBH Neg. No. HA(a)-597-17.



Fig. 5. CIRCULAR ENCLOSURE, SITE 50-Ha-D22-149. BPBH Neg. No. HA(a)-602-12.

features were used for agricultural purposes, based on a conversation with Douglas Yen, then ethnobotanist at B. P. Bishop Museum. Although Yen questioned the validity of these pahoehoe clearings as agricultural features, ethnohistoric documentation presents a different view.

Chester A. Lyman, while visiting the Komoosoa area of Puna in 1846, observed the following:

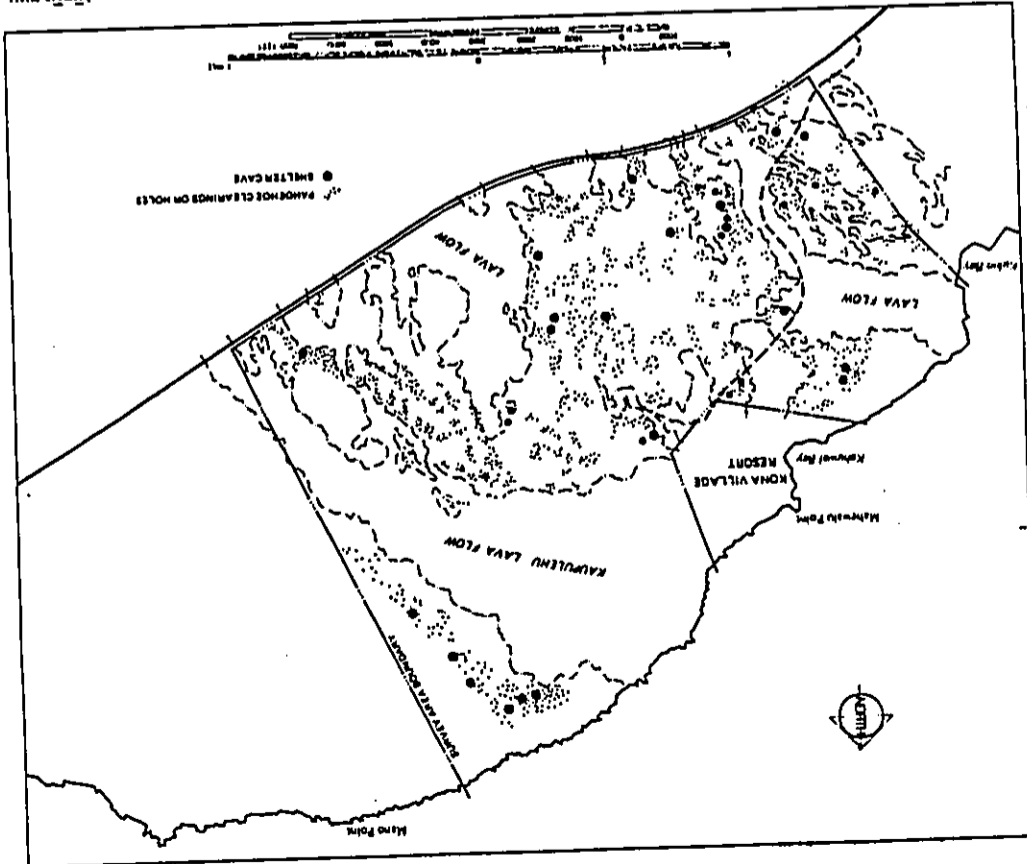
We passed a potato patch in the broken lava which exceeded anything I had seen. Not a particle of soil was anywhere to be seen, and the holes dug among the stones to receive the potatoes were some of them 6 feet in depth—thus securing a degree of moisture and shelter from the sun—though no more soil than on the surface [Zwoy et al. 1959:24].

This entry in the historical record provides substantial evidence for the use of these pahoehoe clearings or holes as agricultural features. Cleghorn (1980:29) provides a similar conclusion, based on information derived from Handy and Handy (1972:127-129). Foranader (1919-1920, VI:164) refers to the term used to designate the planting of sweet potatoes in rocky places as *wakalii*. Sweet potatoes grown in the semidisintegrated lava were fertilized by heaping rubbish around the vines, which also facilitated the holding of moisture in arid areas (Handy and Handy 1972:129). However, sweet potatoes grown in this fashion were considered tasteless (Ibid).

It is likely that some of these features were used as planters for sweet potatoes or other vine produce such as watermelons (Ellis 1963:30, 31). It is also likely that these features had multiple purposes. There is no soil or organic material in or around these features, however, this fact does not justify eliminating the possibility that these features were used agriculturally. Chronologically these features are historic in some cases, as evidenced by the cleared pahoehoe blocks that are presently resting on the 1801 Ka'upulehu flow, and may predate the aa flow.

Moore and Bevacqua (1972) present a good argument for the use of these pahoehoe clearings or holes as quarries for abrader material and/or construction stone. Although there are no abrader grinding surfaces in the vicinity of these pahoehoe planters, the possibility still exists that they are agricultural features or abrader quarry locations. Their consideration of these clearings or holes as burial, storage, and/or shelter sites is not

FIG. 7. LOCATION MAP OF PAHOEHOE CLEARINGS OR HOLES AND SHELTER CAVES FOUND WITHIN KA'UPULEHU AHUPUA'A.



supported, as most of the features are shallow and horizontally open, thereby providing unsuitable areas for burial, storage, or shelter.

Modified Ridge Gardens

These are natural ridges that have been modified and used possibly as garden areas. These garden areas are based on the clustering of pahoehoe clearings or holes that modify the existing natural feature. Sites D22-63, -73, and -128 are examples of this modification.

Rectangular Depression

This feature consists of a rectangular area built up against a natural outcrop. Its interior is filled with rubble, creating an uneven surface. Like the pahoehoe clearings or holes, this feature was probably used for agricultural purposes. McCoy (1976) recorded similar features in the dry environment of Easter Island. The features there were used for growing sweet potatoes. Cleghorn (1980:29) also mentions this type of feature in the Hilina Pali area of Hawaii's Island. Site D22-136 is an example of this type of feature.

Petroglyphs and Papanu

The rock carvings from the Ka'upulehu area are both interesting from an anthropological point of view and artistic. There were four sites within the survey area that had clusters of petroglyphs. A total of 50 petroglyphs and 2 papanu were counted within the survey area. Soehren (1963) located a number of petroglyphs and papanu along the existing fence line and included them in his Sites D22-22 and -23. There are other areas on the Kona Village Resort grounds that are noted by J. Halley Cox and Edward Stasack (1970) as having exceptional petroglyphs. These grounds are noted for numerous sail petroglyphs in various sizes. Two sail petroglyphs were found near the kiave growth makai of Site D22-12. Figure 8 illustrates one of the many petroglyphs within the present survey area.



Fig. 8. PETROGLYPH, SITE 50-Ha-D22-165. BPH Neg. No. HA(a)-604-11.



Papamā are the playing boards used in the game kōnane, which comprise multiple lines of pecked holes (Buck 1957; Cox with Stasack 1970). Figure 9 illustrates such a feature in association with a temporary shelter Site D22-79.

#### Hidden Scatters

These are areas where midden (shellfish, fish bone, etc.) are distributed over the surface. These areas are often isolated, and not necessarily found in association with structural remains. Sites such as these derive their importance from their location in relation to other sites or features. Research potential of these sites is minimal, unless the scatter is substantial.

#### Isolated Finds

Isolated finds are areas where artifacts have been located. Like midden scatters, these finds are important not only for the artifacts they reveal, but also for their relationship to other sites or features within the area. Site D22-72 is an example of this feature category.

#### Historic Walls

There were several of these walls within the survey area. Site D22-180 is a good example of a historic wall. It is known that the Ka'ūpūlehu area was used during the historic period. These walls were used to contain introduced animals. Soehren (1963) noted an animal pen within the area that is leased by Kona Village Resort.

#### SUMMARY AND CONCLUSIONS

One hundred fifty-one archaeological sites, consisting of 802 features were recorded in the survey area. These sites indicate that a wide range of activities probably occurred in the area, including those related to habitation, fishing, agriculture, religion, and burial of the dead. Most of the sites appear to be prehistoric in age (pre-1778), though some of them may also have been used in historic times.



Fig. 9. PAPANŪ, SITE 50-Ha-D22-79. BPEH Neg. No. HA(a)-601-15.

The sites and features recorded in Ka'upulehu are not unique, and can be compared with sites in similar environments, such as 'Anae'omalu (Barrera 1971) and Ka'ihuihua (Kirch 1979). Though it is not possible at this time to make detailed comparisons between these different areas, these comparisons will be possible after further work in Ka'upulehu results in meaningful statements on adaptation to this harsh leeward area.

The range of features and sites recorded in Ka'upulehu, while diverse, does not include some feature types that occurred at 'Anae'omalu and Ka'ihuihua. Such expected features include heiau (pre-Christian place of worship), hale maa (men's eating house), and substantial features that would indicate permanent habitation. It is quite possible that these types of features existed at one time, but are now destroyed. It is possible that such features may have existed along the coast where the present Kona Village Resort is (this is where the principal bay of the area is located). And it is also possible that the 1801 lava flow may have destroyed some of these types of features.

This project has resulted in the inventory of a large portion of a single ahupua'a. This will prove to be valuable not only to the scientific community but to the local community and the tourist industry as well. The ahupua'a as a traditional Hawaiian land division is the largest land division within a noku (island or district) (Handy and Pukui 1972:4). The ideal ahupua'a is a wedge-shape section of land that is widest at the sea and narrows toward the mountains. This land division provided its inhabitants with different environmental zones to exploit for various available natural resources and for cultivated foods. The maka'i portion of Ka'upulehu exhibits only those sites that are representative of the Hawaiians' adaptation to a leeward coastal environment.

Reconnaissance of the mauka land within the ahupua'a would provide information that can be combined with the existing information about the maka'i portion of the ahupua'a to allow the formation of a more complete image of the extent of resource utilization and adaptation by prehistoric and historic Hawaiians to both coastal and upland environments. This information can then be used more accurately to provide an interpretive program that will maintain

the integrity of the Hawaiian resource base, and enhance the cultural and scientific significance of the Ka'upulehu area.

RECOMMENDATIONS FOR SITES WITHIN THE SURVEY AREA

This report documents the range of sites identified within the 2,800 acres of the maka'i portion of Ka'upulehu shupua'a. This land area is a resource that is valuable not only to the scientific community, but also to local residents and the tourist industry. Recommendations will vary from site to site; however, it is clear that a portion of this resource should be intensively investigated. Recommendations regarding the preservation of specific sites will be contingent upon the results of extensive (Phase I) survey. Site recommendations were based on the following guidelines:

- (1) Excavation: A site with excavation potential must have:
  - (a) midden deposits; and/or
  - (b) structural remains unique to the range of features within that category.
- (2) Preservation: A site worthy of preservation is one that may be unique and will provide, or that can be integrated into, an interpretive program that will maintain the cultural value of the site, and add to the scientific analysis of the study area.
- (3) Intensive Mapping: The potential for a site to be intensively mapped is derived not only from the intrinsic value of the site but more importantly, from the amount of adverse impact the site or sites may receive. Those sites selected for intensive mapping are representative of the range of feature categories within the survey area. In some cases, intensive mapping will satisfy mitigation requirements.
- (4) Treatment of Skeletal Remains: The most sensitive sites within the survey area are those with skeletal remains. It is imperative that the following recommendations be carried out for each burial site:
  - (a) Notification of the public 30 days prior to a disinterment date should be given by informing the public via newspaper for 3 days. A Disinterment Permit should be obtained by either the developer or agent contracted to disinter the remains. The permit can be obtained from the State Board of Health, Division of Research and Statistics.
  - (b) Analysis of the remains, which can provide information that is not available through any other means--information on diet, family genetics, diseases, and mortality data. This information, when combined with the archaeological analyses, enhances the cultural value and interpretive potential of the ahupua'a; and

(c) In situ preservation, after on-site osteological analyses are completed. If in situ preservation is not feasible, then it is recommended that the remains be consolidated into one cave (Site D22-80).

Significance of sites within the Ka'upulehu area has been assessed by the following criteria (after Weisler and Kirch 1982):

- (1) cultural value of sites to the local community, to Hawaiians, and to other ethnic groups;
- (2) educational value of sites to Hawaiians and other ethnic groups familiar with aspects of Hawaiian culture;
- (3) scientific value of sites as cultural resources for research and analyses;
- (4) economic value of sites as visitor attractions for the tourist industry; and
- (5) recreational value of sites for residents of Hawai'i.

Assessments and recommendations based on the above criteria for sites in eight areas of study within the present survey area are represented in Table 5. Each of the eight study areas is significant, based on all of the above criteria. Burial sites and petroglyphs are also significant, based on the above criteria. Map B illustrates the eight study areas that are to be included in the proposed Extensive Survey and Mapping Phase. Also illustrated are the burial sites, a petroglyph area with a papamu, and the transects proposed for intensive mapping in the analysis of the pahoehoe clearings. The explanations for these recommendations are as follows:

Study Area 1

This area includes house sites, enclosures, salt pans, petroglyphs, shelter caves, C-shape structures, trails, and garden areas. The recommendations for this area include a test excavation of one site (Site D22-12), which has a visually thick deposit of midden. Testing is also recommended along the beach front dunes in an effort to locate buried deposits. A few of the sites within the study area may be recommended to be preserved at the conclusion of the next phase, based on the potential of the sites as a representative example of coastal habitation, and utilization within the coastal zone. Extensive mapping is also recommended for the entire coastal

Table 5  
AREAS RECOMMENDED FOR INTENSIVE SURVEY AND MAPPING

Study Area	Study Area No.	Assessment Potential*		Assessment Potential*	
		(1)	(2)	(1)	(2)
Study Area 1	1	x	x	x	x
	2	x	x	x	x
	3	x	x	x	x
	4	x	x	x	x
	5	x	x	x	x
	6	x	x	x	x
	7	x	x	x	x
	8	x	x	x	x
	9	x	x	x	x
	10	x	x	x	x
Study Area 2	11	x	x	x	x
	12	x	x	x	x
	13	x	x	x	x
	14	x	x	x	x
	15	x	x	x	x
	16	x	x	x	x
	17	x	x	x	x
	18	x	x	x	x
	19	x	x	x	x
	20	x	x	x	x
Study Area 3	21	x	x	x	x
	22	x	x	x	x
	23	x	x	x	x
	24	x	x	x	x
	25	x	x	x	x
	26	x	x	x	x
	27	x	x	x	x
	28	x	x	x	x
	29	x	x	x	x
	30	x	x	x	x
Study Area 4	31	x	x	x	x
	32	x	x	x	x
	33	x	x	x	x
	34	x	x	x	x
	35	x	x	x	x
	36	x	x	x	x
	37	x	x	x	x
	38	x	x	x	x
	39	x	x	x	x
	40	x	x	x	x
Study Area 5	41	x	x	x	x
	42	x	x	x	x
	43	x	x	x	x
	44	x	x	x	x
	45	x	x	x	x
	46	x	x	x	x
	47	x	x	x	x
	48	x	x	x	x
	49	x	x	x	x
	50	x	x	x	x
Study Area 6	51	x	x	x	x
	52	x	x	x	x
	53	x	x	x	x
	54	x	x	x	x
	55	x	x	x	x
	56	x	x	x	x
	57	x	x	x	x
	58	x	x	x	x
	59	x	x	x	x
	60	x	x	x	x
Study Area 7	61	x	x	x	x
	62	x	x	x	x
	63	x	x	x	x
	64	x	x	x	x
	65	x	x	x	x
	66	x	x	x	x
	67	x	x	x	x
	68	x	x	x	x
	69	x	x	x	x
	70	x	x	x	x
Study Area 8	71	x	x	x	x
	72	x	x	x	x
	73	x	x	x	x
	74	x	x	x	x
	75	x	x	x	x
	76	x	x	x	x
	77	x	x	x	x
	78	x	x	x	x
	79	x	x	x	x
	80	x	x	x	x
Study Area 9	81	x	x	x	x
	82	x	x	x	x
	83	x	x	x	x
	84	x	x	x	x
	85	x	x	x	x
	86	x	x	x	x
	87	x	x	x	x
	88	x	x	x	x
	89	x	x	x	x
	90	x	x	x	x
Study Area 10	91	x	x	x	x
	92	x	x	x	x
	93	x	x	x	x
	94	x	x	x	x
	95	x	x	x	x
	96	x	x	x	x
	97	x	x	x	x
	98	x	x	x	x
	99	x	x	x	x
	100	x	x	x	x
Study Area 11	101	x	x	x	x
	102	x	x	x	x
	103	x	x	x	x
	104	x	x	x	x
	105	x	x	x	x
	106	x	x	x	x
	107	x	x	x	x
	108	x	x	x	x
	109	x	x	x	x
	110	x	x	x	x
Study Area 12	111	x	x	x	x
	112	x	x	x	x
	113	x	x	x	x
	114	x	x	x	x
	115	x	x	x	x
	116	x	x	x	x
	117	x	x	x	x
	118	x	x	x	x
	119	x	x	x	x
	120	x	x	x	x
Study Area 13	121	x	x	x	x
	122	x	x	x	x
	123	x	x	x	x
	124	x	x	x	x
	125	x	x	x	x
	126	x	x	x	x
	127	x	x	x	x
	128	x	x	x	x
	129	x	x	x	x
	130	x	x	x	x
Study Area 14	131	x	x	x	x
	132	x	x	x	x
	133	x	x	x	x
	134	x	x	x	x
	135	x	x	x	x
	136	x	x	x	x
	137	x	x	x	x
	138	x	x	x	x
	139	x	x	x	x
	140	x	x	x	x
Study Area 15	141	x	x	x	x
	142	x	x	x	x
	143	x	x	x	x
	144	x	x	x	x
	145	x	x	x	x
	146	x	x	x	x
	147	x	x	x	x
	148	x	x	x	x
	149	x	x	x	x
	150	x	x	x	x
Study Area 16	151	x	x	x	x
	152	x	x	x	x
	153	x	x	x	x
	154	x	x	x	x
	155	x	x	x	x
	156	x	x	x	x
	157	x	x	x	x
	158	x	x	x	x
	159	x	x	x	x
	160	x	x	x	x
Study Area 17	161	x	x	x	x
	162	x	x	x	x
	163	x	x	x	x
	164	x	x	x	x
	165	x	x	x	x
	166	x	x	x	x
	167	x	x	x	x
	168	x	x	x	x
	169	x	x	x	x
	170	x	x	x	x
Study Area 18	171	x	x	x	x
	172	x	x	x	x
	173	x	x	x	x
	174	x	x	x	x
	175	x	x	x	x
	176	x	x	x	x
	177	x	x	x	x
	178	x	x	x	x
	179	x	x	x	x
	180	x	x	x	x
Study Area 19	181	x	x	x	x
	182	x	x	x	x
	183	x	x	x	x
	184	x	x	x	x
	185	x	x	x	x
	186	x	x	x	x
	187	x	x	x	x
	188	x	x	x	x
	189	x	x	x	x
	190	x	x	x	x
Study Area 20	191	x	x	x	x
	192	x	x	x	x
	193	x	x	x	x
	194	x	x	x	x
	195	x	x	x	x
	196	x	x	x	x
	197	x	x	x	x
	198	x	x	x	x
	199	x	x	x	x
	200	x	x	x	x
Study Area 21	201	x	x	x	x
	202	x	x	x	x
	203	x	x	x	x
	204	x	x	x	x
	205	x	x	x	x
	206	x	x	x	x
	207	x	x	x	x
	208	x	x	x	x
	209	x	x	x	x
	210	x	x	x	x
Study Area 22	211	x	x	x	x
	212	x	x	x	x
	213	x	x	x	x
	214	x	x	x	x
	215	x	x	x	x
	216	x	x	x	x
	217	x	x	x	x
	218	x	x	x	x
	219	x	x	x	x
	220	x	x	x	x
Study Area 23	221	x	x	x	x
	222	x	x	x	x
	223	x	x	x	x
	224	x	x	x	x
	225	x	x	x	x
	226	x	x	x	x
	227	x	x	x	x
	228	x	x	x	x
	229	x	x	x	x
	230	x	x	x	x
Study Area 24	231	x	x	x	x
	232	x	x	x	x
	233	x	x	x	x
	234	x	x	x	x
	235	x	x	x	x
	236	x	x	x	x
	237	x	x	x	x
	238	x	x	x	x
	239	x	x	x	x
	240	x	x	x	x
Study Area 25	241	x	x	x	x
	242	x	x	x	x
	243	x	x	x	x
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	248	x	x	x	x
	249	x	x	x	x
	250	x	x	x	x
Study Area 26	251	x	x	x	x
	252	x	x	x	x
	253	x	x	x	x
	254	x	x	x	x
	255	x	x	x	x
	256	x	x	x	x
	257	x	x	x	x
	258	x	x	x	x
	259	x	x	x	x
	260	x	x	x	x
Study Area 27	261	x	x	x	x
	262	x	x	x	x
	263	x	x	x	x
	264	x	x	x	x
	265	x	x	x	x
	266	x	x	x	x
	267	x	x	x	x
	268	x	x	x	x
	269	x	x	x	x
	270	x	x	x	x
Study Area 28	271	x	x	x	x
	272	x	x	x	x
	273	x	x	x	x
	274	x	x	x	x
	275	x	x	x	x
	276	x	x	x	x
	277	x	x	x	x
	278	x	x	x	x
	279	x</			

area. At present many of the sites along the beach are being damaged by the jeep road that parallels the coast and crosses many of these sites. Extensive mapping is needed to accurately document the present condition of the features.

Study Area 2

This area includes a burial cave, shelter caves, house platforms, a variety of temporary structures, petroglyphs, papamū, trail segments, and possible agricultural features. The recommendations for this area include test excavations for five sites. The sites chosen are those that have the potential to yield information on chronology (the time the site was in use). Excavations have the potential to yield information regarding diet and variation between sites based on the analysis of midden. All of the sites may have preservation potential, and may be an asset to the development if they are incorporated into a historical preserve. Since the area incorporates a wide variety of sites exhibiting a range of activities that took place in the past, historical interpretation of this area would incorporate religious, habitation, recreation, and agricultural aspects of Hawaiian prehistory. Extensive mapping is recommended for this area to document the range and distribution of sites. One site (D22-22) is a burial cave that is presently being visited on a restricted basis by permission of Kona Village Resort. Due to the accessibility of the cave, osteological analysis of the remains is recommended. In situ preservation of the remains is also recommended after the analysis is completed. If in situ preservation is carried out, the entry to this cave should then be sealed to insure that no further disturbance to the remains occurs.

Study Area 3

This area includes a burial cave, shelter caves, trails, a possible shrine, house platforms, petroglyphs, and pahoehoe clearings or holes. The recommendations for this area include test excavations of four sites. The sites chosen have the potential to yield information on the functions of its features and their relationship to other features within the area. Data valuable in assessing diet and consumption preferences can be examined by the recovery and analysis of midden. Technology of stone tools, and lithic

material preference can be examined. The testing of sites within this area will help to provide a broader image of the extent of utilization and adaptation to an arid environment by the Hawaiians. All 16 sites may have the potential for preservation as a complex. This complex of sites includes features representative of religious, agricultural, and domestic aspects of Hawaiian prehistory. Extensive mapping is recommended to document the variety and distribution of sites within the study area. The single burial cave (D22-114) within the study area currently has a wooden ladder placed at its entrance. This access to the burial cave and the disturbed condition of the remains increases the necessity for osteological analysis. Again, in situ preservation is recommended after the analysis is completed.

Study Area 4

This area includes trails, enclosures, walls, and cairns, and designates sites that represent the adaptability of the Hawaiians to a rugged environment. Most of the sites within this area are constructed on an sea flow. Adjacent to this flow, on the north side, is an anchialine pond. This natural feature is significant in that it may have provided a source for potable water and food. Extensive mapping is recommended to provide documentation of the variety and distribution of sites within the study area.

Study Area 5

This area includes a burial cave, shelter caves, trails, and two possible shrines. Excavation is recommended in a shelter cave that is also a sepulcher (Site D22-173). Since these sites are in an area that has a high potential for adverse impact, extensive mapping is recommended.

Study Area 6

This area includes, shelter caves, petroglyphs, pahoehoe clearings or holes, temporary structures, and cairns. Excavation is recommended for two sites (D22-163 and -165): both are shelter caves with midden deposits. Extensive mapping is recommended for all sites to document the variety and distribution of features.

unknown. However, the present location of this feature, near the southern ahupua'a boundary line, suggests it is a boundary shrine (Kirch 1979:17; Marshall Weisler, pers. com.).

Shelter Caves

Four caves (D22-80, -92, -100, and -193) should be mapped and excavated because they:

- (1) have midden deposits;
- (2) have the potential to yield chronological data;
- (3) exhibit a variety of construction methods; and
- (4) represent an image of dispersed utilization within the ahupua'a.

Transects 1 and 2

These two areas are proposed for extensive mapping only. The features to be mapped are the pahoehoe clearings or holes. By taking a closer look at these features it is hoped that questions related to their function can be answered. The two transects cross-cut two different pahoehoe lava flows. Transect 1 crosses a more recent historic flow, while Transect 2 crosses an older, possibly prehistoric flow. The variability between the two areas can then be compared.

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Study Area 7

This area includes trails, walls, shelter caves, and temporary structures. Only one site (D22-181), consisting of multiple shelter caves, has the potential for excavation; the other sites may be suited for preservation. The trail segments (D22-156 and -178) may in fact be one trail, and this should be determined during mapping phase. An early map of the area shows a trail and wall in the general vicinity of D22-180. The trail would be a valuable asset in reconstructing the access route between mauka and makai portions of the ahupua'a. It is recommended that this trail be followed to determine its extent.

Study Area 8

This area consists mainly of small shelter caves. Four have the potential for excavation. Site D22-107, a trail segment, may be part of the larger system designated as Sites D22-156 and -178. Extensive mapping is recommended.

RECOMMENDATIONS FOR SITES OUTSIDE THE STUDY AREA

Burial Caves

In each of the remaining caves the skeletal remains should be analyzed systematically. The remains should be treated with care and respect, and, if possible, returned to the original cave. However, if this is not feasible, due to the adverse impact that the site might suffer as project development progresses, the skeletal remains should be consolidated and placed in burial cave D22-80.

Petroglyphs and Papanui

Site D22-79, contains petroglyphs, a papanui, and associated features, all of which should be extensively mapped.

Shrine

This site (D22-189) is the only one of its kind in the survey area. The presence of corn, a cluster of cairns, and waterworn cobbles signifies that this is a religious site. The construction date of this site is currently

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APPENDIX A

This appendix provides brief descriptive information for the 151 sites found during the reconnaissance at Ka'upulehu makai. The descriptions are based on rough estimations of size and, include only those sites that were identified during the present survey.

D22-32 Alignments

This site consists of three alignments that cross a natural pahoehoe basin. The walls are located at three different points within the basin. The eastern wall is 3 m by 80 cm by 40 cm. The western wall is 2.3 m by 50 cm by 40 cm. The northern wall is 4 m by 65 cm by 55 cm high. Each is constructed of stacked pahoehoe blocks and slabs.

D22-33 Alignment and Cairns

This site consists of two features. The alignment is 4.5 m by 70 cm by 50 cm. There are four cairns within a 5 m radius of this alignment. Three are collapsed; the intact one is 1.6 m in diameter and 45 cm high.

D22-34 Trail

This trail is worn into the pahoehoe flow and is visible for a distance to the south and north. It parallels a cave shelter and a possible shrine or burial.

D22-52 Possible Trail

This possible trail segment is marked by a scatter of waterworn pebbles over a pahoehoe flow. The scatter area is approximately 15 by 25 m. There is also one cairn near this scatter.

D22-53 Enclosure

This site consists of three features: an enclosure wall, a simple low wall alignment, and a rough cairn. These three features are located within a small natural depression in the pahoehoe. The enclosure is approximately 2 m<sup>2</sup>, with wall heights ranging between 35 and 50 cm. The simple alignment extends to the south from the edge of the natural depression for 2 m. The wall alignment is approximately 55 cm high. The rough cairn was not measured.

D22-54 Enclosure

This feature is located in a natural depression in the pahoehoe. The natural ledges have two wall segments of stacked rock left standing, between 20 and 30 cm high.

D22-55 Crescent-Shape Structure

This feature is a crescent-shape stacked wall segment, 2 m long and 30 cm high. The feature is located on an open pahoehoe flat.

D22-56 Shelter

This feature consists of a natural overhang in the pahoehoe flow that has created a shelter. The ledge is approximately 5 m wide, with an interior length of 1 m. The height of the overhang is roughly 60 cm. The interior is scattered with six *cellana* sp. shells.

D22-57 Pahoehoe Clearings

This site consists of three clearings in the pahoehoe. Two of the clearings show similarities, in that the rocks that have been removed are somewhat stacked to provide a windbreak. The clearings vary in depth between 15 and 70 cm, and are 1.5 by 2.0 m wide and long. All planters are marked, two by a large waterworn boulder, the third by a small cairn.

D22-58 Pahoehoe Clearings

This site consists of a cluster of four clearings. There is an upright slab of pahoehoe and a single waterworn rock in the center of the cluster. The four clearings vary in depth between 35 and 80 cm, and vary in size between 60 cm and 1.0 m.

D22-59 Shelter Cave and Pahoehoe Clearings

This site consists of a single shelter cave and a cluster of six planters. The cave opens to the southeast, and has an interior that exceeds 6 m in linear depth. There is a light scatter of midden on the surface. The entrance to the cave is paved and is 1.5 m high and 3.0 m wide. The cluster of clearings extends along the north slope of the natural depression in which this site is located. The clearings vary in depth between 15 cm and 1 m, and vary in size.

D22-60 Midden Scatter and Pahoehoe Clearings

This site consists of two features: a midden scatter and two planters. The midden scatter is on the lee side of a tumulus that serves as a windbreak. Either side of the midden scatter along the pahoehoe ridge is a stacked rock wall that looks like it serves as a filler to a possible opening in the pahoehoe rise. The clearings are 25 cm deep, and 60 cm by 1.5 m in size.

D22-61 Shelter Cave and Pahoehoe Clearings

This site consists of a small shelter cave and numerous clearings. The shelter cave has a southwestern opening that is 2 m wide and 60 cm high, and an interior linear depth of 8 m. The clearings are clustered in a constricted area between two pahoehoe ridges. The planters vary in depth between 25 and 50 cm, and vary in size between 1.0 m by 60 cm and 1.5 by 2.0 m.

D22-62 Shelter Cave and Associated Walled Enclosures

This site consists of a tumulus, two walled enclosures, and one midden scatter under a overhanging ledge. The associated features are in a natural depression in the pahoehoe. All of these features, with the exception of the shelter cave, are located in a north-south axis along the eastern edge of the depression; the shelter cave is located at the extreme southern end of this natural depression. The enclosures vary in length between 2 and 3 m. The linear depth varies between 70 cm and 1.5 m. The heights of the enclosure walls vary between 55 and 70 cm. Midden was noted within the enclosures.

D22-63 Modified Ridge (Garden)

This site encompasses a pressure ridge that has been modified. The modification consists of cleared areas on the surface of this ridge. The surface is made of a combination of cinder and blocky pahoehoe rock. There are numerous obvious clearings, probably for planting purposes, that dot the surface. The depth of these features varies between 50 cm and 1 m.

D22-64 Modified Ridge

This site, found at the northern end of the pahoehoe ridge where Site D22-65 is located, consists of a cluster of clearings in the pahoehoe with numerous waterworn rocks scattered within the cleared areas. The naturally decomposing ridge end has several dribble spires (Macdonald and Abbot 1970:29). The depths of these clearings vary between 50 and 75 cm below the surrounding surface. A cairn, 2 m in diameter and 60 cm high, is located at the northernmost point of this cluster of clearings. The cairn is constructed of stacked pahoehoe blocks, with the central portion conically depressed.

D22-65 Shelter Cave and Associated Features

This site consists of an elongated shelter cave located on the eastern slope of a pressure ridge (Site D22-6). The entrance of the shelter cave faces east, and is 2.2 m wide. The interior ceiling height is 70 cm, and the interior linear depth is approximately 10 m. Other features include a walled shelter on the top of the ridge, which is approximately 2 m long, and averages 80 cm high. A midden scatter and an occasional fragment of coral litter the surface of this ridge. At the base of the ridge to the west is a cluster of five cairns. The average dimensions of the cairns are 50 by 70 by 50 cm. Three of the cairns had a single waterworn boulder either incorporated in the cairn or lying nearby.

D22-66 Shelter Walls and Cairn

This site consists of three separate stacked pahoehoe walls. The lengths vary between 1.6 and 3.8 m, the widths vary between 40 and 50 cm, and the heights vary between 50 and 60 cm. Two of the walls abut a pressure ridge that forms the edge of a large natural basin. The cairn is 1.2 m long, 80 cm wide, and 40 cm high.



D22-67 Midden Scatter with Pahoehoe Clearings

This site is located in a large natural pahoehoe basin. The midden scatter is light, and one fragment of porites coral was noted. Approximately 50 clearings dot the slopes of the basin.

D22-68 Shelter Cave

This site consists of a single shelter cave with a midden scatter. The entrance opens to the north, and measures 2 m wide. The interior ceiling height is 50 cm, and the interior linear depth is 6 m.

D22-69 Shelter Cave and Pahoehoe Clearings

This site consists of a shelter cave in a natural pahoehoe bubble. The entrance opens to the northwest, and measures 6 m wide. The interior ceiling height is 75 cm, and the interior linear depth is 5 m. Also, the interior contains a light midden scatter, with a single waterworn rock and a fragment of coral. Associated features included eight clearings.

D22-70 Shelter Cave and Pahoehoe Clearings

This site consists of a single shelter cave in a natural pahoehoe bubble. The entrance opens to the northwest, and measures 4 m wide. The interior ceiling height is 70 cm, and the interior linear depth is 3 m. The interior contains a light midden scatter with a single waterworn rock. Associated features include two clearings.

D22-71 Burial Cist and Associated Features

This site incorporates a feature that was previously recorded by Ching (1971) and Rosendahl (1973). A detailed description of this feature will be provided under a separate heading (see Site D22-35). The associated features in this area consist of a burial cave, with the partial remains of one individual, and numerous pahoehoe clearings. The clearings dot the area surrounding the shelter cave for approximately 50 m to the north and northwest.

D22-72 Isolated Find

This site consists of a single cist in the pahoehoe with three wooden objects and one adz. The wooden objects recovered include, one image, one bowl (in fragments), and an unknown object. These artifacts are in very poor condition, and efforts to preserve them should be undertaken immediately. Associated features include three clearings along the edge of a finger of the 1801 aa flow.

D22-73 Pahoehoe Clearings

This site consists of a concentration of clearings within a natural depression that is ringed by a pressure ridge. There are approximately 30 individual clearings within this depression.

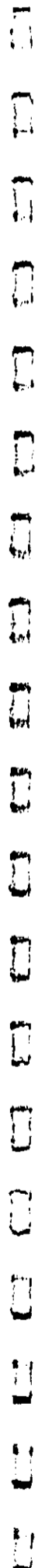
D22-74 Trail

This site consists of a trail segment across an aa flow. The western end is marked by a cairn that is approximately 55 cm high and 50 cm wide. The trail follows an east-west axis across the aa flow, which is narrow at the point of crossing. The width of the flow at this point is 122 m.

D22-75 Shelter and Burial Cave with Associated Features (disturbed)

This shelter and burial cave feature is located within a large lava tube that has a collapsed opening. The entrance opens to the south, and is partially hidden behind a concentration of lava boulders. The opening is 8 m wide, and the interior ceiling height is 1.5 m. The three major chambers that make up the cave have areas large enough to allow standing and moving comfortably. The northern chamber, which is marked by the remains of a single individual who was interred in a trunk, is the first of four individuals interred in this cave (not all of the tubes were entered, and it is likely that more skeletal remains may be found). Identified within this northern chamber were carrying poles; pūlu pillows; and bundle, canoe, and coffin burials. In the northeastern chamber, fragments of wood and coconut shell were noted, as well as waterworn rocks and midden.

Associated features include six petroglyph figures pecked into the surface of the pahoehoe above the entrance to the cave; three cairns, noted on the



D22-80 Shelter and Burial Cave (disturbed)

This site is located within a natural pahoehoe sink containing radiating lava tubes that were used as shelters (the largest tube was used both as a shelter and a burial cave). The shelters near the surface incorporate walls and platforms that extend from the natural overhang of the depression toward the center. The largest of the shelters near the surface is enclosed by a 6-m-long wall of stacked pahoehoe blocks, 85 cm high. The shelter overhang on the east side varies in depth between 3.25 and 15.00 m. The ceiling is 1.1 m high. The interior space is scattered with midden.

The burial cave entrance is on the southwestern side of this depression. It has a 2-m-diameter opening that is nearly vertical to the floor, 2 m below. The entrance area is large enough to allow people to stand for more than 50 m back from the entry. The tube continues along a northerly direction for another 50 m and then opens into an enormous chamber that continues in two directions, east and west, for several hundred meters. The ceiling height in this area is well over 10 m, and the width is similar. The floor is uneven as a result of probable roof fall. This area of the cave has several side tubes that were not explored, and which may have more burials. We counted twenty individuals, but this was a rough estimate, and it is likely that more exist.

D22-81 Pahoehoe Clearings

This site is located within a natural depression that is ringed by a pressure ridge that has been modified by the construction of clearings in the broken pahoehoe surface. The total number of clearings was not counted, but the area has clearly been modified.

D22-82 Burial Cist (disturbed)

This site consists of a single cranium in association with a handful of carrying poles; the longest of the poles is a 1-m-long fragment. The opening of the cist is in a pahoehoe bubble that measures 75 cm in diameter. The ceiling height inside is 50 cm, and the tube length exceeds 10 m. There was a pahoehoe slab to one side of the cist's opening that probably served as a lid to this opening. A single cairn marks the entrance to this cist.

southwest edge of the ridge above the cave (there were several small cairns that marked the petroglyphs, but these are thought to have been constructed by visitors to the sites); a single crescent-shape wall constructed of rope pahoehoe slabs, 2.4 m by 1.2 m by 35 cm; and 16 clearings, located in a 45 by 20 m area.

D22-76 Shelter Cave

This site is located within a natural tumulus with a collapsed area that provides an entrance to a chamber that was used as a shelter. The chamber entrance opens to the south and has a nearly vertical drop to the floor. The chamber ceiling is 1.75 m high, and the chamber area is approximately 20 by 7 m. The midden deposit is several centimeters deep with a dense ash deposit. There was an octopus-lure shell at the entrance. No other artifacts were noted.

D22-77 Shelter Cave

This site consists of a single collapsed elongated lava tube at the edge of an aa flow. The interior area is 2.0 by 1.5 m. The entrance is open to the north, and has a ceiling height of 1.3 m.

D22-78 Trail

This is a steppingstone trail across a small section of aa. The trail is approximately 40 m long, and has a north-south axis. The steppingstones are slabs of pahoehoe that have been placed on the rough aa.

D22-79 Pahoehoe Clearings and Associated Features

This site has an approximate area of 20 by 60 m. The most prominent features are two platforms: one is linear and measures 5.4 m long by 60 cm high; the second is circular and measures 2.5 m in diameter, and 55 cm high. Near these platforms are a papamā and nine petroglyphs that include human figures and lettering. The clearings in the area are numerous; over 56 were counted. These varied in size between 55 by 75 cm to 1.5 by 2.5 m, and in depth between 25 and 50 cm.

D22-83 Shelter Cave (disturbed)

This site is located in a collapsed lava tube that has two entrances, and which follows a northwest-southeast axis. The northwest opening has a paved entry. This entrance is approximately 4.8 m wide, the interior cave ceiling is 1.4 m high. The tube extends approximately 15 m back to the southeast entry. There is an abundance of midden.

D22-84 Pahoehoe Clearings

This site consists of two clearings that have a walled partition. They are constructed on the west side of a large pahoehoe boulder. The wall that divides the two clearings is 2.1 m long, 60 cm high, and 35 to 40 cm wide. It is constructed of pahoehoe blocks removed from the clearings. This is a clear example of this feature type, and is located 240 ft above sea level.

D22-85 Shelter with Pahoehoe Clearings

This site is located on a pahoehoe ridge and slope surrounded by an fingers. The shelter is open to the northeast, with little or no overhang. It measures 2 m<sup>2</sup>. Four clearings were identified in the area.

D22-86 U-Shape Wall and Clearing

This site consists of two features, located on a pahoehoe flat surrounded by an aa flow. The U-shape feature is constructed of stacked pahoehoe slabs, 1.9 m long (with two arms extending to the west), and an overall height of 50 cm. Three meters to the west is a small pit excavated in the pahoehoe that is ringed by pahoehoe blocks. It is 65 cm<sup>2</sup> and 45 cm deep.

D22-87 Pahoehoe Clearings

This site is located on a relatively flat unbroken surface of pahoehoe. Ten clearings were noted in this area adjacent to the road to the Kona Village Resort. One clearing was exceptionally large; its dimensions are 2.5 by 1.4 m, with a depth of 1.45 m. A single boulder-size waterworn rock was in the bottom of this clearing.

D22-88 Shelter Cave

This site is located within a lava tube that has a collapsed portion serving as an entry; this entrance is 80 cm by 95 cm. The interior ceiling is 1.0 to 1.2 m high. Midden scatter inside the tube contains a diversity of marine as well as brackish-water remains. The tube extends in a northerly direction for approximately 5 m, and in the southerly direction for approximately 10 m. The cave does not exceed 4 m at its widest point.

D22-89 Crescent-Shape Structure

This site consists of a single crescent-shape wall segment. The overall dimensions are 2 m by 60 cm by 20 cm. This feature is constructed out of stacked rope pahoehoe slabs.

D22-90 Trail

This trail segment is visible for approximately 10 m. Pahoehoe slabs placed on an aa flow mark the trail's route. Also noted in this area were several planters or clearings in the pahoehoe surface.

D22-91 Shelter Cave (disturbed)

This is an open-ended lava tube. The entrance on the east end has a well-built platform that ranges between 75 cm and 1 m high. The entrance at this point is 5.40 m wide and 2.65 m high. The tube extends to the west for approximately 10 m.

D22-92 Shelter Cave and Associated Features (disturbed)

This shelter cave is entered through a pahoehoe-slab paved area. The cave's natural opening is approximately 8 m wide, and its ceiling is 7 m high. The interior at the entrance is paved with stepped terraces. The largest of the terrace platforms contained within the cave is approximately 3.5 m by 2.5 m by 35 to 40 cm. Natural ledges are also incorporated into other platforms along the interior of the cave sides. A large cairn is located immediately to the right of the entrance and main platform; it is approximately 1.70 by 1.15 by 1.10 m. The surface of this cairn is littered with the artifacts of pot hunters, items noted were waterworn pebbles, wood

fragments, a human cranium fragment, coconut fragments, and midden. Additional platforms were noted in the cave adjacent to the entrance on the left. There was a square clearing in the blocky pahoehoe rubble outside and near the beginning of the paving that leads to the cave entrance. The overall dimensions were 3 m<sup>2</sup>, and the walls were approximately 50 cm wide and 60 cm high. A few clearings in the blocky rubble were also noted; some being quite deep, down to 1 m. A small opening leading to a narrow elongated tube containing a single parietal bone of a cranium is located along the western edge of this collapsed lava tube, and south of the enclosures.

D22-93 Shelter and Associated Features

The multiple features that make up this site are located within a pit crater whose entrance is on the northwest edge. The walls of this natural feature are approximately 7 m high. There is a lava tube below the pit entrance; no skeletal remains or midden were noted in the tube. A pahoehoe-slab paved area, 5 by 1 m, is located along the east wall, as is an overhang 1.5 m above the floor; midden litters the floor. The short leg of the platform is 4 m long, 55 cm high, and extends back 1.2 m. The longer leg of the platform is 6 m long, 50 cm high, and extends 3 m; the ceiling at this point is 1.5 m high. Also in this area is a hole, 1 m in diameter, in the platform, which probably functioned as a cupboard. The entire area is littered with midden.

D22-94 Rectangular and Square Enclosures and Alignments

This site consists of four features:

Feature A is an enclosure that is constructed on the west side of a large lava blister. The walls are constructed of pahoehoe slabs, with their interior sides lined with upright slabs. The west wall is 4 m by 60 cm by 70 cm. The south wall is 1.75 m by 60 cm by 15 cm. The interior area of this enclosure is composed of smooth pahoehoe; no midden was noted.

Feature B is a single alignment of stacked pahoehoe on the west side of a large lava bubble. The alignment is 3 m by 40 cm by 45 cm.

Feature C designates a set of walls that form an enclosure. These walls are constructed on the west side of a large lava blister. The longest segment

measures 2.9 m by 50 cm by 70 cm. Two additional wall segments divide the area; the most northern wall segment is 1.9 m by 50 cm by 70 cm. The total area enclosed by this feature measures approximately 4 by 2 m. The lava blisters that have been incorporated into these features serve as a natural windbreak or shade for the enclosure located on the west side.

Feature D is a small enclosure built at the edge of, and incorporating, an aa flow. The overall size is 3.4 by 2 m. The walls are 45 cm high, and portions are finished with smooth slabs of pahoehoe.

D22-95 Trail

This segment of trail crosses an aa flow for approximately 38 m. Along this trail are approximately 10 pahoehoe slabs to mark the way.

D22-96 Trail

This trail parallels an aa finger that roughly runs a north-south axis. The trail segment crosses pahoehoe, and shows up as an worn area on the pahoehoe.

D22-97 Shelter Cave

This site is located within a collapsed lava bubble at the edge of an aa flow. The sink is approximately 20 m in diameter, and has lava tubes that radiate away from the center to the edges. The central portion of the sink is paved with blocky pahoehoe chunks. At the southern edge, below the natural overhang that provides a shelter with a ceiling height of 2.5 m, is a dense scatter of midden that extends back 5 m. Waterworn rocks are frequent on the surface of the paved area. A small opening to a lava tube is located at the northern edge of this sink. Midden was also noted on the interior ground surface of this shelter. A trail with pahoehoe slabs leads to this site.

D22-98 Trail

This trail segment is approximately 6 m long. The trail that crosses an aa flow is marked by pahoehoe slabs. This trail was noted on the edge of Site D22-97.

D22-101 E-Shape Shelter and Pahoehoe Clearings

This feature measures 2.70 by 1.45 m. It is open to the north, and is partitioned by a 65 cm length of wall. The site is located on an old pahoehoe flow that is surrounded by aa. Eight clearings were noted near this feature.

D22-102 Shelter Cave

This is a collapsed circular lava bubble that is open to the northwest. The entrance is paved with blocks of pahoehoe that form a raised platform 60 cm above the floor of the small lava tube that extends to the south. The northeast edge of this bubble is open and forms a natural ledge. The lava tube's ceiling height is 1.10 m, and it extends back approximately 1.75 m. The floor of the lava tube has a dense deposit of midden.

D22-103 Shelter Cave

This shelter is in a lava tube that has a vertical opening measuring 1.4 m by 70 cm. The interior area is approximately 6.0 by 1.5 m, and the interior ceiling height is 1.1 m. Midden was noted on the floor of the lava tube. This site is approximately 15 m north of Site D22-88.

D22-104 Circular Enclosure

This feature is 2.2 m in diameter, and constructed of stacked pahoehoe blocks that are 60 cm wide and 25 cm high. This enclosure is located on the edge of an old pahoehoe flow, within the vicinity of Sites D22-88, -103, and -105.

D22-105 Shelter Cave

This shelter is located within a lava tube that has a vertical opening. The entrance is 1.1 m by 65 cm. The shelter's ceiling height is 1.2 m, and its interior space is 2.0 by 4.4 m.

D22-106 Shelter Cave

This shelter is located in a natural depression with a lava tube that opens to the south. The entrance is 2 m wide, and the interior ceiling height is 75 cm. The interior area is 6.0 by 2.5 m. There is a light scatter of midden on the inside and outside surfaces of the shelter.

D22-99 Shelters and Associated Features

This site is located within a collapsed elongated lava tube. The lava tube is located on a rise and is approximately 20 m long. The overhanging edges of this tube provide shelters. There is a paved entrance that leads to a shelter on the west side of this lava tube.

The shelter located at the most northern portion of this tube is paved with slabs of pahoehoe below the overhang. The ceiling is approximately 2.4 m high, and the interior depth of the shelter is 1.6 m. A small platform outside the entrance of this shelter is approximately 80 cm high. Cultural material in this area consists of midden and coconut fragments.

A second shelter is located along the overhang on the east side of this tube. This shelter has a ceiling height of 75 cm and a depth of 1 m; the floor surface is scattered with midden. In the more open area of this lava tube, located along the western edge, there is a lava tube opening that has a wall segment on the south side. There was no midden or other cultural material noted inside this feature.

D22-100 Shelter Cave Pahoehoe Clearings

This site consists of a shelter cave and pahoehoe clearings. The site incorporates a large lava tube that has a ceiling height of 1.2 m, and that extends back approximately 4 m. The tube opens to the south and is 4.3 m wide. There is a 2 m<sup>2</sup> area that is in front of the cave entrance, approximately 60 cm below the surrounding surface. A low wall edges this natural depression. A larger area, approximately 4 m<sup>2</sup> and paved, fronts the cave opening to the south. A rectangular enclosure is constructed on the west edge of the cave entrance, and measures approximately 1.5 m by 1.0 m by 35 cm. Coral and waterworn pebbles litter the enclosure surface. Midden is plentiful in the cave and in the area that fronts the cave entrance. An interesting construction feature that distinguishes this shelter from others is that the naturally formed cracks in the surface of the lava bubble have been filled in with additional blocks of pahoehoe. There were four clearings noted within the site area.

D22-111 House Platform

This is a rectangular house platform, 6 m long and 3 m wide. The platform is constructed out of pahoehoe blocks and clinkers; the edges are trimmed with larger pahoehoe blocks. The surface has porites coral fragments, waterworn rocks, and midden.

D22-112 House Platform

This is a rectangular house platform 5.0 m long and 4.5 m wide. The platform is constructed out of pahoehoe blocks and clinkers, and its west face is built 30 cm above the surrounding ground level. The surface of the platform has a light scatter of midden.

D22-113 C-Shape Structures and Pahoehoe Planters

This site consists of two C-shape structures:

Feature A is located on the south side of a pahoehoe lava bubble. This feature is 3.3 m long and 1.0 m wide; the walls are 50 cm wide and 50 cm high.

Feature B is located approximately 9 m northwest of Feature A. This feature is 2.8 m long and 1.7 m wide; the walls have rounded corners and are 80 cm wide and 90 cm high. There are approximately 30 clearings within the vicinity of these two structures to the north.

D22-114 Burial Cave

This site is on the edge of a natural depression that is ringed by a pressure ridge. There is a lava tube on the north side, with a vertical entry 8 m deep; there is currently a ladder to assist entry. Approximately 17 individuals are interred in this lava tube. Gourd fragments and carrying poles were noted.

D22-115 Petroglyphs

This site consists of five individual petroglyphs. The petroglyphs depict human figures and other, unidentified, images. These petroglyphs are located below Sites D22-110, -111, and -112.

D22-107 Trail

This trail segment is approximately 50 m long, and crosses both an and pahoehoe flows. There is a cairn at the southern point, near Sites D22-104 and -105. The cairn is 40 cm in diameter and 50 cm high. The trail is approximately 60 cm wide, and is possibly part of trail D22-96.

D22-108 Circular Enclosure

This feature is 1.55 m in diameter, and constructed of stacked pahoehoe slabs that are 35 cm wide and 20 cm high.

D22-109 Shelter Cave and Pahoehoe Clearings

This shelter cave is located in a lava bubble, and opens to the east. The entrance is 2.5 m wide, the interior ceiling is 70 cm high, and the interior space is 2 m<sup>2</sup>. At the surface of this feature is a wall segment that runs east-west on the south side of the entrance to the cave. Midden was noted inside the shelter. There are eight clearings in the vicinity.

D22-110 House Platform and Associated Features

This site consists of three features:

Feature A is a rectangular house platform. It is constructed on smooth pahoehoe that has been covered with a layer of pahoehoe clinkers. The edges of this platform are trimmed with larger pahoehoe blocks. The platform is 7.5 by 5.5 m. There is a rock-lined, square hearth in the center of the platform. Midden and volcanic glass are scattered over the surface. One basalt adz fragment was noted but not collected.

Feature B is a platform constructed of pahoehoe blocks that fill in a natural sink. This feature is approximately 6 by 2 m, and is 20 cm below the surrounding ground level. There are three pits that have been excavated into the platform; these may have been part of the initial construction, but looting cannot be dismissed. There is a wall segment at the southern end of this platform constructed with pahoehoe slabs, 3 m by 70 cm by 35 cm.

Feature C is a large cairn located south of Feature A. The cairn is 5 by 4 by 1 m and has a square pit in the center. Concentrations of midden were noted between and around designated features.

D22-116 Shelter Cave

This site is located inside a collapsed lava tube that opens toward the north. The entrance is 4 m wide, and the interior ceiling height is 1.25 m. The interior area is 7.0 by 2.5 m, and contains a light scatter of midden and a single goat skeleton.

D22-117 Enclosure Walls and Associated Features

This site consists of four features:

Feature A is a U-shape structure 2.5 m long and 2.0 m wide. This feature opens to the north, and has walls 50 cm wide and 35 cm high.

Feature B is a platform, 3 m long and 4 m wide, constructed of pahoehoe blocks, and raised 60 cm above the ground level.

Feature C is a series of wall segments that are perpendicular to a natural pressure ridge that forms the eastern wall. The approximately 7 m area is partitioned into three parts. The most southerly wall segment is 2.5 m long, with an interior area of 1.5 m<sup>2</sup>. This open enclosure has one cupboard at the junction of the wall and the pressure ridge. The wall segment is 1 m wide and 1 m high. The largest of the partitioned areas is 3 m long and 4.5 m wide. The natural outcrop at this point is 2 m high, and is naturally red, in contrast to the surrounding black pahoehoe. This area is littered with porites coral and midden. The last of the small enclosures incorporates a lava bubble. Completing this small feature is a wall segment 1.5 m long. The lava bubble has an opening 1.5 m wide, and an interior ceiling height of 70 cm.

Feature D is a shelter cave located at the very northern end of the natural pressure ridge. It opens to the east onto a naturally raised platform that has a stacked rock wall along the edge. This outside area measures 3 by 7 m. The shelter cave has an opening of 2.5 m, and a ceiling height of 1.5 m. The interior and exterior surface of this feature are littered with midden.

D22-118 Shelter Cave and Associated Features

This site has two features:

Feature A is a roughly circular platform with two pits excavated through

the paving. The platform is 4.5 m in diameter, and the two pits are each 30 cm in diameter and 60 cm deep. The platform is edged by larger basalt rocks, and is scattered with midden, waterworn rocks, coral fragments, adz flakes, and adz preforms.

Feature B is a shelter cave located to the east of the platform that incorporates a lava bubble that opens to the north. The cave has an entrance 1.2 m wide, an interior ceiling 1.45 m high, and an interior 90 cm wide. A light scatter of midden outside the shelter was noted. Five clearings were counted near this site.

D22-119 Cairn and Pahoehoe Clearings

This site covers an area 13 by 20 m. There are 15 clearings within this area. The cairn associated with these clearings is 1.4 m by 1.0 m by 70 cm, and is constructed of stacked pahoehoe blocks.

D22-120 C-Shape Structure, Cairns, and Pahoehoe Planters

This site consists of three feature types:

Feature A is a single C-shape shelter, roughly 2 by 2 m. The walls are constructed of stacked pahoehoe blocks, 45 cm high.

Feature B is 5 m to the south of Feature A, and consists of two large cairns. The cairns are approximately 3 m apart on an east-west axis. The cairns are constructed of pahoehoe blocks, and measure 3.9 by 3.2 by 1.0 m and 3.8 by 2.5 m by 80 cm. The slope to the northwest of these features is interrupted by 22 clearings and 12 small cairns for approximately 75 m. These smaller cairns vary in diameter between 1.0 and 1.5 m, and in height between 30 and 60 cm.

D22-121 C-Shape Structure and Pahoehoe Clearings

This structure incorporates a cleared area in the pahoehoe surface, and is 4.90 by 3.35 m. Walls have been constructed along two sides of the cleared area, 80 cm wide and 60 cm high. The southern end is blocked by upright placed pahoehoe slabs that are 1.1 m high. There are 13 clearings to the north and downslope of this feature.

D22-127 T-Shape Structure and Associated Features

This site is located on an isolated portion of pahoehoe flow that is surrounded by aa and scaly pahoehoe flows. The cross wall of the T-shape structure is 5 m long, between 60 cm to 1 m wide, and 65 cm high. The wall that completes the "T" is 3.4 m long, 40 cm wide, and 50 cm high.

A second feature is a single alignment of stones 2.7 m by 60 cm by 50 cm. All walls are constructed of scaly pahoehoe slabs and blocks. There are two clusters of clearings adjacent to these two features. The area in the immediate vicinity of this site has more clearings located on the old pahoehoe.

D22-128 Pahoehoe Clearings

This site consists of a natural depression that is ringed by a pressure ridge. The area has over 40 clearings, constructed along the fissures in the pressure ridge. A single artifact was noted near a cluster of clearings at the north end. The artifact, a multi-purpose tool, is an oval waterworn boulder, 30 by 17 by 90 cm, that shows battering on the ends, and grinding on one of its flat surfaces. This artifact was not collected.

D22-129 Cluster of Circular Enclosures

This site consists of three circular enclosures, each approximately 1.6 m in diameter and 35 cm high. No midden was noted.

D22-130 Petroglyphs (Modern)

This site consists of seven individual modern petroglyphs. They include a heart, several animals (turtle, dog, and fish), a human, and lettering in French. Several small cairns mark this spot.

D22-131 Circular Enclosure

This site consists of a circle of stone, one stone high (35 cm) and 3.2 m in diameter. A single *Callana* sp. was noted. Pahoehoe clearings are in the vicinity of this site.

D22-122 Shelter Cave/Burial Cave

This site is located within a collapsed lava tube. The cave opens to the east with a 3.25-m-wide entrance. The interior ceiling is 85 cm high. Midden is scattered over the surface leading to the entrance and the interior. A human cranium and mandible were noted approximately 15 m into the cave. No other skeletal remains were noted.

D22-123 Circular Enclosure

This site is a single circular enclosure. The enclosure is constructed of stacked rope pahoehoe slabs and small blocks that are 20 cm wide and 20 cm high; the diameter of the enclosure is 2 m. No midden was noted.

D22-124 Shelter Caves and Pahoehoe Planters

This site consists of multiple shelters located in a collapsed elongated lava tube. A total of eight shelters, all with substantial midden deposits, are clustered together in an area 22 m long and 11 m wide; they are connected by segments of paving. Some of the shelters are enclosed by walls. Pahoehoe planters (15 were noted) are located downslope to the north and northeast of this cluster of shelters.

D22-125 Trail

This trail crosses an old pahoehoe flow in a north-south axis. The pahoehoe has been cleared of the natural broken surface, providing the illusion of a clean swept trail. The trail continues approximately 70 m to the south, paralleling Site D22-124 on the west. The trail is visible to the north, but this portion was not followed.

D22-126 Shelter Cave and Pahoehoe Clearings

This site consists of one shelter cave marked by a cairn. The shelter cave is open to the southeast, and its entrance is approximately 2 m wide. It has an interior ceiling height of 80 cm. The cairn at the entrance is 65 by 45 by 45 cm, and is constructed of stacked pahoehoe blocks. To the north and down the slope are 12 clearings.



D22-132 Pahoehoe Clearings, Modified Outcrop

This site is located on a small pahoehoe ridge, the surface of which has been modified by the stacking of pahoehoe blocks to form clearings. Twelve clearings were noted.

D22-133 Wall

This is a single alignment of stacked pahoehoe blocks, 3 m by 60 cm by 65 cm.

D22-134 Crescent-Shape Structure

This feature is 2.1 m by 60 cm by 45 cm. It is constructed of stacked pahoehoe blocks.

D22-135 C-Shape Structure

This structure is constructed of stacked pahoehoe blocks, and is 4 m long and 2 m wide. The walls are 65 cm wide and 65 cm high. Two cairns are approximately 6 m to the east and west of this feature.

D22-136 Rectangular Depression

This structure is constructed on the edge of, and incorporates, a natural pahoehoe ledge. The interior of this feature is completely filled by rubble, and is presently covered in morning-glory. This feature is roughly 2.5 by 1.2 m.

D22-137 Cluster of Cairns

This site consists of a cluster of ten small cairns. These cairns vary in diameter between 75 cm to 1.3 m, and in height between 30 cm and 60 cm. The cluster is roughly circular, the diameter of which is approximately 15 m. There is a low wall in the center of the cluster, which is 3 m by 1 m by 50 cm. It is oriented on an east-west axis.

D22-138 Crescent-Shape Structure

This feature is 1.5 m by 40 cm by 45 cm, and is constructed of rough slabs of pahoehoe that have been placed one against another.

D22-139 Shelter Cave with Associated Features

This site consists of four features that are clustered together in a natural depression in the pahoehoe. The general area is covered with a dense scatter of midden, coral fragments, and waterworn rocks.

Feature A is a shelter cave that opens to the south. Its entrance measures 1.7 m wide, and its interior ceiling height is 90 cm. The entrance is sheltered on the west by a low L-shape wall. The longer wall is 1.7 m and 60 cm high.

Feature B is a platform that is east of the cave shelter, and bounded by a wall constructed of large pahoehoe blocks. The platform is approximately 3.0 m by 2.5 m by 40 cm. The wall is approximately 6 m by 60 cm by 70 cm.

Feature C is a C-shape structure that is 2.0 by 1.8 m. The structure wall is constructed of pahoehoe blocks, and is 80 cm wide and 1 m high.

Feature D is an elongated enclosure that is 2.6 m long, approximately 1.5 m wide, and 65 cm high.

D22-140 Shelter Cave

This feature opens to the south with an entrance that is 3 m wide. The interior ceiling height is 50 cm. The interior area of the cave is approximately 5 m<sup>2</sup>. Midden litters the interior and exterior of this site.

D22-141 Alignment and Cairn

The alignment is constructed of stacked pahoehoe blocks, 2.5 m by 65 cm by 65 cm. The cairn is 90 cm in diameter and 70 cm high, and incorporates a waterworn rock.

D22-142 Petroglyphs and Circular Enclosure

The petroglyphs consist of five pecked triangular-bodied human figures located on the older pahoehoe flow within a kiawe thicket. The circular enclosure is approximately 3 m in diameter and 25 cm high.

D22-143 Shelter Cave and Associated Features

This site consists of four features, all within a 15 m<sup>2</sup> area.

Feature A is a shelter cave located in a collapsed sink, roughly 8 m in diameter. The entrance, which is a nearly vertical drop, is obstructed by a large kiawe tree that is growing in the open area fronting the overhang. The entire northwest half of the sink is open, and contains a deep deposit of cultural debris. This feature has been severely looted.

Feature B is a shelter cave located in a pressure ridge. The entrance is a vertical shaft 2 m deep. The shelter has an internal area of approximately 3.0 m<sup>2</sup>, and a ceiling height of 1.25 m. Midden is lightly scattered on the surface interior.

Feature C is a C-shape structure that is open to the west, and measures 3 m long. The area is divided into two smaller compartments. A platform of pahoehoe-block fill is constructed on the back wall.

Feature D is a papamū that is on the old pahoehoe flow northeast of Feature A.

D22-144 Trail

This trail runs in a north-south axis for approximately 50 m. Watervorn rocks mark the trail over the pahoehoe, and pahoehoe slabs provide steppingstones over the aa flow. There are approximately five pahoehoe clearings within the area.

D22-145 Shelter Cave and Associated Features

The area of this site is approximately 20 m<sup>2</sup>, and contains numerous features. The features include a single shelter cave, a raised house platform, several small enclosures, and cairns. Each feature was covered with a dense midden deposit. A trail crosses the aa flow adjacent to these features. Pahoehoe clearings are also represented in this complex.

D22-146 Shelter Cave and Associated Features

This feature is located in a natural depression with a natural cave at the east end. The cave opens to the west, has an entrance width of 4 m, and

an interior ceiling height of 90 cm. A dense deposit of midden is present inside the cave and along the crevices of the natural depression. Other features include a circular enclosure that is 2.5 m in diameter and 1 m high. A trail segment and pahoehoe clearings are adjacent.

D22-147 C-Shape Structure

This feature opens to the west, and is constructed of stacked pahoehoe blocks and slabs. It measures 3.5 m by approximately 1.5 m by 70 cm.

D22-148 U-Shape Structures

This site consists of two structures that are part of a larger complex that is bisected by a fence that bounds the Kona Village property. These features are constructed of stacked pahoehoe blocks, and are located on the edge of a scaly pahoehoe flow. Feature A is 2 m<sup>2</sup>, with walls that range between 80 and 85 cm high. Feature B is 2.4 m by 2.1 m by 60 to 90 cm. A light scatter of midden is visible on the surface around these features.

D22-149 Circular Enclosures and Cairns

This site consists of two circular enclosures. Feature A is a single enclosure 3 m in diameter and 35 cm high. Feature B is a double enclosure; the larger enclosure has a diameter of 3.0 by 2.5 m, with walls 30 to 60 cm high. A few small cairns and pahoehoe clearings were also noted.

D22-150 L-Shape Structure

This structure is 3 m long, with a shorter perpendicular segment 1.5 m long, 65 cm wide, and 50 cm high. Some midden is present.

D22-151 C-Shape Structure

This structure is 1.25 m long and 1.50 m wide, and is constructed of stacked pahoehoe blocks, 65 cm wide and 70 cm high. This feature is built into a flow of scaly pahoehoe.

D22-152 Trail

This segment of trail is marked by branch coral scattered along its length. The trail continues north into the present Kona Village Resort property, and also south for roughly 100 m. The trail is visible in the pahoehoe surface.

D22-153 Cairns

This site consists of several cairns. The largest is built on a boulder. It is roughly 3.00 m by 2.25 m by 80 cm. There is a smaller cairn, 1.6 m by 70 cm by 30 cm, at the base of the boulder and to the west. The area has waterworn rocks and waterworn coral chunks similar to those on trail D22-152.

D22-154 Midden Scatter and Pahoehoe Clearings

This site consists of a light midden scatter near a pahoehoe clearing. There are slabs stacked to provide a low windbreak. The stacked segment is 1.5 m long by 35 cm high. There are seven clearings in the area.

D22-155 Circular and Square Enclosures

This site consists of six individual enclosures adjacent to an aa flow. The largest enclosure is 3.5 m long and 3.5 m wide, with walls 50 cm wide and 90 cm high. The smallest enclosure is 2.5 m long and 2 m wide, with walls 50 cm wide and 70 cm high. The area is scattered with waterworn pebbles and light midden scatters. The pahoehoe clearings in the area total 10, and more are located along the edge to the east of the aa flow.

D22-156 Trail

This segment of trail crosses an older pahoehoe flow adjacent to an aa flow. There are numerous clearings within the area. The trail crosses the Kona Village Resort road in a north-south direction.

D22-157 Crescent-Shape Structure and Cairn

This feature is 3 m long, and is constructed of stacked pahoehoe blocks that are 60 cm wide and 60 cm high. The cairn is at the southwest end of the crescent, and is 1 m by 60 cm by 60 cm. This feature is located at the edge of Site D22-156, before the trail crosses the Kona Village Resort road.

D22-158 Shelter Cave

This feature opens to the south with an entrance that is 4.0 m wide. The interior of the cave has a ceiling height of 1.5 m, and there is a light scatter of midden on its floor surface. There are several pahoehoe clearings in the vicinity of this shelter.

D22-159 C-Shape Structure

This feature is open to the west, and constructed of stacked slabs and blocks of pahoehoe. The structure is 5.25 m long and 4.00 m wide; the walls are 60 cm wide and 80 cm high. Portions of the interior wall are faced.

D22-160 Shelter Cave

This feature opens to the east with an entrance that is 3 m wide. The interior is roughly 4 by 5 m in area, with a ceiling height of 1.25 m. There is a light scatter of midden both inside and outside the shelter.

D22-161 Pahoehoe Clearings

This site consists of over twenty individual clearings that are located on a natural ridge at the intersection of the Kona Village Resort main entrance and maintenance roads.

D22-162 Shelter Cave and Cairns

This feature is a small lava tube that opens to the east. Its entrance is 1.5 by 1.0 m, and its interior ceiling height is 90 cm. There is midden inside and outside the cave. A row of five cairns, roughly 70 cm in diameter and 50 cm high, extend to the east for approximately 6 m.

D22-163 Shelter Cave and Platform

This shelter cave is partially walled-in, allowing for a small entrance, less than 1 m wide. The platform on the south side of the cave is 3 m by 2 m by 80 cm. Hidden and waterworn rocks are both in the cave and on the platform. Pahoehoe clearings are adjacent to this feature.

D22-164 C-Shape Structure

This feature is constructed of stacked pahoehoe blocks. It is 2.4 m by 1.2 m by 45 cm, and is located in a shallow depression northeast of the existing water pipes.

D22-165 Shelter Cave and Associated Features

This site consists of a shelter cave, an enclosure wall, and approximately 17 petroglyphs. The shelter has two openings: a small one on the south, and a larger one (5 by 5 m) on the west. The interior ceiling height is 1 m, and the interior area is roughly 7 by 3 m. The area fronting the western entrance is enclosed by a low wall, approximately 80 cm high. This courtyard area and the interior of the cave have dense deposits of midden, volcanic glass, and waterworn rocks. The 17 petroglyphs are located within a 10 m radius of this cave, and include human and animal figures, and western printing.

D22-166 Enclosure and Shelter

This site consists of two features:

Feature A is a large walled enclosure, 11 to 12 m long, and 7 m wide. It is built abutting an aa flow on the north, is divided by a raised platform on the west end, and is also partially divided by a wall that terminates halfway across the width of the structure. The wall at the west end is 1 m wide and between 1.20 and 1.35 m high. The eastern portion doesn't have formalized paving, as does the western portion, and its walls are 3 m high.

Feature B is a small shelter built into the aa flow, partially enclosed by a stacked aa clinker wall. It is 1.5 m<sup>2</sup>, and its ceiling height is 1 m. There was no midden inside the structure.

D22-167 Burial Cave

This site is located in an isolated pocket of old pahoehoe surrounded by an aa flow. A small trail segment crosses the aa at the northernmost entry into this pocket, and there is a small cairn at the end of this trail. The burial cave is located at the eastern end of the pocket. The surface has a light scatter of midden; there is also midden inside the cave beneath the

burials. There are two openings to the cave; the larger entry is on the west, walled-up side. The smaller entry on the east is roughly 80 cm<sup>2</sup>. The interior area is approximately 7 m<sup>2</sup>. The skeletal remains of three individuals were placed on sawn boards, their heads placed on pulu pillows. Each was dressed in western clothes, shoes, and hats. Several lei, recently placed on the skeletal remains, were also noted. Large panes of window glass littered the floor of the cave.

D22-168 Trail and Associated Features

This trail segment is 20 m long and crosses an aa flow. One waterworn cobble was noted. At the base of this trail are three recently-constructed cement basins with the inscription "Lavern Coll 75".

D22-169 Trail

This trail traverses both smooth and scaly pahoehoe in a north-south axis. This trail is visible because the surface of the lava is worn.

D22-170 U-Shape Structure

This feature opens to the west, it is 1.85 by 1.50 m, and is constructed of stacked pahoehoe slabs. The walls are 40 cm wide and 45 cm high.

D22-171 Shelter

This feature is similar to D22-166, Feature B. It is constructed directly into the upright scaly pahoehoe. The slabs have been stacked, creating a small shelter, 2 by 1 by 1 m.

D22-172 Enclosed Terrace

This site consists of two features: an enclosure terrace, and a cairn. The terrace area is roughly 9 by 6 m. There is a 3 m by 2 m by 70 cm cairn constructed on the east end of this terrace. The cairn construction incorporates waterworn cobbles and coral. Midden is scattered on the surface of the terrace. Three smaller cairns are incorporated into the enclosure wall and vary in diameter between 60 cm and 1 m. The enclosure wall varies in height between 35 and 40 cm.

D22-173 Shelter and Burial Cave

This site consists of a single cave formed by the collapsed roof of a lava tube. The cave is open to the northwest, has an entrance width of 6 m, and an interior ceiling height of 2.7 m. The interior wall is 8 m back from the front overhang. There is a small platform built against the wall of the cave on the north side of the entrance. The cave floor has some roof fall, and the deposit has been disturbed by both natural occurrences and possible pothunters. Two lava tubes on the west wall of the cave are partially walled-in: one has numerous skeletal remains; the other has a collapsed trunk, and possibly more skeletal remains. Midden is extensive both inside and outside the cave; waterworn cobbles are abundant inside the cave on the platform. The entry may be paved, however, the entrance is obscured by kiawe.

D22-174 Walled Pahoehoe Clearing

This feature is built into a pahoehoe outcrop. The wall that parallels the outcrop is 1.5 m long and 75 cm wide, and is constructed of roughly stacked pahoehoe blocks.

D22-175 Pahoehoe Clearings

This site consists of a single pahoehoe slope that has been modified to create clearings in the pahoehoe lava. Over 25 clearings were counted. The total area is roughly 30 by 8 m.

D22-176 Cluster of Cairns

This site consists of six cairns, constructed on a roughly east-west axis. Of the six, three are collapsed, and three are well-built and large. These cairns vary in size between 2.0 m by 1.7 m by 65 cm, and 2.0 m by 2.5 m by 1.6 m. Branch coral and midden are scattered over the surface between and around the bases of these cairns.

D22-177 Walled Clearing

This site consists of a single walled clearing in the middle of a scaly pahoehoe lava flow. Other clearings are present in the vicinity.

D22-178 Trail

This site marks the confluence of two trail segments. One trail heads off in a 160° SW direction, and the other trail heads off in a 40° NE direction. Neither trail was traveled to determine the extent of the segments.

D22-179 Wall and Associated Features

This feature traverses the aa and pahoehoe flows paralleling D22-180. The wall is constructed of aa clinkers. Several additional features are incorporated into the wall construction, and include a cairn and an L-shape structure.

D22-180 Historic Wall

This feature crosses the aa and pahoehoe lava, is well-built, and is 60 cm wide and 1.5 m high. There are standing gate posts presently incorporated into the wall.

D22-181 Shelter Caves

This site consists of two caves formed by the collapse of a lava tube. The larger of the caves has an opening 9 m wide, and opens to the west. It also has an interior ceiling height of 1 m, and the back of the tube is 3 m wide. The smaller cave has an opening 3 m wide, opens to the east, has an interior ceiling height of 1 m, and has an interior space of approximately 3 by 5 m. Both caves face an open area, and both interior and exterior surfaces of the caves have extensive midden deposits.

D22-182 L-Shape Structure with Cairn

This site consists of three features: an L-shape structure with walls between 2.0 and 3.5 m long; a single cairn 1.6 m in diameter by 65 cm high; and a cupboard that is 90 by 90 by 80 cm.

D22-183 Alignment and Cairns

This site consists of three features: a single alignment or wall, and two cairns. The wall is 4 m by 60 cm by 70 cm. The cairns are 1 m in diameter by 70 cm high, and 1.2 m by 80 cm by 65 cm.

D22-184 C-Shape Structure

This feature is 2.2 m long, with walls 60 cm wide and 45 cm high.

D22-185 Alignment and Cairn

This site consists of two features, a wall and a cairn. The wall is 4.5 m by 60 cm by 45 to 65 cm. The cairn is 1.6 m in diameter and 55 cm high.

D22-186 Enclosures

This site consists of three roughly circular enclosures that range in size between 1.0 by 1.5 m to 1.25 by 2.00 m; wall heights range between 35 and 60 cm. These features are located at the base of the aa flow at the edge of the shupua'a boundary of Kūki'o and Ka'upūitehu.

D22-187 Shelter

This feature utilizes a natural pahoehoe bubble in the lava. The addition of two low walls provides a sheltered area that is 3.4 m deep and 1.0 m wide. The natural bubble is 2.0 m deep and is included in the above measurement. The height of the natural feature is 1.75 m, and the height of the wall is 75 cm.

D22-188 Crescent-Shape Structure and Cairn

The crescent-shape feature is 2.2 m long, and has a wall height of 60 cm. Three waterworn rocks are near this feature, which is open toward the sea. The cairn is 1.2 m by 1.6 m by 70 cm.

D22-189 Shrine

This site consists of five cairns, a possible altar area at the east end of the site area, and a midden scatter in the center. The total area of this site is approximately 30 by 15 m. The cairns are constructed of lava blocks and slabs with waterworn coral chunks incorporated into each cairn. The cairns are between 1.0 and 2.0 m long, 1.3 m wide, and range between 1.1 and 1.4 m high. Waterworn rocks, coral, and an upright stone mark the east end of this site.

D22-190 C-Shape Structure and Cairn

This site consists of a single C-shape structure and a cairn. The C-shape is approximately 2 m long, and constructed of lava blocks 25 cm high. The cairn was not measured.

D22-191 Cairns

This site consists of eight cairns in a circle and three pahoehoe clearings. The cairns are each no greater than 70 cm in diameter and 35 cm high. Three of the cairns are collapsed.

D22-192 Alignment and Cairn

This site is located in an area edged by an aa flow. The alignment is 3 m long, 70 cm wide, and 50 cm high. The cairn is 1 m in diameter and 50 cm high.

D22-193 Shelter Caves and Petroglyph

This site consists of three shelter caves located in an elongated lava tube. A single petroglyph was noted near the mauka shelter. There are over 20 clearings in the area associated with these shelter caves.

The makai shelter opens to the east and has an entrance that is nearly vertical. The entrance measures 4 by 3 m, and the interior ceiling height is 3 m. The interior area is roughly 24 m<sup>2</sup>. The floor is level with a considerable midden deposit.

The middle shelter is open towards the sea, and has low steps in the entry. The entrance is small, roughly 1.5 m<sup>2</sup>, and the interior ceiling is 1.5 m high. The floor is sloped, and has some surface midden.

The mauka shelter opens to the south, with a cairn marking the front. The cairn is marked by branch coral. The shelter has an entrance 2 by 1 m. The interior ceiling height is 1.5 m, and the interior area is roughly 20 m<sup>2</sup>. This interior of the cave has a dense midden and ash deposit.

D22-194 Circular Enclosure and Crescent-Shape Structure

These two features are located in an area surrounded on three sides by an aa flow. The circular enclosure measures 1.5 m in diameter, and has a wall

APPENDIX B

This appendix contains descriptions for sites identified by Reinecke, Soehren, Ching, and Komori. No changes have been made to the descriptions of Reinecke, Soehren, and Komori, except for the addition of Bishop Museum site numbers. Ching's descriptions, however, have been summarized onto one page.

Reinecke, John  
1930 "Survey of Hawaiian Sites from Kailua, Kona to Kalahuipuaa, Kohala." Ms. in Department of Anthropology B. P. Bishop Mus.

50-Ha-D22-27 and 47 (This site has been divided)  
Site 118. Walled hut site; the stones about a caved-in lava bubble may mark another hut site. Walled shelter; pen. Large pen adjoining the a-a flow on Kaupulehu land. Dwelling site on a-a above it. A few graves on the edge of the a-a flow.

50-Ha-D22-28  
Site 119. At Waistuhi a reef makes practically a fishpond in front of the sand dune. There is kiawe growth here and a sizable marsh.

50-Ha-D22-29  
Site 120. Very small pen on the sand.

50-Ha-D22-14  
Site 121. Remains at Kaupulehu hamlets. There is a belt of kiawe which probably hides some house sites. At the south end are some low unskillfully-walled enclosures. One contains four house platforms, all but one paved with ilihii. Two more house sites hard by. Under the kiawe farther north is a lot with a large house platform. There seem to be others, perhaps four or five.

I regret not having followed up the extension of the kiawe inland behind the a-a, which should contain several sites and perhaps walls of braotkish water.

I did not see the famous Ka Wai Ihu a Kane, the legend of which was secured from Kanula Iuhopu thru Mrs. L. Iannagi, and is added in the Appendix.

On the lava Leoch north is a very small platform.

that measures 90 cm wide and 60 cm high. The crescent-shape structure is 1.6 m long, and has a wall that is 40 cm high.

D22-195 Shelter Cave

This shelter cave is located in a lava tube. The entrance is nearly vertical, and measures 6 by 3 m. There are a number of clearings in the immediate area. The floor of the cave has a sparse scatter of midden.

D22-196 Trail

This trail crosses an aa flow in an east-west direction. The trail is marked by pahoehoe slabs that have been placed on an aa flow.

D22-197 Midden Scatter

This site consists of a light scatter of food remains in an area roughly 2 m<sup>2</sup>.

D22-198 Shelter Cave

This site is located in a partially collapsed lava tube that is surrounded by a scaly pahoehoe flow. The entrance opens to the south, and measures 1.7 m wide by 1 m high. The tube extends back nearly 6 m, and there is a light midden scatter on the floor surface.

D22-199 Shelter Cave

This site is located in a natural depression that has a rockshelter at its makai end and a lava tube on its eastern edge. The rockshelter is fronted by a platform and walls that intersect the edge of the natural depression. The rockshelter has an opening 5 m wide and an entry height of 1.75 m. The shelter extends back only 1 m, and seems to be blocked after this point.

The lava tube opens to the east. The entry has been walled and faced with pahoehoe slabs. There are low steps that form the floor of the entry, which is "S"-shaped. The tube is on an east-west axis, and is long and narrow. The interior ceiling height is 1.5 m, with the widest portion of the tube roughly 2.5 m. A cache of fish bones was noted in a gourd bowl directly on the interior side of the entry wall. No collection of these items was made.



50-Ha-D22-13  
 Site 122. After crossing the abominable Kaupulehu Flow, west branch, one reaches a pahoehoe flat about 1 1/2 x 1/2 miles in extent. I have divided it, for purposes of description, into seven areas, but it should be understood that the ruins are practically continuous, if sometimes buried under the sand.

The whole area is the most interesting on this coast, for several reasons:

1. The great number and continuity of the remains.
  2. The apparent considerable age of many of the ruins.
  3. The apparent lack of a water supply even barely adequate.
  4. The large number of a localized form of storage cupboard, a well-built box-like form at the back of walled sites, due no doubt to the very hard, solid pahoehoe offering no handy little caves.
  5. The large number of native salt pens (see photographs). These were sometimes built directly on the pahoehoe as a floor; sometimes the base was built of carefully arranged flat rocks. As the sun's rays had to strike the pen directly, the walls were usually about 8-12" high, built of carefully selected stones. Sometimes the pen was rectangular, but oftener rounded or circular, about 8 or 10 feet across. The floor and the base of the wall were cemented with a hard native cement of good quality, which still clings to scattered stones and to patches of pahoehoe floor where there are now no walls. Salt is still gathered here, but from natural pockets.
- At the western end of the flats: (a) remains of pens; (b) remains of walled dwelling site with "cupboard"; (c) shelter site, walls and cupboard; (d) remains of three shelters; (e) pebble-covered ruins of about six platforms--a usual feature of these coarse sand beaches--(f) shelter, walls and cupboards; (g) sundry traces of old enclosures; (h) sand-drifted walled shelter.

50-Ha-D22- 9, 10, 11, and 12.  
 Site 123. (a) Ruins of a walled site; (b) at an interval of some 500', the remains of an enclosure, two shelters, and a cave. At this spot are several petroglyphs of unusual type, copied on page 24 rather roughly from sketches.

50-Ha-D22-5, 7, and 8.  
 Site 124. (a) Platform c. 30x6x4, like part of wall. Shelter attached and recent shu on it. May possibly be a fishing house. (b) Two good platforms, 15x10, 11x10. (c) Trace of large platform adjacent to a. (d) First of salt pens: a group of three about a heap of stones. Four other pens are near. (e) Walls of yard and trace of house platform; traces of walls and platform north of it. (f) Two modern shelters by Kiawe mauka. (g) A spring with fairly brackish water; traces of ruins in hollow to north. (This is the only water supply noted.) (h) A large platform on the beach; remains of two smaller ones and an enclosure just it. (i) Ruins of it,

a shelter pen with cupboard and four more salt pens, with traces of cement on pahoehoe. (j) Walled site, cupboard, shu in front. (k) Pen and three shelters, apparently. (l) Several small areas marked off by rows of stones in the sand. (m) Whitened patches on pahoehoe marking sites of salt pens. A salt pen with walls 2' high; four others with very well-built walls 1-3' high--unusual. (n) Two modern shelter pens.

50-Ha-D22-1, 2, and 3.  
 Site 125. (a) Isolated shelter pen. (b) Three shelter pens together. (c) Shelter pen with pieces of wall. All these are about a prominent site on a knoll (d) which may be taken as the starting point for #125; it consists of a house site and two carefully walled enclosures, all used for dwelling; cupboard. (e) Usual traces along the beach. (f) A number of salt pens. (g) Ruins of walled site on beach. (h) Remains of several house sites on coast.



Soehren, Lloyd J.

1963 "Archaeology and History in Kaupulehu and Makalawena Kona, Hawaii." Ms. in Dept. Anthropology, B. P. Bishop Mus.

All sites on the following pages should be prefaced with the following 50-Ha-D22-.

#### Sites

1. On a flat pahoehoe eminence about 100 yards inland from the boundary point at Pohakukaha is the best preserved house site surviving in the land of Ka'upulehu. Its elevation has undoubtedly saved it from the fate of the other sites along this beach which have been almost completely obliterated by high surf and tidal waves.

The structure is divided into two compartments, the floor of the makai one being about one foot lower than that of the other. The east or back wall is built at the edge of the pahoehoe ridge and is extended southward 19' beyond the house. The lower, makai compartment is 9'x11' inside, and has been somewhat disturbed, especially the floor. Because it was filled and paved with rubble, it may have been torn up by artifact hunters. The upper compartment, 11'x13', has a solid pahoehoe floor covered with only a thin layer of sand save for a few outcrops. Near the southwest corner of the room is a small fireplace. The outer walls of the structure are two feet high and from two to three feet thick, while the wall dividing the two compartments is four feet thick and two feet high. All are very carefully constructed and present a smooth, even face, especially on the inner surfaces. The door of the structure has been broken down and considerably widened. The absence of pottery and glass indicates that the site was abandoned before articles of European manufacture were in current use.

A few yards makai and in the sand at the base of the pahoehoe lie the remains of another site which appears to have been similar to the one just described. Unfortunately, only the long back wall and the beginnings of the side walls can be traced.

It might be noted here that the majority of surface sites are oriented with their long axes perpendicular to the shore. Doorways were probably located on the southwest side to allow the prevailing sea breeze of the day to enter the house, while the chilly land breeze of the night would be blocked. However, none of the sites were found sufficiently intact to permit positive identification of the entrance.

2. About two hundred feet west of D22-1 is a rectangular stone wall enclosure, 9'x11', with walls two feet thick and perhaps originally two feet high. It is now in very poor condition. The makai wall is missing, perhaps buried under the sand.
3. Another rectangular walled site, 12'x13', with walls two feet high and two feet thick. The doorway, two and a half feet wide, faces into the sea breeze. The structure is considerably disturbed. Nearby are two salt pans of the type described under site D22-5.
4. At this site only faint traces were found of several walls and salt pans. A nearly ruined section of a wall containing a semicircular "bay window" five feet in diameter is reminiscent of an example found at Honokohau (site M2-19).

8. Almost completely buried in the sand is the outline of a stone walled house site, about 9' x 11'. The makai side is bounded partly by a stone wall which joins a ledge in the pahoehoe to continue westward across the front of the site. Several faint petroglyphs were found on the pahoehoe ledge, mostly buried in the sand and much weathered. Behind the site and buried in the sand is another stone wall which seems to form the corner of a large yard enclosure; the eastern wall is about 20' long and the southern about 35' long. It does not appear to have been connected with the wall at the makai side of the site, and may represent a distinct, if not older, site.

9. Another site mostly buried in sand appears to have been a large rectangular stone walled house site. The eastern wall measure 32', the southern 22', and the western 24'. The northern or makai side is open, perhaps destroyed by high surf.

10. A long stone wall can be traced running mauka for about fifty feet from the top of the beach. At the makai end of the wall and on the high point of the beach is a large, loose heap of stones, some of which have bits of lime mortar adhering to them. The cairn appears to be of modern origin, while the wall may have once been part of a yard enclosure.

The beach area surrounding this site shows many faint traces of house platforms, but the sand and stone washed up by the sea have obliterated almost all distinguishing features.

5. At the eastern edge of a low place often flooded by high surf is a group of salt pans of interesting type. Smooth, rectangular stones are placed on the pahoehoe to form a circle seven to nine feet in diameter, or sometimes a rectangle of comparable area. The joints were then sealed and the pan lined with a lime mortar, which was probably made by burning coral from the beach. Three such pans were found on the pahoehoe at this site, and two more circular ones are surrounded by a broken wall two feet thick and up to two feet high, covering an area of 2x3 fathoms. Against the east end of the enclosure are the remains of two slightly smaller pans. The dimensions and overall appearance suggests that the pans had been built within an older walled house site. A spring reported to be near this site was not found.

6. Over three hundred yards inland a small sleeping cave was found on the eastern side of a large pahoehoe ridge. Considerable shell litters the floor, but no artifacts were found.

7. On the opposite side of the low sandy depression is a massive stone wall 35' long, from three to six feet in thickness and three to five feet high. The base course contains stones rather larger than commonly used, some standing two feet high. At the mauka end is a small enclosure, 5' x 9' inside, open on the makai side, which is probably a modern fisherman's windbreak. In the mauka end wall is a "cupboard", built at ground level by placing two slabs on edge a foot or so apart and covering them with a third slab.

A few yards west of the wall are two old papani and two petroglyphs, all much weathered.

perishable materials might have been used, if indeed the holes were covered. Their use as postholes seems unlikely.

A few yards east along a low ridge a pile of shell fragments was found. A crack in the top of the ridge has been partially filled with beach pebbles and coral, with scattered bits of shell and sea urchin spines. About fifty feet east of the sleeping cave are the remains of a small enclosure two fathoms square, built against the makai side of a low ridge. The walls are about two feet thick, but their original height is unknown. In the center of the mauka wall is a circular pit resembling those described above; another may have been in the makai end of the adjoining eastern wall, but it is much disturbed and indistinct.

13. At the western end of the beach, a few yards from the edge of the a'alewa, are the ruins of a stone walled structure on the sand and gravel beach, and a rectangular walled area inland on the sand. The stone structure on the beach is quite massive, standing from two to three feet high, and from two to six feet in width. It is quite unusual in being curved to form a small enclosure about seven feet in diameter, open to the west. At the back of the enclosure opposite the entrance is a fine example of the stone "cupboard" as described at site H22-7. Save for this feature the site might be suspected of being recently built by itinerant fishermen; even so, the "cupboard" and portions of the wall may have been incorporated into a modern windbreak. Circular enclosures are most unusual among ancient Hawaiian sites.

11. About four hundred feet inland from the shore is a small pahoehoe pressure ridge, on the mauka side of which is a commodious sleeping cave. Because of the shelter faces the upland whence come the cold night airs, a stone wall had been built across the entrance to keep the occupants warm. Considerable shell and sand litters the floor, and it is possible that the site was used by visiting fishermen as a workshop also.

On the pahoehoe above the shelter is a massively built corner of a stone wall, apparently the remains of a stone walled house site. Much sand and shell suggests a house floor.

12. An interesting example of the use of natural features of the land is found at this site. A bubble on small tube in a pahoehoe ridge with the opening at the top provided comfortable accommodations for one or two occupants. With the addition of a stone wall windbreak around the flat top of the ridge an area about 9'x12' was made available for working and living. The wall was built in the shape of a U with the opening to seaward, thus funneling the cool sea breeze of the day into the site, and blocking the colder night winds from the mountains. The wall is in good condition, two and a half to four feet thick and in places five feet high. The ends of the U are enlarged and raised slightly to form a distinctive portal. About nine feet from the end of the eastern arm of the wall is a rough circular pit in the wall, reaching half way to the ground. A similar hole five feet from the end of the western wall extends three feet to the floor level. The function of these two features is unknown, but suggest storage places. No flat slabs suitable for covering the holes were found; however,

play may have built the structures (personal communication, 1962).

Some distance inland is a curious group of ten small ahu about two feet high arranged roughly in a circle around a central ahu of similar size. No function is readily apparent; the foregoing comment may apply to this feature as well.

21. About two hundred yards east of the petroglyph field, and on the mauka side of the new road, is an extensive area covered with crude structures of a rather puzzling nature. The area is one of scaly pahoehoe with numerous small pressure ridges and forms a fairly distinct zone in the generally smooth pahoehoe. Perhaps fifty crude structures, built from one to three feet high of the rough lava immediately available, are strung out in a more or less east-west direction, some lying in two parallel rows but most at random. They range from semi-circles about six feet in diameter to squares or rectangles one or two fathoms in extent. Some are built to include small shelters, such as are occasionally used for sleeping. Most of the shelters are open to the sea breeze of the day. Varying quantities of sand, coral and shell are to be found in almost all the sites, and a number contained several small water-worn pebbles. One rough papamu and a faint petroglyph were found in the area.

Their small size, extreme crudeness, and the roughness of the surrounding ground make it unlikely that the structures were ever intended for other than temporary use. Whatever use that may have been is entirely speculative: possibly they represent temporary campsites of visitors or travelers, or better, the encampment of a military force. But the most plausible explanation comes from Dr. John R. Smeck, who suggested that children at

22. About a half mile inland from Ka'upulehu pond and immediately adjacent to the 1801 lava flow is an interesting complex of features, including petroglyphs, papamu, ruined structures and a cave. The most striking petroglyph represents a human foot with six toes. A small, faint sail was found, and a second footprint of crude outline; five papamu and part of another are scattered over this area, the largest being 13'x17'.

The stone structures are much disturbed, hence are difficult to evaluate. The largest appears to have been divided into two compartments, one about 1x2 fathoms and the other about 2x2 fathoms. The walls may have been two feet high originally. The other structures, or heaps of stones, are completely beyond identification.

Of most interest is the cave, formed by the drainage of lava from under the hardened pahoehoe of the surface. Just inside the easily negotiated entrance is a floor containing midden material from which a few small artifacts of bone and seashell were recovered. One branch of the cave runs makai parallel to the 1801 lava flow and contains three burials. Two are canoe burials, in which a half canoe is placed upside down over the remains, while the third is simply extended on the floor without a covering. Only one of the canoes was found intact; the other had disintegrated.

A second branch of the cave extends almost under the 1801 flow, and contains about a dozen burials, five of which are in wood coffins, and the remainder extended in the open. Miscellaneous items of western manufacture are associated with these burials. Most of the coffins appear to have been opened.

Just inside the entrance to the cave are two long oars, 12.1 and 12.8 feet long, both lacking the blades. The shorter one appears to have been made as an approximate copy of the longer, for it is incomplete in detail and of very light wood, possibly hau. The oars were undoubtedly used to carry a coffin to the cave for interment.

In addition to the oars, four poles ranging from 9.3 to 9.9 feet in length and 0.15 to 0.2 feet in diameter were found. Three are notched at one end after the fashion of rafters used in thatched houses, and one is plain. These poles were probably used as were the oars.

The site has been visited by collectors, as is indicated by the opened coffins and other evidences. Five torches were found, made of joints of bamboo stuffed with rolled burlap. It is unfortunate that burial caves are not generally held in the same regard as more conventional cemeteries, with which they share equal legal protection.

23. Just past the mauka edge of the zone of scaly pahoehoe, and about fifty yards from the 1801 flow is a small group of petroglyphs, four of human figures and one small seal. One of the figures sports an elaborate head-dress which is reminiscent of certain of the stock images in the museum.

24. This structure is apparently unfinished, and was possibly intended for use as a small pen. It is 2x4 fathoms, built of small rough slabs of lava from the surrounding scaly pahoehoe, with a rough door in the east end. The north wall is unfinished.

25. On the mauka side of the belt of kiawe along the beach and east of Waiakahi pond, two cist burials were found in a slight depression in the lava. They are about 6'x10', one foot high, and placed side by side. No other sites were found in this area, although the recent rapid spread of the kiawe may have obscured some.

26. On the a'a lava, just inland from Kumukaa Point, a very rough papamu was found on the makai side of the trail at its highest point, and a few yards makai the number 18 was seen carved on a rock. In the same vicinity are several low, short stone walls, almost indistinguishable from the surf rounding lava, and forming no readily apparent pattern. Along the western edge of this ancient flow and overlooking the beautiful Kuki'o Bay are several graves. The trail which crosses this flow is typical, with markers of white coral placed at intervals along the sides, and occasionally smooth beach stones are found on the trail itself. Many of the stepping stones have been removed and cast aside, probably to make it easier for horses or mules to use the trail.



Komori, Eric  
1981

"Archaeological Reconnaissance Survey of Makai Area (TKM:7-2-3:2)  
at Ka'upulehu, Hawai'i Island." Ms. in Dept. Anthropology, B.P.  
Bishop Museum.

Site 50-Ila-D22-41

This wall is located on the trail (Site 26) approximately 130 meters from its northern end. The wall, which extends 5 meters on both sides of the trail, is 1.0 meter high and 0.5 meter wide, and is constructed of stacked aa clinkers. The remains of a wooden gate and pieces of iron are present on and around the walls. Two crude carrying sticks, found in a crevice near the gate, measure 65 cm and 106 cm in length and have diameters of 1.75 to 2.00 cm (Fig. 11). One end of each stick is notched in a manner characteristic of Hawaiian carrying sticks. The opposite end of each stick is broken.

Site 50-Ila-D22-42

This site is a C-shaped shelter, 2.5 meters in diameter and 0.75 meter in height, upon the seaward side. It is located up the coast. A wooden palette, modern bottles, and other debris litter the area around the structure.

Site 50-Ila-D22-43

This site consists of nine features, located on the aa at the northern end of the *kūpuka* (Fig. 12). A petroglyph is located ca. 30 meters to the southeast (Fig. 13). The features are described below.

(a) An *āhu* (cairn), 1.5 meters in diameter and 0.5 meter high, constructed of stacked aa clinkers.

(b) A rectangular enclosure, 4 by 5 meters, with a 4-meter-long wall segment extending from the eastern wall. The walls are 1.0 meter high and are constructed of stacked aa clinkers. The interior of the structure has been leveled by clearing large stones, and coral sand has been deposited at the entrance (Fig. 14).

-82-

-83-

(c) An *āhu*, 1.0 meter in diameter and 0.4 meter high, constructed of stacked aa clinkers.

(d) A small rectangular platform, 2 by 2.5 meters, with walls constructed on the edges of three sides. The walls add 0.3 meter to the 0.4-meter height of the platform. The platform is constructed of stacked aa clinkers, and numerous pieces of coral and shell are present on its surface.

(e) This structure consists of a slightly raised rectangular platform, 1 by 2 meters, with a wall on three sides (similar to Site 29d). A rectangular enclosure, 3 by 2 meters, abuts and is incorporated into the rear wall. Three waterworn stones are present on the platform and a "cupboard" is incorporated into the wall of the enclosure (Fig. 15). The rear wall of the enclosure may be another platform that has deteriorated.

(f) A rectangular platform, 1 by 1.5 meters and 1.2 meters high. Constructed of stacked aa clinkers, the platform is stepped in two

Site 50-Ila-D22-44

This site consists of two *āhu* located on the southern edge of the aa flow, and an enclosure that utilized the flow as one of its walls. The *āhu* are roughly 1.5 meters square and 1.0 meter high, and are constructed of stacked aa clinkers. The enclosure is formed by a wall 10 meters long and 0.5 meter high, and may contain burials. It is slightly curved to meet the aa flow. A survey marker labeled "Kukio" is located 30 meters north of these structures.

Site 50-Ila-D22-45

This site is an *āhu* that consists of aa clinkers stacked against the north side of a large boulder. The *āhu* is 1.5 meters in diameter and 0.5 meter high.

Site 50-Ila-D22-46

This site is a complex of five poorly constructed enclosures or C-shapes. The structures are situated within 2 to 3 meters of each other, and each measures about 1.5 meters across. A small circle of stones, 1.0 meter in diameter and one to two stones high, is located near the southern edge of this complex.

Site 50-Ha-D22-47

This site consists of four structures located on the southern edge of the aa flow. At the base of the flow is a low swampy area, which may be the remnant of a fishpond (Fig. 17). The four features are described below.

Site 50-Ha-D22-48

This site is a small collapsed lava blister, measuring 3 meters across the opening, that has a low rubble wall constructed in front of the opening. The interior of the cave has been cleared of rubble and a sparse deposit of shell midden is present.

Site 50-Ha-D22-49

This site is a sparse accumulation of shell midden on a bare pahoehoe outcrop. No modification of the outcrop was noted.

Site 50-Ha-D22-50

This site is a low area of bare pahoehoe where two collapsed lava blisters have been modified by removal of rubble in the interiors and construction of low rubble walls in front of the openings. Sparse accumulations of shell midden are present in the interiors.

Site 50-Ha-D22-51

This site is a sparse accumulation of shell midden on a bare pahoehoe outcrop. No modification of the outcrop was noted.

Ching, Francis  
1971 The Archaeology of South Kohala and North Kona: Surface Survey.  
Kailua-Kawahae Road Corridor. Hawaii State Archaeological Journal  
71-1. DLNR, Division of State Parks.

SITE NO.	DIMENSIONS	DESCRIPTION
50-Ha-D22-35	15 m x 7.8 m x 1.8	Set stone pathway leads into dwelling cave. Artifacts include: Coral file, coconut cup, wood, coral abrader.
D22-36		
D22-39	2.1 m x 1.8 m x 3.5 m	Trail, continuation of site D22-200. Enclosure "O" shaped built of stacked lava.
D22-40		
D22-79		
D22-80	8 m x 5 m x 50 cm	Trail. A well worn trail on pahoehoe running mauka-makai and was used by mules. A glass fragment was found. Labeled the Kukio-Puhia Pele Trail. Seven petroglyphs with individual dimensions. Dwelling Cave. Extensive midden concentrations. Artifacts include: Coral file, worked animal bone.
D22-91	10.7 m x 5.75 m x 2.5 m	A fire place is located near the entrance of this dwelling cave. There is a thick covering of shell midden extending on outside the cave. Incisors and worked bone were found in the cave.
D22-200		Trail. Stepping stone trail over the aa of the Kapulehu flow. Stepping stones are located only at the end of the trail. House Platform. No signs of habitations.
D22-201	4 m x 3 m	Writing on pahoehoe, and associated dots.
D22-202	5.8 m x 4.5 m x 85 cm	Shell midden scattered on floor of habitation.
D22-203	12 m x 4 m x 1.5 m	Shell and wood material in cave.
D22-204		

APPENDIX C  
 NOTES ON THE HISTORY OF KA'UPŪLEHU  
 by  
 Marion Kelly

The shupua'a of Ka'upulehu is a large land division on the island of Hawai'i, stretching over 23,500 acres from the sea to the top of Hualālai. Its climate and terrain vary from a rocky sea coast (with a combination of smooth pahoehoe and rough, jagged aa lavas) to a heavily forested upland and a barren alpine mountain top. The upland rainfall supports a variety of flora, including a forest of ohi'a-lehua (Metrosideros collina) and koa (Acacia koa). At the sea coast, a small amount (a few inches per year) of rainfall support sparse grass in small pockets here and there. Today, kiawe (Prosopis pallida) is prominent just back of the morning-glory-covered sand dunes of Kalaeamānō and Weiakūhi. The kiawe is thick in the Ka'upulehu petroglyph field behind the Kona Village Hotel, which surrounds a brackish-water fishpond.

The lava flows of 1800-1801 covered much of Ka'upulehu and other North Kona shupua'as, from Pu'uva'ava'a to Mahai'ula. The flows emanated from two separate sources. The flow that affected Ka'upulehu began near the summit of Hualālai at Hina-kapo-'ula and flowed northward toward Kīholo. About half way down the slope the flow crossed over into Pu'uva'ava'a's shupua'as. About three miles from the sea, the flow divided and one spur flowed back into Ka'upulehu, with about a mile and a half of the older pahoehoe flow forming a kīpuka (clear place within a lava bed) between the two branches of the new aa flow (Stearns and Macdonald 1946:147; Fig. C-1).

Because of the low rainfall, sparse vegetation, and extensive lava-covered land, the portion of Kona north of Kailua, including Ka'upulehu, is sometimes called Kekaha, 'āina malo'o (a dry, sunbaked land). Sheltered by the abrupt rise of the mountain Hualālai, Kekaha receives very little rain below the 1,000-ft elevation level, and even at 2,000 ft the yearly rainfall average is only between 25 and 30 in. The 19th century lava flows contribute to Kekaha's desolate appearance, and make foot travel difficult, if not impossible, unless one stays on the numerous trails laboriously built by past generations of Hawaiians, or on roads bulldozed in recent years.

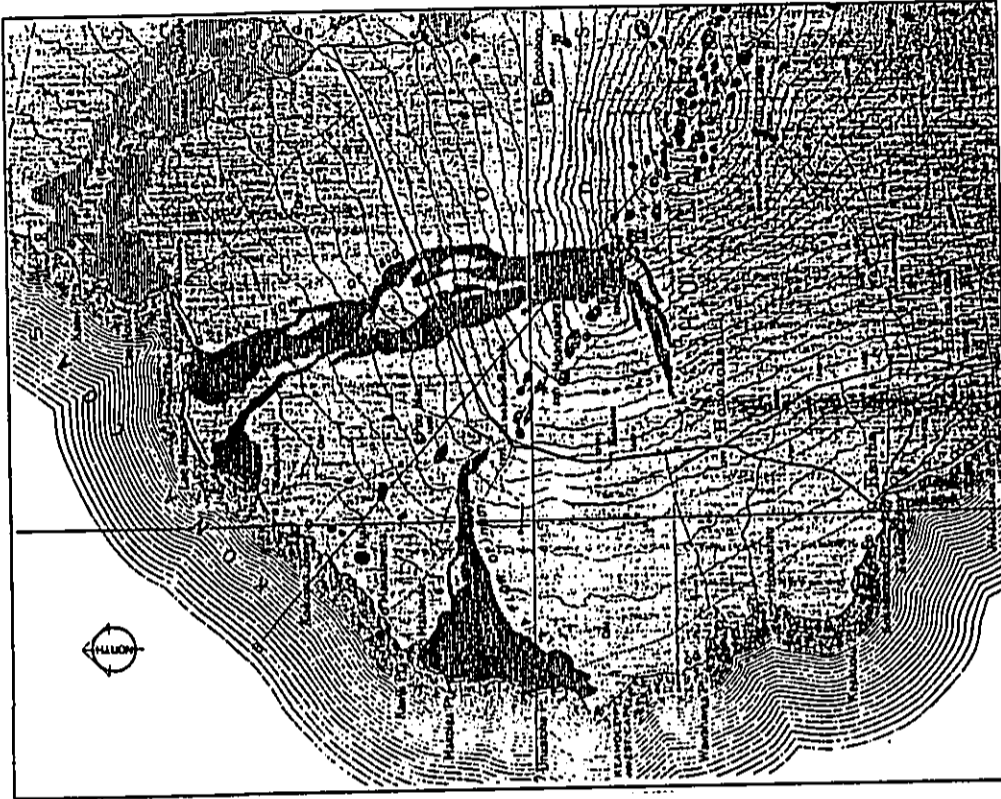


Fig. C-1. PORTION OF MAP SHOWING 1800 and 1801 LAVA FLOWS IN NORTH KONA. Note branch of 1800 flow that affected the Ka'upulehu area (Stearns and Macdonald 1946).



The arid conditions of Kekaha were partially offset by the presence of natural features that provided numerous brackish-water ponds along the coastline and bays. The Hawaiians turned these ponds into fishponds by building walls across them. Some walled ponds were quite large, such as those at Honokōhau, Kaloko, and Kīholo. The brackish coastal ponds tend to be small, such as those at Awake'e, Kūki'o, and Ka'upulehu. The largest of these today is probably at Makalawena. Because Ka'upulehu was historically a popular place, as evidenced by numerous petroglyphs there, perhaps the Ka'upulehu fishpond was larger before the 1801 lava flow. Pa'āies, Kamehameha's fishpond, is said to have been filled in by the southernmost flow from Hu'ehu'e (see Appendix C-1).

CULTIVATION IN KEKAHA

Because of the generally arid conditions of the lands of Kekaha, North Kona, it has long been believed that no cultivation could possibly have taken place in such an area. However, there is evidence to contradict this assumption. Rev. William Ellis wrote in his Journal of a Tour Around Hawaii that Revs. Thurston and Bishop had, in 1842:

walked out in a N.W. direction (from Kailua town), till they reached the point that forms the northern boundary of the bay, on the eastern side of which Kairua is situated. It runs three or four miles into the sea; is composed entirely of lava.... \*

\* They enjoyed a fine view of the town and adjacent country. The houses, which are neat, are generally built on the seashore, shaded with cocoa-nut and kou trees, which greatly enliven the scene.

\* The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots [Ellis 1963:30, 31].

Thus Ellis cites evidence that in 1824 Hawaiians living in Kekaha were growing certain crops in what was characterized as "barren rocks." We therefore might assume that people living in Ka'upulehu at that time, or earlier, were cultivating crops among what appears to us today to be "barren rocks." Additionally, we cannot assume that the climate 200 or more years ago was the

same as it is today. Previous to the flow of 1800, local conditions at Ka'upulehu may have been more conducive to cultivation. Ka'upulehu, from its history of being the residence of great chiefs, and from the presence of hundreds of petroglyphs (see below), was for generations both a popular oasis with a brackish-water fishpond and a sanctuary for canoe travelers between Kīholo and Kailua. The people living in Kekaha may very well have been able to cultivate, at least seasonally, certain crops, including: tobacco, sweet potatoes, and perhaps in the shelter of lava-rock pits, even bananas. In addition to seasonal rains as a source of water, heavy dew could have been conserved, and evaporation reduced by mulching techniques.

The shoreline dwellers probably received their main vegetable diet from the uplands of their shupua'a; but, at least seasonally, they would have grown some plants closer to their coastal dwellings than the gardens in the uplands. In 1841, the American expedition captained by Charles Wilkes visited Kona, Hawaii, and he wrote:

The natives, during the rainy season, also plant in excavations among the lava rocks, sweet-potatoes, melons, and pine-apples, all of which produce a crop [Wilkes 1845:91].

KA-'Ū-PŪLEHU OR KA'UPU-LEHU?

The meaning of the place name, Ka-'ū-pūlehu is, according to one source, "the roasted breadfruit," the 'ū being short for 'ulu (breadfruit) (Pukui, Elbert, and Hookini 1974:96). It is explained that in a certain legend, "Pele set two girls, Pā-hinahina and Kolowu'o, roasting breadfruit here (known then as Manu-ahi). Only Pā-hinahina shared her breadfruit. That night Hualālai erupted near Hu'ehu'e and destroyed the village, but spared the house of Pā-hinahina" (ibid.). Manu-ahi, the old name for Ka-'ū-pūlehu, means "fire bird" (ibid.:146).

Another source states that the place name Ka'upulehu should be divided into the word ka'upu, meaning a kind of bird, and lehu, meaning numerous; thus meaning many birds of this kind (Pukui and Elbert 1971:128, 184; R. Lyman, pers. com.). The dictionary suggests that ka'upu might be a term for a kind of albatross, although it defines the term mōi as the word for a Laysan albatross (Pukui and Elbert 1971:233).

#### THE KOROHKI OF KA'UPULEHU

The Hawaiian historian Samuel M. Kamakau identifies the powerful Hawaiian chief Kame'eiamoku as living at Ka'upulehu, and his twin brother, Kamanava at Kiholo, in the adjoining ahupua'a of Pu'uwa'awa'a (Kamakau 1961:118). Kame'eiamoku and Kamanava were the sons of Kekaulike, high chief of Maui, and in later life, they were staunch supporters of Kamehameha I, becoming two of Kamehameha's four secret advisors (Kamakau 1961:126); the other two were Ke'eunuku and Keave-s-heulu (ibid.). Kamanava was at one time the husband of Kamehameha's mother, Keku'apaiwa II. They were considered, also, younger brothers of Kalamio'pu'u (ibid.:155), who was Kamehameha's uncle. Keoua, Kamehameha's father, was a half brother to Kalamio'pu'u, and they had the same mother, Kamaka'imoku.

During the 1790s, Hawaiian chiefs eagerly supplied the Western traders with food, firewood, and fresh water in order to obtain foreign goods, including metal, firearms, and gunpowder. The possession of these foreign items enhanced the status of a chief among his peers and gave him powerful advantages in battle with his adversaries; but getting these goods was not always easy. Most of the trading-ship captains were men who drove hard bargains; Captain Simon Metcalfe was one of these. Metcalfe is best remembered for his massacre of scores of unsuspecting Hawaiians in their canoes while they were trading with his ship, Eleanor, off Olowalu, Maui (Kamakau 1961:146; Kuykendall 1947:24).

In the 1780s and early 1790s, Kame'eiamoku had his home at Ka'upulehu. When Captain Metcalfe visited the area on his ship, Eleanor, Kame'eiamoku experienced humiliating treatment by Metcalfe's crewmen while trading with them. Kame'eiamoku vowed he would revenge his humiliation by capturing the next ship that came by. As luck would have it, the next ship was a small schooner, Fair American, that was under the command of Captain Metcalfe's son, Thomas. Kame'eiamoku and his men captured the ship near Ka'upulehu, killed the crew, and threw them overboard, with the exception of Isaac Davis, the mate (Kuykendall 1947:24-25; Kamakau 1961:146-147). Davis was brutally beaten, but somehow managed to remain alive until Kame'eiamoku's forces took

pity on him, took his half-dead body ashore, and nursed him back to health. With cannon, muskets, swords, axes, and gunpowder captured, Kamehameha proposed to send an army to Maui to defeat Maui's high chief, Kalanikupule. He enlisted the assistance of Isaac Davis and John Young, to man the cannon and muskets. Young had been prevented from returning to his ship, Eleanor, at the time Davis was taken.

It was common practice that whenever chiefs left their homeland, they placed a kapu forbidding trade with foreign ships to take place in their absence. Western ships in those days were carrying sea otter furs from the northwest coast of North America to China to be sold, and they were desirous of getting fresh water and food supplies as quickly and as cheaply as possible, in order to get to China before their competitors. Thus, the gaining of Western weapons and the use of them in interdistrict or interisland warfare disrupted trade.

In 1792, 1793, and 1794, Capt. George Vancouver spent winters in the Islands. He was familiar with the Hawai'i Island chiefs because of his visits there with Capt. Cook in 1778 and 1779, and sought to enlist their assistance in setting up a kingdom under one chief. He believed that this would reduce warfare and thus the disruption of trade, and would provide price controls, so that traders could rely on uniform, low prices for their needed supplies. Vancouver called for a council of the Hawai'i Island chiefs in 1794, preliminary to having the island of Hawai'i ceded to Great Britain by the chiefs. At the council meeting Vancouver insisted the Kame'eiamoku never again attempt to capture a Western trading ship, and that all the Kohala and Kona chiefs give their support to one chief, Kamehameha, who, with their help, would become the high chief of all the islands. The chief of Ka'upulehu, Kame'eiamoku, was one of the most powerful chiefs; gaining his support for Vancouver's plan was crucial to its success (Kelly 1967:405-406; Appendix C-2).

#### PETROGLYPHS AT KA'UPULEHU

One of the richest and most varied petroglyph fields in the Hawaiian Islands is the one located near the pond of Ka'upulehu. The petroglyphs found here include many canoe sails, some writing, and human figures. One

petroglyph appears to depict two figures carrying a corpse on a pole; another shows a fight between two figures; and a third seems to show a spear being thrown, perhaps in a contest during makahiki season.

Rev. William Ellis remarked that petroglyphs "had been made by former travellers, from a motive similar to that which induces a person to carve his initials on a stone or tree, or a traveller to record his name in an album, to inform his successors that he has been there" (Ellis 1963:334). Perhaps these petroglyphs at Ka'upulehu provide a record of some of the activities of the Hawaiian chiefs who lived there. If this is so, the petroglyphs indicate that Ka'upulehu was a popular port of call for sailing canoes.

#### LOMO IN KONA

Among the pantheon of Hawaiian gods, the most prominent one associated with Kona, Hawai'i, is Lono.

Lono is plainly identified with Kona, Hawai'i, and is said to have introduced the main food plants, taro, sweet potato, yams, sugar cane, and bananas to Hawai'i, and also 'awa. Hogs were likewise identified with Lono, but there is no mention of his having brought them to Hawai'i.

The fact that the Makahiki festival and the rituals for inducing rainfall and fertility centered in Kona comes out clearly in the description of the Makahiki [Handy and Handy 1972:523].

#### KANE AT KA'UPULEHU

A story about the god Kane at Ka'upulehu was collected by John Reinecke in 1931, as told by Manuia Manupau to Mrs. L. Yanagi:

A chief of Kaupulehu had a lovely daughter. One day a handsome young man appeared; he was the god Kane in disguise. The chief married his daughter to the young man because of his fine looks. But the stranger turned out to be a worthless husband; he slept day and night; he never worked. This angered the chief. Kane always spoke to the rest of the villagers, even his father-in-law, through his wife; the chief therefore had his daughter pester Kane until he could stand it no longer, to do something useful.

At last Kane told his wife to have the chief command all the people of Kaupulehu to gather wood for one day. The chief hesitated at such a seemingly foolish demand, but finally sent his followers out to obey it. Then Kane ordered them to build a huge imu.

He then went mauka and gathered all the kalo in a great patch. This he bundled all together, pulled up a lehua tree by the roots, tied the

kalo to it, and carried the untrussed tree down to the village, naturally to the amazement of all. The chief began to suspect that his son-in-law was a god.

Kane made the villagers enlarge the imu, into which he put all the kalo. He then entered it with the kalo, just before sunset, and commanded his wife to cover him, ordering her not to open the imu until his return. She reluctantly obeyed.

The imu was situated about a mile from the coast. Kane went underground until he reached the spot where the spring now is; here he emerged, the spring flowed forth, fresh water, as from a faucet (at low tide). Then he came and appeared to his wife, who cried out in alarm, thinking him a ghost. But he reassured her, and made her and the villagers follow him to the imu which they opened. And behold it was full of all sorts of food, pigs, fish, yams, kalo, and whatever else can be cooked in an oven. The people cried out, "He is a god!" and Kane revealed his identity.

Then he had them follow him to the spring, which he gave them for drinking and for healing (and no doubt disappeared).

If one will dive in twenty-five times, five times repeated five times, once in the morning and once in the evening until the required number is fulfilled, he will be cured of whatever ails him. Then he should dive once more to give thanks. No woman in her period may approach the spring, which is pure water [Reinecke 1930-1931].

#### LEASES AND DEVELOPMENT

Bishop Estate first leased Ka'upulehu ahupua'a to Hualalai Development Corp. on 1 January 1961 for a term of 65 years. The lease included most of the ahupua'a, and covered roughly 18,228 acres.

In October of that same year, Hualalai Development Corp. sublet to John M. Jackson 62 acres at Kihawai Bay for the purpose of building the Kona Village Hotel. The portion of the ahupua'a mauka of the Mamalahoa Highway, approximately 7,700 acres, was sublet to Garner Anthony in 1962.

By 1 January 1963, John Jackson had assigned the sublease to his family-owned Island Copra and Trading Company, Inc. On 30 April 1979, Island Copra and Trading Company, Inc., merged with Kona Village Property, Inc., the new company retaining the name Island Copra and Trading Company, Inc. The 62 acres of coastal property was taken over by the new company, a subsidiary of Cambridge Pacific, Inc. More recently, on 1 January 1983, Bishop Estate leased this property (now reduced to about 60 acres) directly to Kona Village partnership, which is made up primarily of MF Properties partnership and

AAE, Ltd., a Colorado company. Land use at the Kona Village Hotel included single-story buildings for the hotel, an access road, and, for a few years, a small-plane landing strip near the hotel, providing access by air. Water is obtained from a well mauka of Queen Ka'ahumanu Highway, at approximately the 1,400-ft elevation.

The lease on the bulk of Ka'upulehu went from Hualalai Development Corp. to Signal Oil Corp. in 1968, and then on 30 April 1979, to Cambridge Pacific, Inc., a Canadian Company. Finally, in 1984, Barnwell Hawaiian Properties went into partnership with Cambridge Pacific, Inc., and the lease was assigned to Kaupulehu Development, a subsidiary owned by the partnership.

RECOMMENDATIONS

Ka'upulehu has a more recent history that needs to be researched and described. The use of the land in the 20th century should be recorded. This will be done in the next increment of fieldwork.

ACKNOWLEDGMENTS

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The Destruction of the Great Fishpond of Pa'aiea

(Taken from Kelly 1973:88-91.)

The lava flow of 1801 erupted from Hualalai and went toward Kiholo, Ka'upulehu and Mahaiula. It was said to have filled in a 3-mile-long fishpond belonging to Kamehameha. The name of the pond was Pa'aiea. "From Keahole Point the lava was to be seen flowing down like a river in a stream of fire extending from the northern edge of Hualalai westward straight toward Ka'eiehuluhulu and the sweet-tasting aku fish of Hale'ohi'u" [Kamakau, 1961:185].

Kamehameha made an offering to Pele after which the lava flow ceased [Kamakau, 1961:140-141]. Kaahumanu, her sister, Kamehameha, and other chiefs accompanied Kamehameha when he went to appease Pele and extinguish the flow. They landed in Kekaha at Mahai'ula [Kamakau, 1961:184]. "The reasons given for the flow may be summed up as: first, Pele's wanting the aku of Hale'ohi'u and the aku fish of Kiholo... second, her anger at being denied the breadfruit of Kameha'akama in upper He'ehu'e..." [Kamakau, 1961:186].

Others wrote that Pele wanted the "aku fish from the fishponds of Kiholo and Ka'upulehu and aku fish from Ka'eiehuluhulu..." [Kamakau, 1961:184-186; Emerson, 1909:124].

Kamakau placed the destruction of Pa'aiea pond in "...the fourth year of Kamehameha's rule" [Kamakau, 1961:184]. As the lava neared Ka'eiehuluhulu, destroying houses, topping coconut trees, and filling fishponds, Kamehameha and his *kahuna* offered sacrifices and gifts. Not until then did the flow cease. Thus, there are no sizable fishponds N of Keahole Point until you reach Makalawena.

A story about the fishpond of Pa'aiea along this coastline was related by Eliza Maguire in her book of legends [1926:4-7]. She wrote that Pa'aiea was "a very large fishpond extending from Ka'eiehuluhulu near Mahaiula, and as far as Wawaloii on the boundary of Ooma." The pond was three miles long and a mile and a half wide. "Fishermen going to Kailua and further South, often took a short cut by taking their canoes into the pond and going across [it], thus saving him time and the hard labor of paddling against the Eka\* and also against the strong current from Keahole" [Maguire, 1926:4].

The chief who owned the pond permitted no one to take or eat fish from it without permission. An old woman came and asked for some fish and was refused. She left empty-handed. On her way home a person who lived nearby invited her to eat at his house. When she finished eating and was given a gift of a fish by her host, she gave him some instructions: "Tonight, you and your wife put up a *lepa*\*\* back of your

\*The pattern of Pele being denied food and thus causing a lava flow occurs in many places on Hawaii Island.

\*\*Eka - A strong sea breeze from the South.

\*\*\*Lepa - A piece of *kapa* (Hawaiian cloth) tied at the end of a stick as a *kapu* (forbidden) sign.

house, and here on your fence; for it is said, there will be a night of great doings, and tonight may be the night, and you will have your *uananu* (protection) ready against any evil befalling you" [Maguire, 1926:6]. She then vanished mysteriously. That night fire appeared on Hualalai. It was then that they knew the old woman was Pele. Lava flowed down the mountain side and destroyed the fishpond of Pa'aiea.

A modern-day informant gave his version of the story as follows:

When the volcano flowed at Kiholo, that's where my grandmother was married to my grandfather at Makalawena. The Kohala people had come to see the lava flow and stayed six months. There is where they met.

Pa'aiea was the name of the big fishpond of Kamehameha. People from Makalawena could get into a canoe and come all the way to Keahole paddling in the fishpond. After that, they put their canoes back into the ocean and went to the bay at Kailua.

My grandmother lived up at Kuki'o, beyond Mahaiula. My grandmother had a couple of acres of cotton fields. When she had to mend the olden-day quilts, she went to pick cotton. One day when she was there a lady appeared before her. My grandmother said to her, "*Aloha ano 'aiea, ua pa'ina 'ai 'oe?* (Greetings, shall we eat together?) This is the *ai'oha* of the olden days." "I will get us some poi and salt, but I have no fish." "I will get us some fish," the lady said. But when the lady went to the pond and asked Kamehameha's fishermen for fish, one of the men said, "No, everything is for King Kamehameha." She asked for scales, but the answer was, "No." She asked for the inner parts (*ka'ani, pi'api'ia*), but she got nothing. She went back. When she reached Mahaiula, the *Konohiki* said, "We are in trouble."

When she reached the black hill, two girls were roasting breadfruit. Of the first girl she asked, "For whom are you roasting your breadfruit?" "For La'i," the girl replied. "Is La'i a strong god?" "Yes," the girl answered. The second girl said she was roasting her breadfruit for Pele. The woman said, "Let's sit down and eat it now." She asked the girl where her parents were. "They went to Hualalai to cut *ohi'a* trees." "When your parents come back," the woman said, "tell your father to put a white flag-- not a red flag--to mark the boundaries of your house." When the parents of the girl returned, the father knew someone had been to the house. He asked his daughter who had been there, and she told him the story. That evening Kamehameha's workmen saw a red glow on Hualalai. They said, "We are in trouble."

The flow came from the hill where the girls had roasted breadfruit for La'i. From there it destroyed the fishpond of Kamehameha. When the lava came, it almost covered the fishpond. The *konohiki* and Kamehameha brought a small pig. They let the pig run and the fire *pi'o* (went out, the lava ceased to flow).

The old fishpond at Keahole was Pa'aiea. It covered the distance from Keahole to Ka'elehuluhulu near Mahaiula, nearly 5 miles. That was the place of the pond called Pa'aiea [Kelly, 1971:39-40].

The Story about the Place Name, Ka'upulehu

It is said that the name of Ka'upulehu was originally derived from the story about the two girls who roasted two breadfruit, one for La'i and one for Pele. The correct name, it is said, was Ka-'ulu-pulehu, literally, "the roasted breadfruit." Over the years the word 'ulu has been shortened to 'u, thus producing the name used today: Ka'upulehu. In some versions of this story the names of the girls are remembered:

Disguised as an old woman, Pele came to the village (then called Manu-ahi) in the uplands and met two girls, Pa-hinahina and Kolosua'o who were roasting breadfruit. Only Pa-hinahina shared her breadfruit with Pele. That night Hualalai volcano erupted near Hu'ehu'e and destroyed the village, but spared the home of Pa'hinahina [Elbert, Ms.].

John Young's Story about Kamehameha and Pele

One of the earliest written records of the 1801 lava flow is Rev. William Ellis' interview with John Young on July 12, 1823 [1963:55]. In the process of describing a walk into Kekaha north of Kailua village, Ellis related what Young told him about the famous lava flow.

In the afternoon, Messrs. Thurston and Bishop walked out in a N.W. direction, till they reached the point that forms the northern boundary of the bay, on the eastern side of which Kailua is situated. It runs three or four miles into the sea; is composed entirely of lava; and was formed by an eruption from one of the large craters on the top of Mauna Huararai (Mount Huararai), which, about twenty-three years ago, inundated several villages, destroyed a number of plantations and extensive fish-ponds, filling up a deep bay twenty miles in length, and formed the present coast.

An Englishman [John Young] who has resided thirty-eight years in the islands, and who witnessed the above eruption, has frequently told us he was astonished at the irresistible impetuosity of the torrent.

Stone walls, trees, and houses, all gave way before it; even large masses of rocks of hard ancient lava, when surrounded by the fiery stream soon split into small fragments, and falling into the burning mass, appeared to melt again, as borne by it down the mountain's side.

Numerous offerings were presented, and many hogs thrown alive into the stream, to appease the anger of the gods, by whom they supposed it was directed, and to stay its devastating course.

All seemed unavailing, until one day the king Tamehameha went, attended by a large retinue of chiefs and priests, and, as the most valuable offering he could make, cut off part of his own hair, which was always considered sacred, and threw it into the torrent.

A day or two after, the lava ceased to flow. The gods, it was thought, were satisfied; and the king acquired no small degree of influence over the minds of the people, who, from this circumstance, attributed their escape from threatened destructions to his supposed interest with the deities of the volcanoes [Ellis, 1963:30-31].

Appendix C-2

Kame'eiamoku Captures the Fair American

(Taken from Kelly 1973:99-100.)

When Kalaniopu'u was high chief of Hawaii Island, the lands of Kekaha were said to have been under the control of the twins, Kame'eiamoku and Kamanaa, half-brothers of Ke'eamoku [Kamakau, 1961:310]. Chief Kame'eiamoku was living at Ka'upulehu at the time of the death of Kalaniopu'u in 1782, and he was still there when he led the capture of the sloop *Fair American* in 1790 [Kamakau, 1961:147]. This is perhaps the most widely known event in Kekaha's history.

Kame'eiamoku later explained to Capt. Vancouver that he had vowed revenge after a crew member of Capt. Metcalf's *Eleonora* had struck him on the head. As it happened, the next ship that came to Kekaha was the sloop *Fair American* with the son of Capt. Metcalf on board. Kamakau relates one version of the incident:

The capture of the sloop came about in this way. Ka-me'e-ia-moku coveted the muskets, irons, knives, and other death-dealing weapons of the foreigners, and he had besides an insult to avenge. While he was attempting to climb on board, the men had struck him with a rope. Although this was customary [behavior] with the foreigners, Ka-me'e-ia-moku, being a man of quick temper and having nothing at hand with which to inflict immediate retaliation, nursed his humiliation and vowed to capture the first foreign boat that came his way. He was living at Ka'upulehu, [North] Kona, at the time, and seeing a sloop sailing by he and his men immediately determined upon its capture. Among the men who joined him in the raid were Nauki, Kuaiwa, Kuahiku, Mano-hili, Na-luhi, 'Ahu-'oie, Pe'e, and some relatives of the chief, Ka-lau-koa, Manu-hoa, Ka-nuha, and Ke-aka-o-ka-lani. They went on board the sloop, killed the five men of the crew and wounded Captain Davis [Isaac Davis]...

Among the things obtained from the sloop was a cannon which the natives called "Robert" (Iopaka) and a number of muskets, swords, axes, powder, and clothing. These things were taken before Kamehameha together with the prisoner... [Kamakau, 1961:147].

Appendix C  
REFERENCES CITED

Capt. Metcalf, after having perpetrated the Olowalu Massacre on Maui [Kamakau, 1961:145-146], had sailed to Hawaii at that time to search for his son on the sloop *Fair American*. John Young, a member of the *Eleonora's* crew, went ashore armed with a sword and musket to see the country. At the end of the day he was prevented from returning to his ship. Kamakau explained that Hawaiian chiefs in those days valued muskets and foreigners to instruct Hawaiians in their use, care, and repair. There was also some fear that Young might carry information back to Metcalf on the *Eleonora* about the sloop having been captured, its crew killed, and Isaac Davis wounded and held prisoner. Consequently, under Kamehameha's orders, Young was detained and asked "to remain [on the island] as a friend (*ai'kama*) of the chief [Kamehameha]" [Kamakau, 1961:146].

The capture of the sloop and killing of the crew was brought up in 1794 by Capt. Vancouver when he called for a council of chiefs at Kealakekua Bay. Vancouver, anxious to serve the interests of the foreign traders, succeeded in uniting several district chiefs on Hawaii Island to support Kamehameha as high chief of the island and in obtaining from these chiefs and Kamehameha the cession of the island to Great Britain [Vancouver, 1798, v. 3:33-34].

Kame'eiamoku did not join the council at first, fearing that Vancouver might kill him in retribution. He was one of two chiefs who were absent from the council at Kealakekua Bay in the early part of Vancouver's visit there. One chief (Kamanawa) was in Hilo where there was some kind of political unrest, and he was afraid to leave for fear things would get out of hand, according to Vancouver. The other was 'I'iamototoo, chief of Koarua [Kame'eiamoku, chief of Kohala]. Kame'eiamoku was "the person who had captured the *Fair American* schooner..." [Vancouver, 1798, v. 3:32]. Vancouver wrote:

The district over which his [Kame'eiamoku's] authority regularly extended was the next district immediately to the northward of us [Kohala]; but his apprehensions lest we should retaliate the injuries he had done to others, had induced him to retire to the eastern parts of Amakooa [Hamakua], as being the most remote from our station. His progress towards Karakooa [Kealakekua], since his visit had been permitted, had been very slow; and as he had advanced he had frequently sent forward messengers, to inquire if I still continued the same friendly disposition towards him... [Vancouver, 1798, v. 3:34].

Kame'eiamoku was a very important and powerful chief. Thus, because Vancouver needed his agreement to the cession and Kamehameha needed his active support, Vancouver agreed to pardon Kame'eiamoku's sin on condition that he promise never again to do such a thing. Kame'eiamoku kept his promise and was a staunch supporter of Kamehameha's ascendancy to the position of high chief over the islands [Vancouver, v. 3:32-36, 52-57; Kelly, 1967:402-408; Kuykendall, 1947:24-53].

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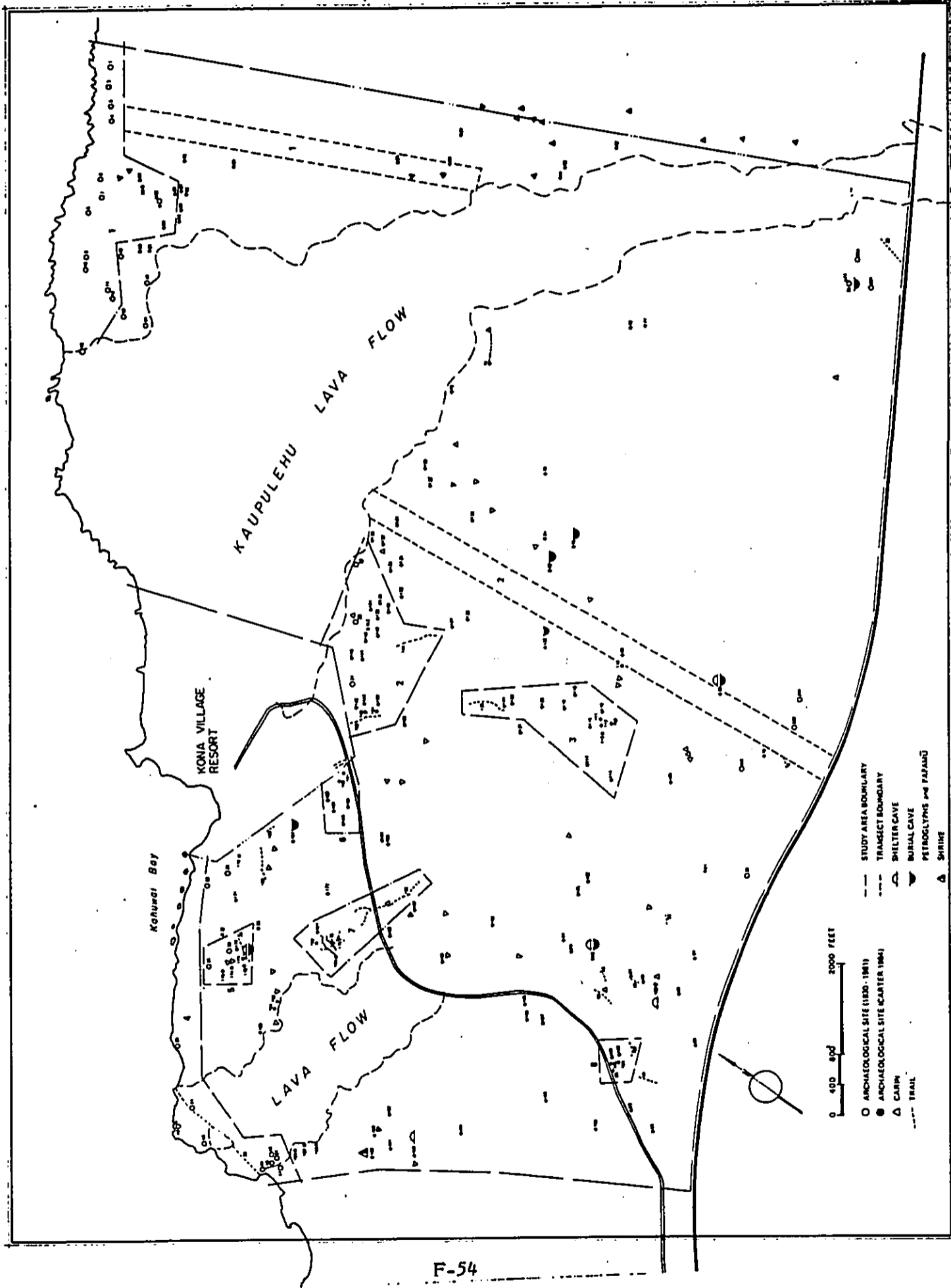
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F-54

PRELIMINARY REPORT UPON COMPLETION OF FIELD WORK:

ARCHAEOLOGICAL SURVEY AND TEST EXCAVATIONS

KAUPULEHU MAKAI RESORT PROJECT AREA

Land of Kaupulehu, North Kona, Island of Hawaii

(TRK:3-7-2-03:por.1)

INTRODUCTION

The purpose of this preliminary report is to present a statement of progress upon completion of archaeological survey and test excavations at the Kaupulehu Makai Resort project area, Land of Kaupulehu, North Kona District, Island of Hawaii (TRK:3-7-2-03:por.1). The archaeological survey and test excavations were conducted by Paul H. Rosendahl, Ph.D., Inc. (PHRI) at the request of Belt, Collins & Associates for their client, Kaupulehu Developments.

The field work was carried out between February 10-March 6, 1986, by a four to six man field team under the on-site supervision of PHRI field Archaeologist Alan T. Walker and the overall direction of Principal Investigator Dr. Paul H. Rosendahl. Field inspections by Dr. Rosendahl were made on February 14, and 25, and March 4, 1986. Approximately 621 man-hours were expended in conducting the archaeological survey and test excavation field work.

PROJECT AREA DESCRIPTION

The Kaupulehu Makai Resort project area includes c. 650 acres located within the northwest (seaward) portion of Kaupulehu ahupua'a, North Kona District, along the leeward coast of the Island of Hawaii. The project area is bounded on the northwest by the Pacific Ocean, southwest by the Land of Koko lot, southeast by the Queen Kahuamahu Highway, and northeast by Kona Village Resort and additional land within Kaupulehu. The project area rises in elevation from sea level to c. 220 ft. and the terrain is an undulating surface of pahoehoe and aa bedrock exposures which may include branches of the 1800-1801 Kaupulehu flow, but a check of relevant geologic sources provided inconclusive results. Except for the narrow sand beach between Kahawai Bay and Kumukehu Point, there are essentially no soils within the project area (Sato et al. 1973). Annual rainfall is estimated to range from about 10 to 20 inches (Armstrong 1983).

by

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The dominant vegetation covering most of the project area are introduced grasses, with scattered specimens of kiawe (*Prosopis pallida* Humb. and Bonpl. ex Willd.) and HMK. Also included within the dry, rocky inland area are scattered specimens of the native shrub 'ilima (*Sida fallax* Walp.), Bona (*Morinda citrifolia* L.), Pua-ai'o (*Capparis sandwicensis* DC), Kolu (*Indigofera suffruticosa* Mill.), Pua-hala (*Azorella alaua* [Nutt. ex Prain] Pope) and 'uhalo (*Waltheria americana* L.). The immediate coastal zone from the shoreline to c. 500-800 ft inland, has a dense stand of kiawe and includes milo (*Isoperia populnea* L.), Hiu (*Cocos nucifera* L.), nauwaka-kahakai (*Scaevola sericea* Vahl) and tree heliotrope (*Messerschmidia EXENISE* [L.f.] Johnston). A portion of the immediate coastal zone has a group of shallow anchialine ponds which include mangrove (*Rhizophora mangle* L.) and various grasses and sedges.

## PREVIOUS ARCHAEOLOGICAL WORK

Previous archaeological work conducted most recently within the present project area was an archaeological reconnaissance of the Māhāi (seaward) parcel of Kaupulehu conducted in September 1984 by the Department of Anthropology, B.P. Bishop Museum, for Barnwell Industries, Inc. (Carter 1985). The primary objectives of that reconnaissance survey were the following: (1) to locate and record any previously undocumented sites; (2) to relocate previously recorded sites, noting present condition; (3) to identify and locate any areas with probable subsurface deposits; and (4) to recommend appropriate work details for subsequent phases of archaeological investigations. Carter stated Objective No. 2 was only partially met due to time constraints, and that previously identified Sites 25, 26, 28, 41, 42, and 43 were not field checked. Furthermore, the coastal areas, which had been surveyed previously and lava flow interiors, were not surveyed by Carter (1985:1, 4). A total of 198 sites including 47 previously identified sites and 151 newly identified sites with numerous component features, were located within the Māhāi section of Kaupulehu (Carter 1985:5). Of these 198 sites, 46 sites are included within the area covered by the present project scope of work. Based on the findings of the 1984 reconnaissance survey, a program of "extensive survey" (including test excavations), intensive mapping, and treatment of human remains was recommended for sites within one general and eight specific study areas (Carter 1985:29-33).

Archaeological field work within the Land of Kaupulehu prior to the September 1984 survey includes six survey projects conducted between 1930 and 1981. In 1930, John E. Keinecke recorded several sites along the shoreline of Kaupulehu while carrying out his survey of sites along the western coast of Hawaii Island for B.P. Bishop Museum (Keinecke Ma.). Keinecke inspected only the most immediate shoreline areas--no more than a few hundred feet inland, and his recording of sites was sketchy--preventing in many areas definite correlation with sites subsequently recorded in the area. Keinecke's sites were later included in an inventory of Hawaii Island sites prepared by B.P. Bishop Museum in 1970 for the Hawaii County Planning Department (Emory 1970). That inventory was based entirely on existing records in the Department of Anthropology, and did not involve any field work. It appears that two of Keinecke's sites (Sites 118 and 119) are included within the present project scope of work. Sites 118 and 119 were redesignated Sites 27/47\* and 28, respectively (Carter 1985:6, 69).

In early 1963, Lloyd J. Soehren of the Dept. of Anthropology, B.P. Bishop Museum, conducted a reconnaissance survey of Kaupulehu and Makalawena for B.P. Bishop Estate (Soehren 1963). Soehren identified a total of 26 sites, of which two (Sites 25 and 28) are included within the present project scope of work. Although Soehren did not make recommendations concerning further archaeological work, and Carter (1985) did not

\*B.P. Bishop Museum site designation system: all two and three digit site numbers prefixed by 50-Ha-D22- (50-State of Hawaii, Ha-Island of Hawaii, D-North Kona District, 22-Land of Kaupulehu).

physically inspect Sites 25 and 26, she recommended they be intensively mapped and the presence of any human remains (Site 25) treated appropriately (Carter 1985:1-29).

Between June-October 1970, the Parks Division of the State Department of Land and Natural Resources conducted a surface survey of the Kailua-Kawaihae road corridor for the State Department of Transportation (Ching 1971). Ching identified approximately 18 sites in the vicinity of Kaupulehu, of which one (Site 1161\*), a cave shelter, is included within the present project scope of work. Site 1161 was redesignated Site 91 (Carter 1985:6, 10). Regarding Site 91, Ching recommended archaeological salvage operations (Ching 1971:5-7).

The coastal portion of Kaupulehu was subsequently inspected between 1971 and 1975 by the State of Hawaii during the Statewide Inventory of Historic Places. The State inventory identified approximately seven sites in the vicinity of Kaupulehu of which one (Site 4708), is included within the present project scope of work. Site 4708 was redesignated Site 30 by Carter (1985:6, 10).

In April 1981, Eric Komori of the Dept. of Anthropology, B.P. Bishop Museum, conducted a reconnaissance survey of two parcels of land in the coastal portion of Kaupulehu for Cambridge Pacific, Inc. Komori identified a total of 19 sites, of which eight (Sites 26 and 27 through 33) are included within the present project scope of work. Sites 27 through 33 were redesignated Sites 41 through 47, respectively (Carter 1985:6, 10). Based on the findings of the reconnaissance survey, Komori evaluated the sites as "not unique for the leeward coast of the Island of Hawaii." Therefore, in situ preservation of the structures is not necessary" (Komori 1981:21). However, Komori recommended Site 26 (foot trail) be preserved and incorporated into the landscaping of the development project areas. Regarding the remaining sites, he recommended a program of salvage excavations (including mapping) and proper treatment of human burials prior to construction activities.

Archaeological work conducted previously in the general vicinity of the project area includes salvage of the Ke-hole to Anaeboomalu section of the Kailua-Kawaihae Road (Queen Kaahumanu Highway) (Rosendahl 1973), survey and testing along the coast of the Lands of Kukio 1st and 2nd, and Manini'owali (Cordy 1978, 1981), and reconnaissance surveys in Kukio 1st (Renger 1970; Rosendahl 1985; Walker and Rosendahl 1985).

## SCOPE OF WORK

The basic objective of the archaeological survey and testing project was to recover archaeological data sufficient to determine and document the significance of archaeological remains. Based on consultations with staff of the State Historic Preservation Office, the Hawaii County

\*Hawaii Register of Historic Places (BHRP) site designation system: all four-digit site numbers prefixed by 50-10-19- (50-State of Hawaii, 10-Island of Hawaii, 19-USCS 7.5 series quad map ["Kiholo, Hawaii"].

Planning Department, and the Kamehameha Schools Hawaiian Institute, the following tasks\* were determined to constitute an appropriate scope of work for the archaeological survey and test excavations project:

1. Limited reconnaissance survey of the aa lava flow land situated seaward of the existing Kona Village access road. This survey would be accomplished by means of a 100% coverage aerial reconnaissance (helicopter) of the approximately 80 acre section, supplemented by sample pedestrian transects;
2. Intensive surface survey of 41 previously identified sites. This work would include appropriate detailed recording (written descriptions, measurements, scaled plan maps, photographs, and surface midden and artifact collections) at the following specific sites—

Study Area 4—Sites 26-28, 41-47 (10 sites)  
Study Area 5—Sites 25, 30, 34, 172-176 (8 sites)  
Study Area 6—Sites 161-166 (6 sites)  
Study Area 7—Sites 156, 178-182 (6 sites)  
Study Area 8—Sites 88, 103-107 (6 sites)  
Other Sites—Sites 92, 100, 167, 189, 193 (5 sites);

3. Test excavations at 21 previously identified sites. This work would involve testing to determine the nature, depth, and content of stratigraphic deposits, and to recover portable artifacts and ecofactual samples suitable for analyses (including dating), at the following specified sites—

Study Area 4—Sites 27 and 43  
Study Area 5—Sites 172 and 173  
Study Area 6—Sites 163, 165, and 166  
Study Area 7—Site 181  
Study Area 8—Sites 88, 103, 105, and 106  
Other Sites—Sites 91-93, 97, 100, 102, 189, 193, and 199;

4. Laboratory analyses of data recovered from the reconnaissance survey, intensive surface survey, and test excavations; and
5. Preparation of written reports (Preliminary and Final). In addition to a full descriptive account of project findings, the Final Report will provide site-specific interpretations of site functions and ages, a general interpretation of past patterns in Kaupulehu, site-specific significance assessments, and recommendations for appropriate further treatment of significant sites.

\*The listed tasks have been adapted from the Scope of Work provided by Belt, Collins & Associates (Letter of January 6, 1986; Series 86-050).

Subsequent on-site field inspection by PHRI of Sites 27, 97, 106, and 189, which had been listed for test excavations, revealed very little subsurface deposit and limited excavation potential, while previously identified Site 30 and newly identified Sites 1-101, 1-102 and 1-108 revealed moderate subsurface deposits with moderate to high excavation potential. Furthermore, Sites 91, 93, 97, 102 and 199 were listed for test excavations but omitted from Task 2, intensive survey detailed recording. Therefore, the scope of work was amended to include all sites for appropriate detailed recording, and to replace those sites of limited or no excavation potential with those of moderate to high excavation potential. Although the present project scope of work was amended, the amount of labor and field tasks completed was not decreased.

#### FIELD METHODS AND PROCEDURES

On February 25 and March 4, 1986, Dr. Rosendahl and Mr. Walker carried out aerial reconnaissance of portions of the project area by means of a helicopter piloted by Mr. Jim Cardin of Kona Helicopters. The aerial reconnaissance consisted of 100% coverage of the aa lava flow land situated seaward of the existing Kona Village access road, in addition to following out previously identified foot trails to determine their extent. After initially flying the periphery, the aa lava flow land was examined utilizing a series of north to south sweeps (average altitude c. 50 ft above ground surface) in order to locate any archaeological features. The approximate locations of foot trails and newly identified sites were plotted on an aerial photograph (c. scale 1"=500', Series XV-3) prepared by R.M. Tovill Corporation, and on a field copy of a 1"=530' scale plan map (an enlarged copy of Carter 1985:Map B) of the project area.

All sites were described on standard PHRI site survey record forms and photographed in 35 mm black-and-white. Detailed recording included written descriptions, measurements, plan maps, and selected surface profiles. Each site was plan mapped at a scale of 1:50 or 1:100, with the exception of trails and amorphous pahoehoe clearings which were simply measured and spatially recorded by metric tape and compass. Each site, or the primary feature within a site complex, was marked with red and blue flagging tape, and with an aluminum tag bearing the site number, date, letters "PHRI", and PHRI project number (86-213). Flagging tape with the site number was also wrapped around a rock and placed on the structure as an aid to future site reidentification. While previously recorded sites were labeled with the appropriate site number, all newly identified sites were assigned three digit temporary field numbers prefixed with "T-", beginning with "T-101".

A total of 31 sites/features were tested which included 36 test units comprising an overall excavated area of c. 57.75 square meters. The test excavations were dug by natural layers or arbitrary levels within layers, and all excavated fill was processed through 1/8th-inch mesh screens to facilitate recovery of portable artifacts and midden remains. The recovered materials, including a 100% quantitative sample of midden remains,

Study Area 8  
 Seven sites (7+ component features) located inland of Study Area 7 at c. 200 ft elevation (Sites 88, 103 through 107, T-101). Tentative functional site types include habitation features and a foot trail. Sites 88, 103, 105, and T-101 tested; and

Study Area-  
 Other  
 Eleven sites (68+ component features) located throughout the project area from c. 20-220 ft elevation (Sites 91 through 93, 97, 100, 102, 167, 189, 193, 199, T-102). Tentative functional site types include habitation features, burial features and boundary/shrine features. Sites 91, 92, 93, 100, 102, 193, 199, and T-102 tested.

Table 1 (at end) summarizes both previously and newly identified sites and their component features with respect to formal type, tentative functional interpretation, preliminary evaluation of site significance and field work tasks completed. Table 2 (at end) summarizes newly identified sites in detail and includes recommended action. Table 3 (at end) summarizes tested sites with respect to test unit numbers, excavated area, recommended action and general contents.

Relocation of sites was hampered by the lack of an adequate site location map (approximate scale 1"=530', no contours or topographic features indicated [enlarged copy of Carter 1985:Map B]). Furthermore, site identifications were sometimes difficult due to a lack of sufficient detail in the existing site descriptions; absence of Carter (1985) field notes requested by PHFI for Sites 30, 91, 93, 97, 102, and 199; and the absence of site identification tags. The aerial reconnaissance survey of the as flow land situated seaward of the existing Kona Village access road failed to identify additional archaeological sites with the exception of a single pahoehoe clearing, therefore, with the exception of Trail 26 and portions of the coastline, pedestrian transects across the as flow were omitted.

CONCLUSIONS

SUMMARY

The archaeological survey and testing project has documented the presence of both prehistoric and historic-period archaeological sites. Furthermore, the findings have provided archaeological data and information useful in understanding the nature and significance of prehistoric and historic-period Hawaiian occupation and exploitation of the North Kona coastal zone within the Land of Kaupulehu. The range of functional feature types identified include both temporary and probably permanent habitation features (walled, cave, and overhang shelters), burial features, foot trails, petroglyphs, boundary features, and shrine

bulk firepit, charcoal, vegetal and ash samples were retained for laboratory analysis. Portions of structural features were dismantled as part of the test excavation units and selected cross-sections were recorded. All detailed soil sample descriptions were done using standard procedures and terminology as set forth in the Soil Survey Manual (Soil Survey Staff 1962).

FIELD WORK FINDINGS

Intensive archaeological survey was conducted at a total of 53 sites (198+ component features) within the overall project area. Of these, 46 sites (and 138+ features) had been previously recorded and seven sites (and 60+ features) were newly identified. The range of formal feature types encountered includes walled shelters and enclosures, trails, a lava formation, walls, cairns, platforms, pits, cleared/leveled areas, rock alignments, terraces, overhang shelters, midden/cultural deposits, modified outcrops, cave shelters, pahoehoe clearings, walled pahoehoe clearings, petroglyphs, burials and a possible ramp.

The sites included within intensive survey can be summarized in terms of Study Area distribution as follows:

Study Area 4  
 Thirteen sites (51+ component features) located along the immediate coastal area (Sites 26, 27, 28, 41 through 47, T-106 through -108). Tentative functional site types include habitation features, foot trails, pond wall, possible fish trap, boundary features and possible burial features. Sites 43 and T-108 tested;

Study Area 5  
 Eight sites (34+ component features) located immediately inland of Study Area 4 at c. 20 ft elevation (Sites 25, 30, 34, 172 through 176). Tentative functional site types include habitation features, burial features, foot trail and features of undetermined function. Sites 30, 172, and 173 tested;

Study Area 6  
 Six sites (23+ component features) located inland of Study Area 5 at c. 20-30 ft elevation (Sites 161 through 166). Tentative functional site types include habitation features, burial features and features of undetermined function. Sites 163, 165, and 166 tested;

Study Area 7  
 Eight sites (15+ component features) located inland of Study Area 5 at c. 60 ft elevation (Sites 156, 179 through 182, T-103, -104). Tentative functional site types include habitation features, foot trails, and possible animal drift wall. Site 181 tested;

features. Several foot trails (Sites 34, 107, 156, 178 and T-103) comprise sections or branches of one major coastal-inland oriented foot trail. The overall physical condition and integrity of the archaeological remains generally varies from poor to fair, with several features being in good condition.

Most of the sites and features are concentrated near the shoreline in the immediate coastal zone (Study Areas 4 and 5). The inland portions of the project area appear to contain fewer sites and features, the principal types being coastal-inland extending foot trails and associated habitation features. This distribution of sites conforms to the general pattern of aboriginal Hawaiian settlement that has been reconstructed on the basis of archaeological, ethnohistoric, and ethnographic sources for the portion of North Kona to the north of Kailua (Moench 1973:60-61). This local environmental setting is characterized by three major zones: a narrow, arid coastal habitation zone associated principally with the exploitation of various marine resources; a sloping, barren middle zone characterized by exposed aa and pahoehoe lava rocklands, and largely devoid of soil or vegetation other than grasses; and an upland habitation zone associated with agricultural exploitation. A forest zone, still further inland, was also exploited but not inhabited. The sites and features identified within Kaupulehu Makai Resort project area evidence the occupation of the narrow coastal zone, and the movement of people and produce along the foot trails through the barren intermediate zone that connect the coastal and inland areas of habitation and exploitation.

#### PRELIMINARY EVALUATIONS AND RECOMMENDATIONS

The significance of archaeological remains can be defined 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, within the framework for significance evaluation used here, refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values.

Based on the findings of the archaeological survey and test excavation field work, the archaeological remains found within the Kaupulehu Makai Resort project area appear to be, for the most part, of low to moderate significance in terms of potential scientific research, interpretive, and cultural values. Specific exceptions to this general evaluation are the following sites:

Site	Significance
25	Complex--potentially high research and cultural value due to newly identified cave shelter with intact cultural deposit and possible burial structures;

43	Complex--high interpretive and cultural values due to possible religious interpretation (Fea. D poss. shrine feature);
44	Complex--potentially high research and cultural values due to newly identified poss. burial structures;
92	Complex--high research, interpretive and cultural values due to the presence of human burial remains and possible religious interpretation (Fea. G, poss., shrine feature);
93	Complex--high research and cultural values due to the presence of three, newly identified, intact human burials and association with adjacent Site 92 complex;
165	Complex--high interpretive and cultural values due to concentration of petroglyphs and newly identified human burial remains;
166	Complex--high interpretive and cultural values due to possible religious interpretation (Carter 1985:17);
167	Complex--high cultural value due to presence in cave shelter of three human burials and cultural remains;
173	Complex--high research and cultural values due to presence in cave shelter of human burial remains and thick cultural deposit containing horizontal features, volcanic glass;
189	Complex--high cultural value due to possible shrine feature situated near the Lands of Kukio 1st and Kaupulehu boundary;
T-107	Complex--potentially high research, and cultural values due to presence of newly identified, possible burial features;
T-108	Complex--high research value due to presence of moderate cultural deposit containing horizontal features, volcanic glass and organic material, ash, or charcoal dating samples and potentially high cultural value due to possible burial feature; and
Various foot trails (26, 34, 107, 156, 178, T-104)	--potentially high interpretive value, as well as cultural value (in terms of traditional access rights).

With the exception of the specific sites and features listed above, most of the sites included within the present scope of work have been handled adequately by carrying out the appropriate level of archaeological work needed to recover the significant data present--thereby preserving the valuable archaeological information rather than the physical remains themselves and therefore, continued physical preservation would not be

considered essential. At the same time, many of the identified archaeological remains, while having only limited to moderate significance in terms of potential research, interpretive, or cultural value, should be considered for preservation and inclusion into the landscaping of the development project area.

Individual site evaluations and recommendations for immediate further action have been included in Tables 1 and 2 (at end). Based on the findings of the archaeological survey and testing, 35 sites (113 component features)--Sites 27, 28, 30, 41, 42, 45-47, 88, 91, 97, 100, 102-106, 161-164, 172, 174-176, 179-182, 193, 199, T-101-103, and T-106, are believed to require no further work. Nine sites (Sites 43, 166, 189, and various foot trails [Sites 26, 34, 107, 156, 178 and T-104]) are recommended for preservation, interpretive development, and inclusion into the landscaping of the development project area due to high interpretive and/or cultural values although no further recording and archaeological excavations are required. For the remaining nine identified sites (Sites 25, 44, 92, 93, 165, 167, 173, T-107, and T-108) further work in the form of intensive archaeological testing and/or mitigation (salvage research excavations, and/or preserve), is recommended. Sites selected for preservation, interpretive development and inclusion into the landscaping of the development project area would not require intensive archaeological testing and/or salvage research excavations. The following specific field tasks were determined to constitute an adequate scope of work for sites not selected for preservation and interpretive development:

Intensive testing- to determine the presence or absence of human burial remains (Sites 25, 44, and T-107) and the nature, depth and content of cultural deposits (Site 25);

Salvage research-excavations

excavation and recovery of portable artifacts and midden remains and detailed recording of non-portable features (scaled plan maps, profiles, and cross-sections, written descriptions and photographs) (Sites 173 and T-108) and archaeological recording, removal and reinterment of human burial remains (Sites 92, 93, 165, 167, and 173, possibly including Sites 25, 44, and T-107 pending test results) and;

Sub-surface-testing

Reconnaissance auger core testing of beach deposits between the north end of Kahawai Bay and the north end of Kumakehu Point to determine the presence of subsurface buried cultural deposits.

As an important initial step, it is recommended that all identified sites be accurately located and 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 further archaeological work determinations (intensive testing and/or mitigation) to be considered on a site-by-site basis.

Finally, it is recommended that a qualified archaeologist monitor all grubbing activity in the vicinity of identified sites. In the event any portable artifacts or buried cultural features or deposits are encountered during the grubbing, work in the area of such remains should be suspended immediately until the monitoring archaeologist has the opportunity to inspect and evaluate the significance of any newly discovered remains.

Upon completion of the field work, survey findings and preliminary conclusions--including tentative evaluations and recommendations, were discussed with Dr. Ross Cordy, staff archaeologist in the Hawaii State Historic Preservation Office (March 18, 1986), and with Ms. Virginia Goldstein, staff planner and historic sites specialist in the Hawaii County Planning Department (March 19, 1986). They are currently reviewing the preliminary conclusions and tentative recommendations presented here regarding any further work to be done within Kaupulehu Makai Resort project area.

It should be noted that the evaluations and recommendations given here have been made on the basis of the archaeological survey and specific test excavations, but prior to any laboratory analysis of recovered material. Laboratory analysis of recovered material is currently in progress. There is always the possibility, however remote, that previously unidentified surface structural remains or subsurface cultural features or deposits of high significance might be encountered in the course of subsequent archaeological investigations or other development activities. In such a situation, archaeological consultation should be sought immediately.

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Table 1.  
SUMMARY OF IDENTIFIED SITES AND FEATURES WITHIN  
KAPUPULEHU MAKAII RESORT PROJECT AREA

Site No. HE-022	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R I C	Field Work Completed DR EX	Comments
Study Area 4 - Previously Identified Sites					
26	Trail	Foot trail	M H H X	X -	Costal trail; portions contain waterworn boulders; preserve
27	Complex Enclosure	Habitat Pond wall	M H M X	X -	Part of Reinecke's Site 118; includes Site 47; Fea. A encloses marsh pond
28	Lava formation	Poss. fishtrap	L L L X	X -	Natural fea. poss. utilized as fishtrap
41	Complex (2) <sup>+</sup> Wall Cairn	Boundary features	L L L X	X -	Situated along Site 26 trail; Fea. B newly identified; see Table 2
42	C-shape	Habitat	L L L X	X -	Utilized recently by fishermen
43	Complex (13) Cairn Box C-shape Cairn Rectangular cairn Enclosure/low platform Cairn Pit	Habitat	M H H X	X X	Fea. B and D tested; Fea. D poss. shrine; Fea. M unusual human figure petroglyph; such-laline ponds in area; site complex

\*Significance Evaluation--Nature: R = scientific research, I = interpretive, C = cultural;  
Degree: H = high, M = moderate, L = low

Field Work Tasks Completed: DR = detailed recording (scaled drawings, photo graphs, and written descriptions), EX = test excavations

<sup>+</sup>Number of component features within complex.

Table 1. (Cont.)

Site No. HE-022	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation R I C	Field Work Completed DR EX	Comments
43	C-shape I J K L M	Cleared area Pit L-shape wall Pit Petroglyph			overlooks cobble beach; preserve; Fea. J-L newly identified; see Table 2
44	Complex (5) Cairn A B C D E	Undetermined Cairn Wall Low platform Low platform	L/H L/M L/H + -	+ -	Fea. C previously identified Site T-125 (Walker and Rosendahl 1985); Fea. D and E newly identified; see Table 2
45	Cairn	Undetermined	L L L	+ -	Constructed against large boulder
46	Complex (5) C-shape Wall A B C D E F	Habitat	L L L	+ -	Site situated on a flow; structures in deteriorated condition; limited excavation potential
47	Complex (7) Cairn A B C D E F G	Habitat	M L L	+ -	Poss. identified by Reinecke as Fea. of Site 118; site situated on a flow; Fea. D part of Site 27; Fea. E-G newly identified; see Table 2
Newly Identified Sites					
T-106	Complex (4) Wall	Habitat	L L L	X -	Newly identified site; see Table 2
	A B C D	Overhang shelter Overhang shelter Overhang shelter			

Table 1. (Cont.)

Site No. Ha-922	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Field Work Completed	Comments
			R	I	C		
174	Walled paboebos clearing	Undetermined	L	L	L	X	Other similar features noted in area; Site 174 part of Site 175
175	Complex (9)	Undetermined	L	L	L	X	Other similar features noted in paboebos clearings recorded
A	Paboebos clearing						
B	Paboebos clearing						
C	Paboebos clearing						
D	Paboebos clearing						
E	Paboebos clearing						
F	Paboebos clearing						
G	Cairn						
H	Cairn						
I	Paboebos clearing						
176	Complex (6)	Undetermined	L	L	L	X	Cairns form rough NE-SW alignment; situated c. 40.0 m south of Site 173
A	Cairn						
B	Cairn						
C	Cairn						
D	Cairn						
E	Cairn						
F	Cairn						

Newly Identified Site

T-105

Study Area 6 - Previously Identified Sites

161	Complex (6)	Undetermined	L	L	L	X	Other similar features noted in area; sample of paboebos clearings recorded
A	Paboebos clearing						
B	Paboebos clearing						
C	Paboebos clearing						
D	Paboebos clearing						
E	Paboebos clearing						
F	Walled paboebos clearing						
162	Complex (7)	Habitat	L	L	L	X	Yes. A contains sparses midden; cairns form crude N-S alignment north of Yes. A
A	Cave shelter						
B	Cairn						
C	Cairn						
D	Cairn						
E	Cairn						
F	Cairn						
G	Cairn						

Table 1. (Cont.)

Site No. Ha-922	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Field Work Completed	Comments
			R	I	C		
T-107	Complex (6)	Undetermined	L/H	L/M	L/H	X	Newly identified site; see Table 2
A	Platform						
B	Platform						
C	Platform						
D	Circular rock alignment						
E	Overhang shelter						
F	Cairn						
T-108	Complex (4)	Habitat	H	M	H/A	X	Newly identified site; see Table 2
A	Midden/cultural deposit						
B	Modified outcrop						
C	Terrace						
D	Low platform						
<u>Study Area 3 - Previously Identified Sites</u>							
T-25	Complex (6)	Habitat/burial	H	M	H	X	Yes. A prob. recorded by Soehren (1963) as Site 25; Yes. A poss. burial; Yes. B-F newly identified; see Table 2
A	Platform						
B	Terrace						
C	Cave shelter						
D	Terrace						
E	Cave shelter						
F	Cave shelter						
30	Complex (5)	Habitat	M	M	M	X	Yes. A and B tested; Yes. C-E newly identified; see Table 2
A	Cave shelter						
B	Cave shelter						
C	Cairn						
D	Terrace						
E	Trail						
34	Trail	Foot trail	M	H	H	X	Prob. extension of main coastal-inland trail
172	Complex (3)	Habitat	M	L	M	X	Yes. A tested; Yes. B contains numerous coral fragments; Yes. C newly identified; see Table 2
A	Modified outcrop/terrace						
B	Modified outcrop						
C	Cairn						
173	Complex (3)	Habitat/burial	H	M	M	X	Yes. B and C situated within Yes. A; Yes. A and C tested; mitigation recommended
A	Cave shelter						
B	Terrace						
C	Terrace						

Table 1. (Cont.)

Site No.	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation	Field Work Completed	Comments
H1-022	Type	Interpretation	R I C	DR EX	
163	Complex (3)	Habitat	L L L	X X X	Yes. A tested; Carter (1985)
A	Cave shelter				Yes. B poss. platforms, but dimensions inaccurate; Yes. C newly identified; see Table 2
B	Rectangular cobble pile				
C	Level cobble area				
164	C-shape	Habitat	L L L	X -	No portable remains visible in structure
165	Complex (4)	Habitat/burial	M H H	X X	Yes. A tested; Preserve/mitigation recommended; Yes. B and C newly identified; see Table 2
A	Cave shelter				
B	Cave				
C	Cave				
D	Petroglyph concentration				
166	Complex (2)	Habitat	M H H	X X	Yes. A tested; contains waterworn cobble concentration; poss. shrines; poss. preserve
A	Enclosure				
B	Overhang shelter				
<b>Study Area 7 - Previously Identified Sites</b>					
136	Trail	Foot trail	M H H	X -	Prob. extension of main coastal-inland trail
178	Trail	Foot trail	M H H	X -	Prob. branch of main coastal-inland trail
179	Complex (3)	Poss. drift wall	L L L	X -	Yes. A segmented, not continuous; poss. crudely constructed drift wall
A	Wall				
B	Cairn				
C	L-shape wall				

Q-10

Table 1. (Cont.)

Site No.	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation	Field Work Completed	Comments
H1-022	Type	Interpretation	R I C	DR EX	
180	Wall	Poss. drift wall	L L L	X -	Wall well constructed; Site 156 trail continues through opening
181	Complex (4)	Habitat	M M M	X X	Yes. A tested; contained high amounts of volcanic glass; Yes. B and C newly identified; see Table 2
A	Cave shelter				
B	Walled shelter				
C	Walled shelter				
D	Cave shelter				
182	Complex (3)	Habitat	L L L	X -	No midden or cultural deposit visible; mislocated on Map B (Carter 1985)
A	L-shaped wall shelter				
B	Cairn				
C	Fit				
<b>Newly Identified Sites</b>					
T-103	Cave shelter	Habitat	L L L	X -	Newly identified site; see Table 2
T-104	Trail	Foot trail	M H H	X -	Newly identified site; see Table 2
<b>Study Area 8 - Previously Identified Sites</b>					
88	Cave shelter	Habitat	M L L	X X	Contained sparse to moderate amounts of midden and 2-3 cm of deposit
103	Cave shelter	Habitat	M L L	X X	Contained moderate amounts of midden and artifacts
104	Low enclosure	Habitat	L L L	X -	No midden or cultural deposit visible
105	Cave shelter	Habitat	M L L	X X	Contained sparse to moderate amounts of midden and artifacts

Table 1. (Cont.)

Site No. HC-022	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Field Work Completed	Comments
			R	I	C		
106	Cave shelter	Habitat	L	L	L	X	Limited to no excavation potential
107	Trail	Foot trail	M	H	H	X	Prob. branch of main coastal-inland trail
<b>Newly Identified Site</b>							
T-101	Cave shelter	Habitat	M	L	L	X	Newly identified site; see Table 2
<b>Study Area - Other - Previously Identified Sites</b>							
91	Complex (6)	Habitat	M	L	L	X	Yes. A tested; contains moderate amounts of midden and artifacts; Yes. B-F newly identified; see Table 2
A	Cave shelter						
B	Terrace						
C	Modified outcrop						
D	Stepping-stone trail						
E	Crude paved area						
F	Pit						
92	Complex (14)	Habitat	H	H	H	X	All fea. situated within Yes. M or the lava channel which forms it; Yes. A and C tested; Yes. G prob. shrine; Yes. K contained human skeletal fragments; main tube (Yes. N) continues to Site 93; mitigation recommended
A	Terrace						
B	Terrace						
C	Terrace						
D	Terrace						
E	Terrace						
F	Terrace						
G	Rectangular cairn						
H	Terrace						
I	C-shape						
J	Stepping-stone trail						
K	Cave						
L	Cave						
M	Crude paved area						
N	Large cave shelter						
93	Complex (8)	Habitat/burial	H	M	H	X	All fea. except Yes. G situated within Yes. H; Yes. A-D tested; Yes. D-G newly identified; see Table 2
A	Terrace						
B	Terrace						
C	Slab paved area						
D	Terrace						
E	Cobble paved area						
F	Burials						
G	Petroglyph						
H	Sink area and tube						

Table 1. (Cont.)

Site No. HC-022	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Field Work Completed	Comments
			R	I	C		
97	Complex (5)	Habitat	L	L	L	X	Contains sparse midden and artifacts; limited excavation potential; Yes. B newly identified; see Table 2
A	Crude slab paved area						
B	Terrace						
C	Cave shelter						
D	Stepping-stone trail						
E	Cave shelter						
100	Complex (5)	Habitat	M	L	L	X	Yes. A tested; contained sparse to moderate amounts of midden and artifacts; Yes. D newly identified; see Table 2
A	Cave shelter						
B	Crude enclosure						
C	Pit and level area						
D	Stepping-stone trail						
E	Cairn						
102	Complex (2)	Habitat	L	L	L	X	Yes. A tested; contained sparse to moderate amounts of midden and artifacts
A	Cave shelter						
B	Terrace						
167	Complex (3)	Habitat/burial	M	L	H	X	Yes. A prob. initially utilized as a habitation cave; contains three historic burials; mitigation recommended
A	Habitat/burial cave						
B	Trail						
C	Cairn						
189	Complex (11)	Boundary marker	M	M	H	X	Situated near Kukio-Kaupulehu Ahupua'a boundary; Yes. A, poss. shrines; limited excavation potential; Yes. C, I-K newly identified; see Table 2
A	Modified outcrop						
B	Cairn						
C	Stepping-stone trail						
D	Cairn						
E	Cairn						
F	Cairn						
G	Cairn						
H	Cairn						
I	Modified outcrop						
J	Cairn						
K	Cairn						

Table 2.  
SUMMARY OF NEWLY IDENTIFIED SITES AND FEATURES  
WITHIN KAPULEHU MAKAI RESORT PROJECT AREA

Site No.	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Recommended Action	Comments
			R	I	C		
<b>Study Area A</b>							
41	Complex (2) <sup>†</sup>	Boundary feature	L	L	L	None	Constructed on large boulder; lithified sand cobble on top
43	Complex (13)	Habitation	M	M	M	Pres.	Recorded with Site Complex 43; Fea. J and L poss. cup-boards
J	Pit						
K	L-shaped wall						
L	Pit						
44	Complex (5)	Poss. burial	L/H	L/H	L/H	Int. Sur. Testing	Poss identified by Reinecke (1930) as fea. of Site 118
D	Low platform						
E	Low platform						
47	Complex (7)	Undetermined	L	L	L	None	Structures in fair to poor condition; constructed of as boulders and cobbles
E	Cairn						
F	Cairn						
G	Cairn						
T-106	Complex (4)	Habitation	L	L	L	None	Site complex situated along Site 26 trail near Site Complex 43
A	Wall						
B	Overhang shelter						
C	Overhang shelter						
D	Overhang shelter						
T-107	Complex (6)	Undetermined	L/H	L/M	L/H	Int. Sur. Testing	Fea. A, B and C poss burials; situated on aa flow and along coast; poss. identified by Reinecke (1930) as fea. of Site 118
A	Platform						
B	Platform						
C	Platform						
D	Circular rock alignment						
E	Overhang shelter						
F	Cairn						

\*Significance Evaluation—Mature: R = scientific research, I = interpretive, C = cultural;  
Degree: H = high, M = moderate, L = low

<sup>†</sup>Number of component features within complex.

Table 1. (Cont.)

Site No.	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Field Work Completed	Comments
			R	I	C		
193	Complex (5)	Habitation	M	M	M	X	Fea. A and B tested; contained sparse to moderate amounts of midden and artifacts; Fea. A contains two entrances; Carter (1985) dimensions are inaccurate; Fea. D newly identified; see Table 2
A	Cave shelter						
B	Cave shelter						
C	Petroglyph						
D	Cairn						
E	Cairn						
199	Complex (5)	Habitation	M	M	M	X	Entrance to Fea. A is walled, wall built, and restricts entry; Fea. C tested; Fea. C-D crudely constructed
A	Refuge cave						
B	Overhang shelter						
C	Terrace						
D	Wall						
E	Poss. ramp						
<b>Newly Identified Site</b>							
T-102	Complex (4)	Habitation	M	M	M	X	Newly identified site; see Table 2
A	Double C-shape						
B	Cave shelter						
C	Terrace						
D	Crude enclosure						



Table 2. (Cont.)

Site No. Ha-D22	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Recommended Action	Comments
			R	I	C		
T-108	Complex (4)	Habitat	H	M	M/	Mitig.	Fea. A tested as part of present project; situated on bluff overlooking Kukio Bay; poss. identified by Reinecke (1930) as fea. of Site 118
A	Hidden/cultural deposit						
B	Modified outcrop						
C	Terrace						
D	Low platform						
<u>Study Area 5</u>							
25	Complex (6)	Habitat/burial	H	M	H	Int. Sur. Testing	Fea. B, D poss. burials; Fea. C good excavation potential artifacts, midden, and cultural deposit present
B	Terrace						
C	Cave shelter						
D	Terrace						
E	Cave shelter						
F	Cave shelter						
30	Complex (5)	Habitat	M	M	M	None	Fea. E prob. extension of main coastal-inland trail
C	Cairn						
D	Terrace						
E	Trail						
172	Complex (3)	Undetermined	L	L	L	None	Contains crude partially faced side
C	Cairn						
<u>Study Area 6</u>							
163	Complex (3)	Habitat	L	L	L	None	Artificially leveled cobble area
C	Level cobble area						
165	Complex (4)	Burial	M	H	H	Pres/Mitig.	Fea. B contains human cranium; Fea. C contains wood planks and cloth, poss. previously utilized for burial
B	Cave						
C	Cave						
<u>Study Area 7</u>							
181	Complex (4)	Habitat	L	L	L	None	Both contain very sparse midden; limited excavation potential
B	Walled shelter						
C	Walled shelter						

Table 2. (Cont.)

Site No. Ha-D22	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Recommended Action	Comments
			R <th>I <th>C</th> </th>	I <th>C</th>	C		
T-103	Cave shelter	Habitat	L	L	L	None	Sparse to moderate midden present on bedrock floor; situated along Site
T-104	Trail	Foot trail	M	H	H	None	Prob. branch of main coastal-inland trail
<u>Study Area 8</u>							
T-101	Cave shelter	Habitat	M	L	L	None	Contained sparse to moderate amounts of midden and 2-3 cm of deposit
<u>Study Area - Other</u>							
91	Complex (6)	Habitat	M	L	L	None	All fea. within lava channel which forms Fea. A; limited excavation potential
B	Terrace						
C	Modified outcrop						
D	Stepping-stone trail						
E	Crude paved area						
F	Pit						
93	Complex (8)	Habitat/burial	H	M	H	Mitig.	Fea. F contains minimum of three burials; burials appear prehistoric; Fea. D also tested
D	Terrace						
E	Cobble paved area						
F	Burials						
G	Petroglyph						
97	Complex (5)	Habitat	L	L	L	None	Terrace situated within sink area; limited excavation potential
B	Terrace						
100	Complex (5)	Foot trail	L	M	M	None	Leads to Site T-101
D	Stepping-stone trail						
189	Complex (11)	Boundary marker	M	M	M	Mitig.	Fea. C oriented toward Site 193; Fea. I poss. shrine; limited excavation potential
C	Stepping-stone trail						
I	Modified outcrop						
J	Cairn						
K	Cairn						
193	Complex (5)	Undetermined	L	L	L	None	Contains no faced sides
D	Cairn						

Table 2. (Cont.)

Site No. Ha-D12	Formal Site/Feature Type	Tentative Functional Interpretation	Significance Evaluation			Recommended Action	Comments
			R	I	C		
T-102	Complex (4)	Habitation	M	M	M	None	Situated near Site 100; Fea. B and C, (located within Fea. B), excavated; Fea. A and D limited excavation potential
A	Double C-shape						
B	Cave shelter						
C	Terrace						
D	Grude enclosure						

Table 3.  
SUMMARY OF TEST EXCAVATIONS

Site No. Ha-D12	Formal Site Type	Tentative Functional Interpretation	Test Excavations TU Area (sq.m)	Immediate Action Recommended	Comments
<b>Study Area 4</b>					
43	Complex (13)*	Habitation	1	Preserve	Contained 10-12 cm thick cultural deposit (Fea. B only), indigenous artifacts and midden
B	Box C-shape		0.5		
D	Rectangular shrine cairn		0.5		
<b>Study Area 5</b>					
T-108	Complex (4)	Habitation	1	Mitig.	Contained 15-28 cm thick cultural deposit, indigenous artifacts, midden, boris, features, and dating samples (vol. glass and charcoal)
A	Midden/cultural deposit		1.0		
<b>Study Area 5</b>					
30	Complex (5)	Habitation	1	None	Contained 1-25 cm thick cultural deposit, indigenous artifacts, midden and vol. glass dating samples
A	Cave shelter		0.5		
B	Cave shelter		1.5		
172	Complex (3)	Habitation	1	None	Contained indigenous artifacts, and midden in bedrock crevices
A	Modified outcrop/terrace		1.0		
173	Complex (3)	Habitation	1	Mitig.	Contained 60-70 cm thick cultural deposit (Fea. A), indigenous artifacts, midden, boris, features and vol. glass dating samples
A	Cave shelter		0.5		
C	Terrace		0.5		

\*Number of component features within complex.

213-030786

Table 3. (Cont)

Site No. 50- Ha-D22-	Formal Site Type	Tentative Functional Interpretation	Test Excavations TU Area (sq.m)	Immediate Action Recommended	Comments
103					(avg. 5-10 cm), indigenous artifacts and midden; poss. firepit tested.
105	Cave shelter	Habitation 2	2.0	None	Contained 1-7 cm thick cultural deposit in bedrock crevices (avg. 2-3 cm), midden and indigenous artifact (1)
T-101	Cave shelter	Habitation 1	2.0	None	Contained 1-3 cm thick cultural deposit, midden and vol. glass dating samples

Study Area - Other

91	Complex (6) A Cave shelter	Habitation 1	1.0	None	Contains 2-15 cm thick cultural deposit (avg. 7 cm), and midden
92	Complex (16) A Terrace G Rectangular shrine cairn	Habitation 1	1.0 0.5	Mitig.	Contains 5 cm soil rock fill, organic material and midden; Fes. G 1/2 sectioned
93	Complex (8) A Terrace B Terrace C Slab pave area D Terrace	Habitation 1	0.5 1.0 1.0 2.0	Mitig.	Contains 5-20 cm thick cultural deposit below dismantled structures, (Fes. A, B, C), sparse to moderate amounts of midden and indigenous artifacts; no human burial remains
100	Complex (5) A Cave shelter	Habitation 1	16.0	None	Entire cave tested; contains 0-7 cm thick

213-030786

Table 3. (Cont)

Site No. 50- Ha-D22-	Formal Site Type	Tentative Functional Interpretation	Test Excavations TU Area (sq.m)	Immediate Action Recommended	Comments
163	Complex (3) A Cave shelter	Habitation 1	5.0	None	Entire cave interior tested; contained surface midden deposit on bedrock
165	Complex (4) A Cave shelter	Habitation 2	6.5	Preserve/ Mitig.	Contained 1-15 cm cultural deposit, indigenous artifacts, midden and vol. glass dating samples
Q166 115	Complex (2) A Enclosure	Habitation 2	1.0	Preserve	Contained 1-28 cm thick cultural deposit, sparse-moderate midden and artifacts; firepit tested

Study Area 7

181	Complex (4) A Cave shelter D Cave shelter	Habitation 1	1.0 1.0	None	Contained 1-10 cm thick cultural deposit, indigenous artifacts, midden and vol. glass dating samples; poss. firepit tested
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Study Area 8

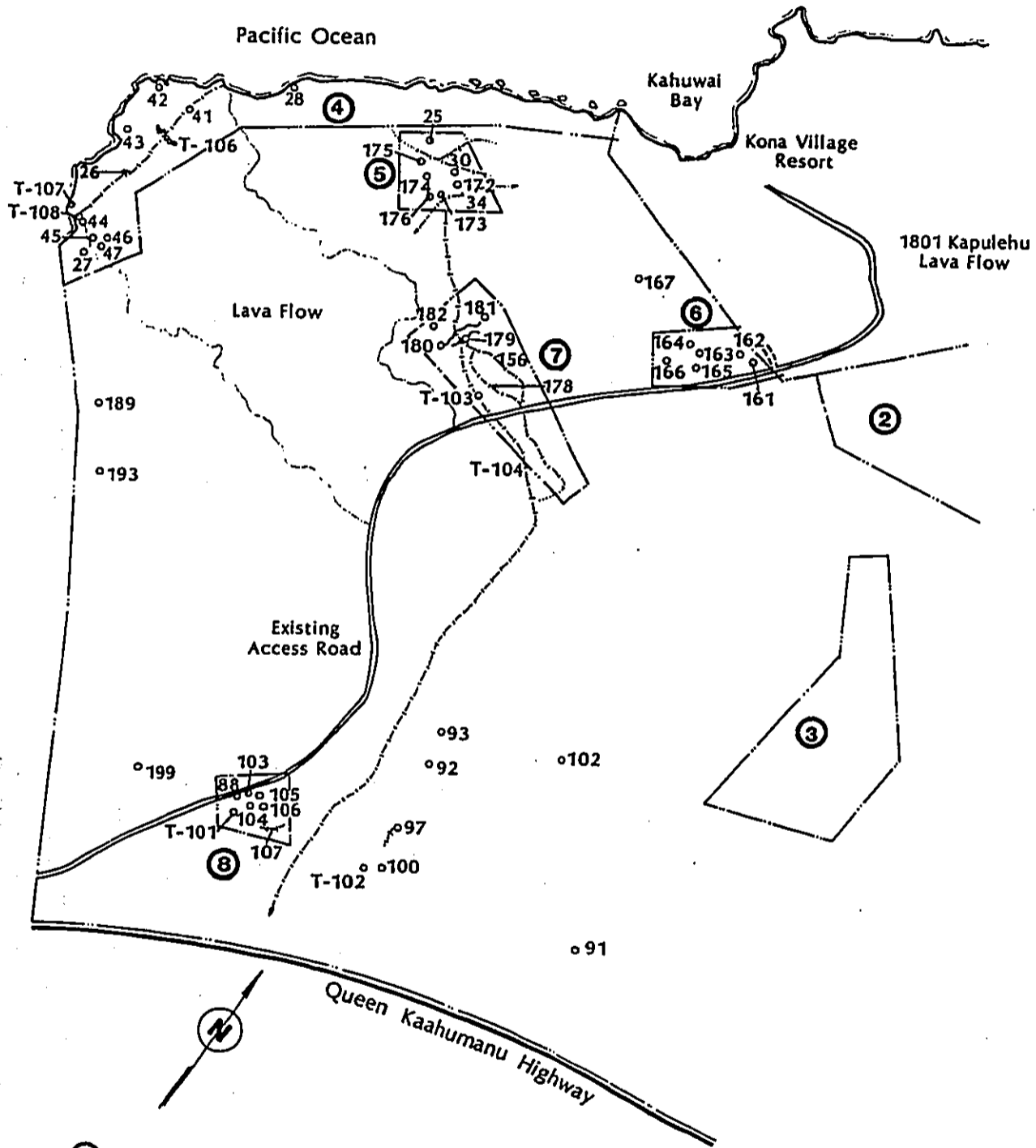
88	Cave shelter	Habitation 2	1.5	None	Contained 1-9 cm thick cultural deposit in bedrock crevices (avg. c. 3 cm) indigenous artifacts and midden
103	Cave shelter	Habitation 2	4.25	None	Contained 1-15 cm thick cultural deposit in bedrock crevices



Table 3. (Cont.)

Site No. 50- Pa-D22-	Tentative Site Type	Functional Interpretation	Test TU	Excavations Area (sq.m)	Immediate Action Recommended	Comments
100						cultural deposit, midden and indige- nous artifacts, and vol. glass dating samples
102	Complex (2) A Cave shelter	Habitation	1	0.5	None	Contains 1-9 cm thick cultural deposit, midden and indigenous artifact (1)
193	Complex (5) A Cave shelter B Cave shelter	Habitation	1 1	0.5 0.5	None	Contains 1-17 cm thick cultural deposit (avg. 6-8 cm), midden indigenous arti- facts and vol. glass dating samples
199	Complex (5) C Terrace	Habitation	1	1.0	None	Dismantled ter- race revealed very sparse soil and 1 pc. midden frag- ment
T-102	Complex (4) B Cave shelter C Terrace	Habitation	1 1	1.0 1.0	None	Contains 1-10 cm thick cultural deposit (avg. 5 cm), midden in- digenous arti- facts, and vol. glass dating samples
TOTALS	31 Site/features		36	57.75		

213-030786



④ Survey Areas  
 - - - Foot Trails

2 and 3 digit numbers= Previously recorded  
 B.P. Bishop Museum Site Number (50-Ha-D22-\_\_\_)

3 digit numbers= PHRI Temporary  
 Site Number (T-\_\_\_)

**SITE LOCATION MAP**

Archaeological Survey and Test Excavations  
 Kaupulehu Makai Resort Project Area  
 Kaupulehu, North Kona, Island of Hawaii  
 (TMK:3-7-2-03:Por.1)

0 400 800 2000 Feet

PHRI Project 86-213

March 1986

PAUL H. ROSENDALH, Ph.D., Inc.  
Consulting Archaeologist

Report 230-041686

Ms. Anne Mapes  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

April 16, 1986

230-041686

2

crossed the pahoehoe in a N-S orientation (see attached Trail Location Map). The trail appeared mainly as a shallow depression measuring 50 to 100 cm in width, and included several areas of cobble fill. Large white coral boulders had been placed at intervals along the length of the trail. Apple, in his book on Hawaiian trails (1965:65), has defined this as a Type "A" single-file foot trail.

Upon completion of the field work, inspection findings were discussed with Dr. Ross Cordy, staff archaeologist in the Hawaii State Historic Preservation Office (April 15, 1986), and with Ms. Virginia Goldstein, staff planner and historic sites specialist in the Hawaii County Planning Department (April 15, 1986). While Ms. Goldstein agreed that continued physical preservation of the trail would not be required, she did recommend that accurate locational plotting of the trail and limited documentary research be conducted prior to on-site development activities. We further recommend that Kona Village consider the preservation and incorporation of representative sections of the trail into the overall landscape design of the planned resort expansion area as points of historic interest.

Another Type "A" foot trail was observed to the northeast of the project area, extending along the shoreline (see attached Trail Location Map). This coastal trail appears to be that indicated on the USGS map of Hawaii County, Hawaii (1:100,000 scale, 1980, sheet 1 of 3). No physical evidence of this coastal trail was identified within the 15 acre field inspection project area, probably because the course of the trail would lead it across the present sand and boulder beach area. Further documentary research is also recommended for this trail, as it is part of a coastal trail system extending through the Kohala and Kona Districts.

If you have any questions, please feel free to contact us at our Hilo office (808) 969-1763.

Sincerely yours,  
*Margaret L.K. Rosendahl*  
Margaret L.K. Rosendahl, B.A., S.O.P.A.  
Supervisory Archaeologist

Attachments: Project Area and Trail Location Maps

References Cited

Apple, Russell A.

1965 Trails: From Steppingstones to Kerbstones. Earl Bishop Museum Special Publication 53. Honolulu: Bishop Museum Press.

Stearns, H.F., and G.A. MacDonald

1946 Geology and Ground-water Resources of the Island of Hawaii. Bulletin 9. Hawaii Division of Hydrography. Honolulu: Advertiser Publishing Co., Ltd.

Subject: Archaeological Field Inspection  
Kona Village Expansion Site  
Land of Kaupulehu, North Kona, Island of Hawaii

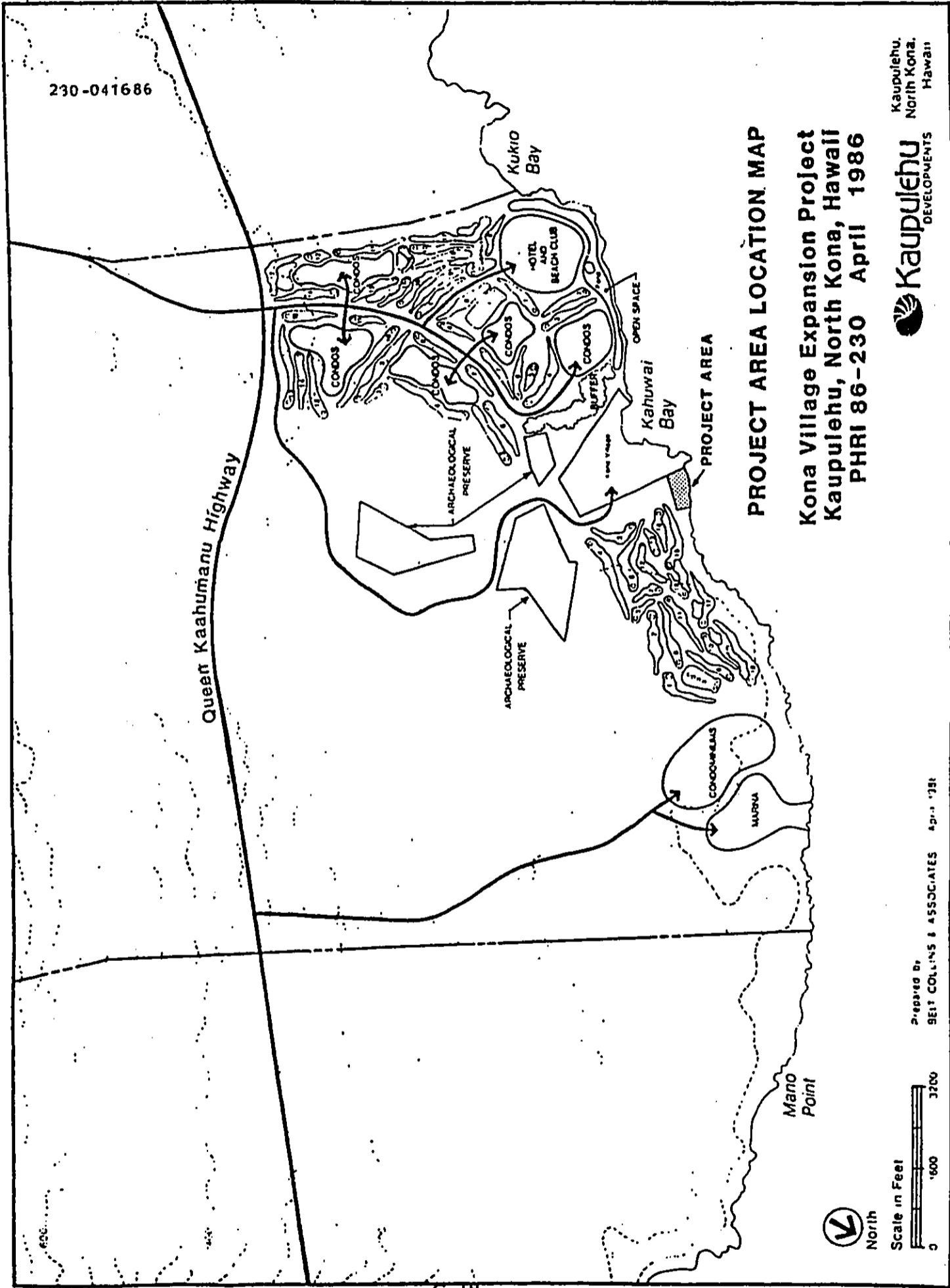
Dear Ms. Mapes:

At the request of yourself and Mr. Jim Bell of Belt, Collins & Associates, Paul H. Rosendahl, Ph.D., Inc. (PHI) conducted an archaeological field inspection of the Kona Village Expansion Site at Kaupulehu, North Kona, Island of Hawaii (see attached Project Location Map). The primary objective of this inspection was to determine the presence or absence of any archaeological sites of potential significance in the project area.

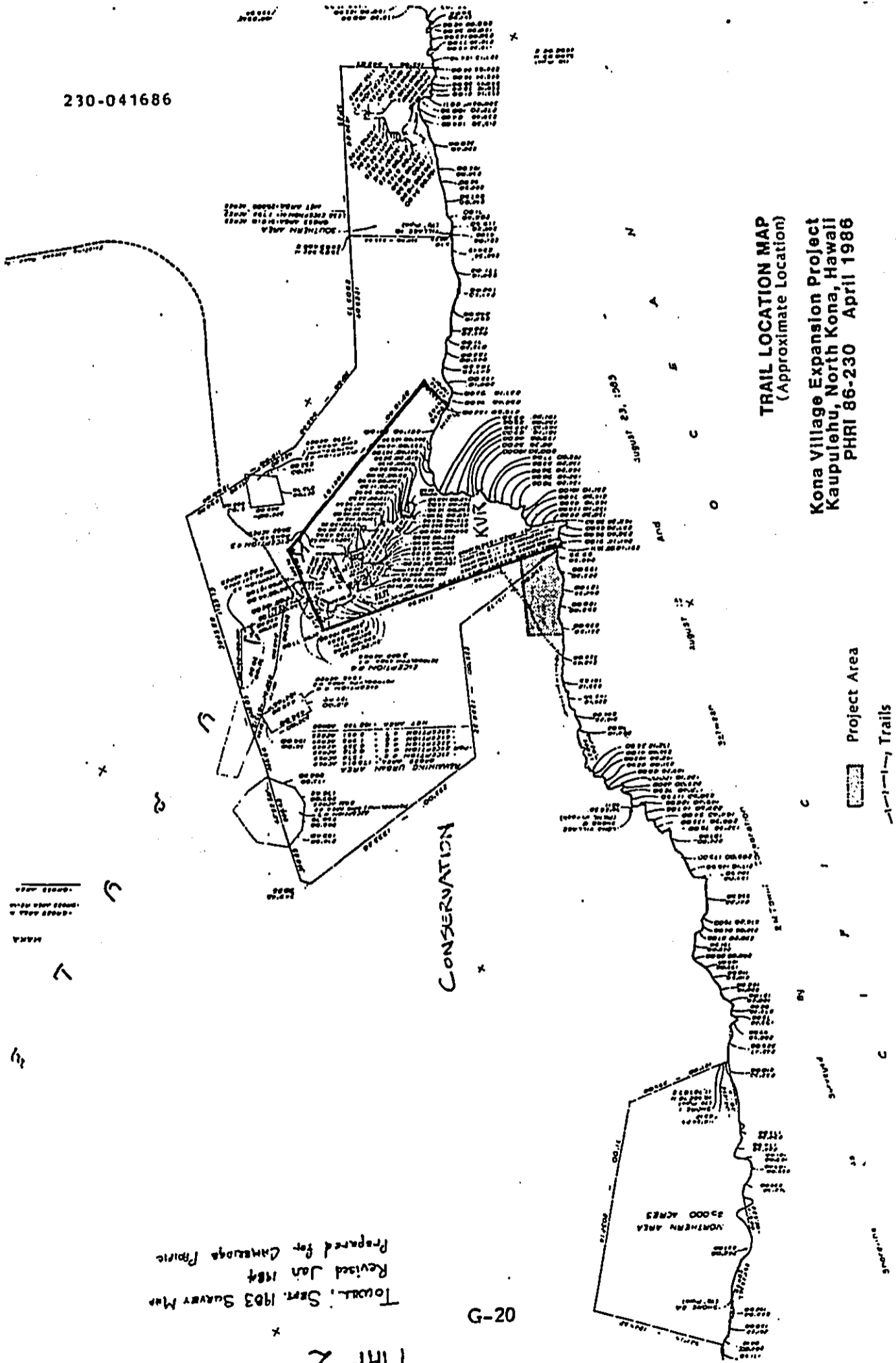
The field work was carried out on April 14, 1986 by PHI Supervisory Archaeologists Margaret L.K. Rosendahl and Theresa K. Donham. The project area consisted of approximately 15 acres situated immediately north of and adjacent to the existing Kona Village complex. The area inspected was c. 1100 (NW-SW) by 600 ft (NW-SE), and ranged in elevation from sea level to c. 50 ft above sea level.

The project area included barren coastal cliffs varying from 3 to 8 m in height and extending 10 m inland. The cliffs were bordered by a 10 to 25 m wide strip of beach consisting of coarse black sand and rounded basalt and coral boulders. The only vegetation present in the project area was found in this zone. Clusters of coconut trees (*Cocos nucifera* L.) and false *KAWAHI* (*Terminalia satiboda* L.), most likely intentional landscape plantings, were scattered along the shoreline and watered by an irrigation system. The piping was partially concealed by a low, stacked boulder wall that ran the length of the project area. In addition to these plantings, there was a large *Kiwa* tree (*Excoecaria mollida* (Humb. and Bonpl. ex Willd.) HK.) at the north end of the sandy stretch. Inland of the sand belt was relatively flat pahoehoe with an aa ridge protruding into the east corner of the project area. According to Stearns and MacDonald (1946:137-138, Plate 1), these lavas are part of the historic member of the Hualalai Volcanic Series, which consists of olivine basalt pahoehoe and aa flows from an 1800-1801 eruption. The Geologic and Topographic Map (Stearns and MacDonald 1946:Plate 1) indicates that the flows reached the ocean; therefore, all portions of the present 15 acre project area are contained within the extent of the flows commonly referred to as the "1801 Kaupulehu Flow."

The inspection of the project area involved pacing off the approximate boundaries and conducting a series of pedestrian passes at 25 to 50 meter intervals, parallel to the coastline. Visibility was excellent. Only one site, a worn, historic period foot trail, was identified during the field inspection. It began near the northernmost planting of coconut trees, and



230-041686



**TRAIL LOCATION MAP**  
 (Approximate Location)  
 Kona Village Expansion Project  
 Kaupulehu, North Kona, Hawaii  
 PHRI 86-230 April 1986

Project Area  
 Trails

MAWA  
 LEGEND  
 LEGEND

TOULI, SERN, 1903 SQUARE MAP  
 Revised Jan 1984  
 Prepared for Cambridge Profile

June 2, 1986

241-060286

2

Ms. Anne Mapee  
Belt, Collins & Associates  
606 Coral Street  
Honolulu, Hawaii 96813

Subject: Archaeological Field Inspection  
Revised Kona Village Expansion Site  
Land of Kaupulehu, North Kona, Island of Hawaii

Dear Ms. Mapee:

An archaeological field inspection of the Revised Kona Village Expansion Site was conducted by Paul H. Rosendahl, Inc. (PHRI), at the request of yourself and Mr. Jim Bell of Belt, Collins & Associates. The area examined is a 10 acre parcel located adjacent to the existing Kona Village, Kaupulehu, North Kona, Island of Hawaii (see attached Project Location Map). The objective of this inspection was to determine the presence or absence of any archaeological sites of potential significance in the project area.

Field work was conducted May 30, 1986 by PHRI Supervisory Archaeologist Theresa K. Donham and Assistant Field Archaeologist David P. Statler. The area examined consists of an additional c. 7.2 acres to the east of the initial 15 acre Expansion Site, which was examined by PHRI on April 14, 1986 (Rosendahl 1986, PHRI Letter Report 230-041686). The revised additional area surveyed is triangular and measures 576 ft along the south boundary, 640 ft along the north boundary, and 544 ft along the west boundary. The west boundary is adjacent to the eastern boundary of the previously surveyed parcel. The easternmost point of the project area is at the southwestern corner of the existing Kona Village tennis courts. Average elevation of the project area is 20 ft above sea level.

The project area consists of pahoehoe and aa lavas of the historic member of the Hualalai Volcanic Series. These flows are from an 1800-1801 eruption that is commonly referred to as the "1801 Kaupulehu Flow" (Stearns and MacDonald 1946:Plate 1). Olivine basalt pahoehoe covers approximately half of the 10 acre parcel, while the remainder is covered with aa which occurs as steep ridges and incised gulleys. Both lavas are extremely soft and loose. Vegetation is totally absent from the project area.

The project area was subjected to systematic pedestrian coverage, with two persons walking east-west transects at 10.0 to 15.0 m intervals. All depressions, blisters, overhangs, and caves were closely examined for evidence of occupation and open areas were examined for surface features.

Evidence of cave utilization within the project area was observed at two locales, where a single *Callinix* sp. (Opilhi) shell and a plastic tumbler were observed. These sites obviously represent recent, short-term usage of caves. Surface features observed include two areas of recent coral *Straffiti* on pahoehoe and a section of a historic trail previously identified during the April 14 field inspection referred to above.

The trail is discernible as a shallow depression over pahoehoe, and as a leveled, filled path over aa. It has an average width of 0.50 to 1.0 m, and water worn coral pieces of various sizes are located along both sides at intervals of 5.0 to 10.0 m. The trail crosses the northeastern corner of the previously surveyed portion of the Expansion Site and the western portion of the revised project area (see attached Trail Location Map). This trail conforms with Apple's type "A" single-file foot trail (1965:65). It was probably in heaviest usage when residences were located in the area now occupied by Kona Village. It is terminated at the south end by an existing gravel road and the parking lot for resort guests.

In summary, no new archaeological sites were located within the revised portion of the Expansion Site, however, a portion of the previously identified trail was located during pedestrian reconnaissance. The findings of the previous survey were discussed with Dr. Ross Cordy--staff archaeologist in the Hawaii State Preservation Office (April 15, 1986), and with Ms. Virginia Goldstein--staff planner and historic sites specialist in the Hawaii County Planning Department (April 15, 1986). At that time, Ms. Goldstein agreed that continued physical preservation of the trail would not be required; however, accurate locational plotting and limited documentary research was recommended prior to on-site development activities (Rosendahl 1986:2). We further recommended that Kona Village consider the preservation and incorporation of representative sections of the trail into the overall landscape design of the planned resort expansion area as points of historic interest. These recommendations are applicable to the revised Expansion Site, particularly since a larger section of the trail will now be affected by development.

If you have any questions, please feel free to contact us at our Hilo office (808) 969-1763.

Sincerely,



Theresa K. Donham, M.A.  
Supervisory Archaeologist

Attachments: Project Area Location and Trail Location Maps

References Cited

Apple, Russell A.

1965 Trails: From Steppingstones to Kerbstones. Bernice P. Bishop Museum Special Publication 53. Honolulu: Bishop Museum Press.

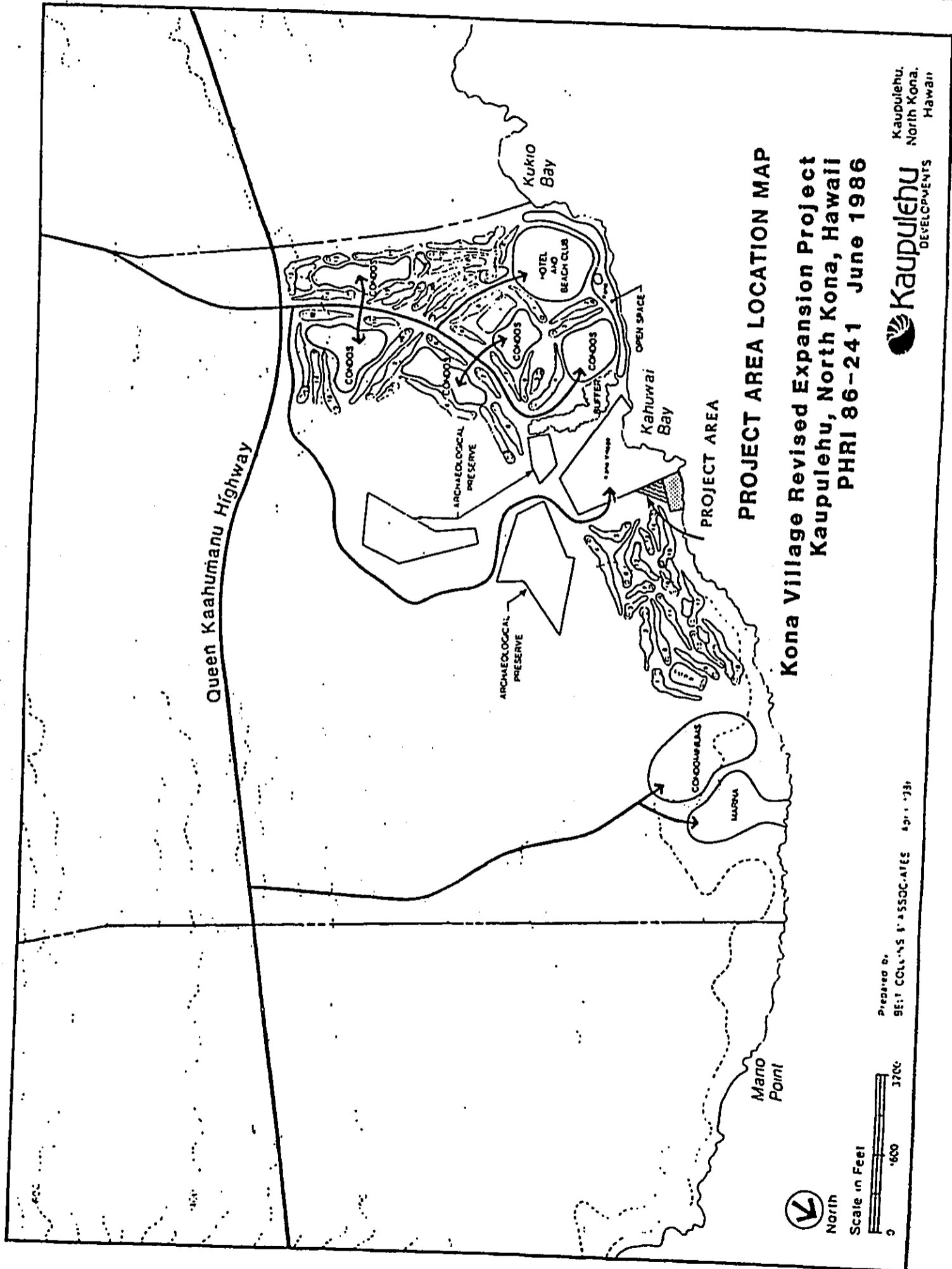
Rosendahl, Margaret L.K.

1986 Archaeological Field Inspection, Kona Village Expansion Site, Land of Kaupulehu, North Kona, Island of Hawaii. PHRI Letter Report 230-041686. Prepared for Belt, Collins & Associates, Honolulu.

Stearns, H. I., and G. A. MacDonald

1946 Geology and Ground-water Resources of the Island of Hawaii. Bulletin 9. Hawaii Division of Hydrography. Honolulu: Advertiser Publishing Co., Ltd.





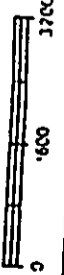
**PROJECT AREA LOCATION MAP**

**Kona Village Revised Expansion Project  
Kaupulehu, North Kona, Hawaii  
PHRI 86-241 June 1986**

**Kaupulehu DEVELOPMENTS**  
Kaupulehu, North Kona, Hawaii

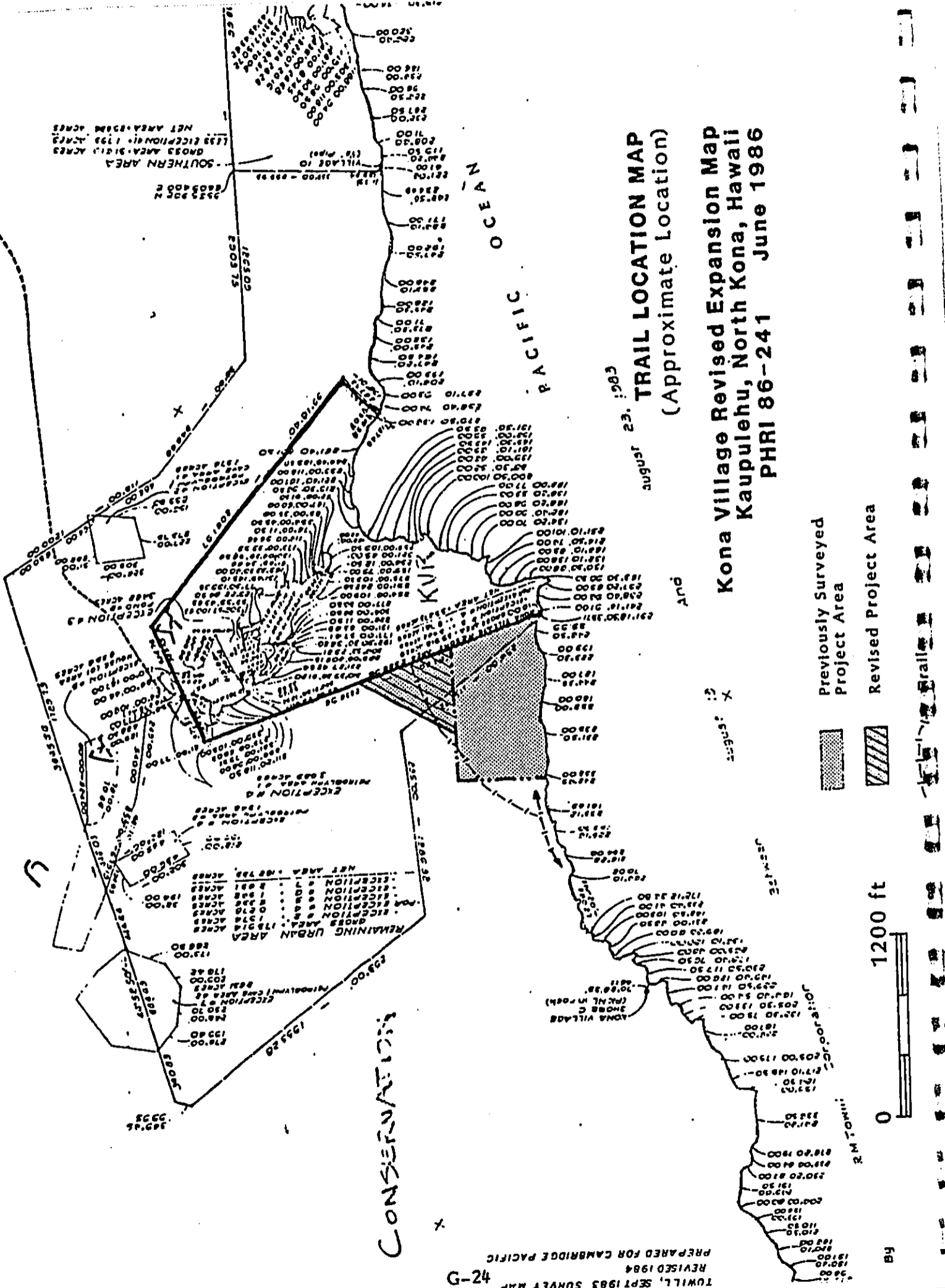


Scale in Feet



Prepared by  
GERT COLLINS ASSOC. AFEE April 1986







TOWILL, SEPT 1983 SURVEY MAP 42-G  
 REVISED 1984  
 PREPARED FOR CAMBRIDGE PACIFIC

CONSERVATION

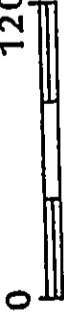
**TRAIL LOCATION MAP**  
 (Approximate Location)

Kona Village Revised Expansion Map  
 Kaupulehu, North Kona, Hawaii  
 PHRI 86-241 June 1986

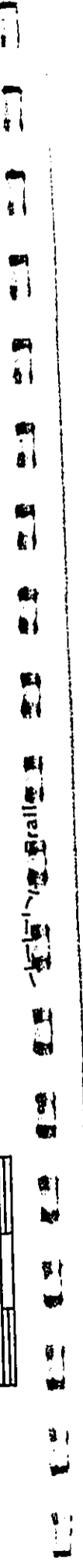
August 23, 1983

-  Previously Surveyed Project Area
-  Revised Project Area

1200 ft



BY





**ENVIRONMENT  
CAPITAL  
MANAGERS  
INC.**

SUITE 805 CITY BANK BUILDING • P. O. BOX 1232 • HONOLULU, HAWAII 96807 • TELEPHONE (808) 537-3007

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**REFERENCES**

**KAUPULEHU RESORT DEVELOPMENT**  
Public Revenue-Cost  
and Economic Impact Analysis

Prepared for:  
Kaupulehu Developments

Date Submitted:  
March 1986

**KAUPULEHU RESORT DEVELOPMENT**  
Public Revenue-Cost  
and Economic Impact Analysis

**SUMMARY AND CONCLUSIONS**

Description of Project

Kaupulehu Developments, Inc., a joint venture of Cambridge Pacific, Inc., and Barmwell Hawaiian Properties, Inc., leased approximately 11,000 acres of land from the Bernice Pauahi Bishop Estate. The land extends from the coastline of the flat coastal plain, across the Queen Kaahumanu Highway, about six miles inland to the Hamalaho Highway.

The proposed project would expand the existing resort activities on the makai property into a self-contained resort/residential community in conformance with the Hawaii County General Plan Intermediate Resort designation for the area.

The project is planned as a low density luxury or super-luxury oceanfront hotel and beach club, beach and golf resort condominiums, and a range of facilities and amenities including two championship golf courses.

Public Revenue-Cost Analysis

For the Kaupulehu project, a revenue-cost ratio of 4.0 to 1.0 was attained. This indicates that an additional \$4.00 in public revenue benefits would accrue to the State of Hawaii and/or the County of Hawaii for every dollar of public cost caused by the proposed development. This would be a definite financial gain to the State and to the County of Hawaii, should this project be implemented. As a standard for comparison, in its civil projects, the U.S. Army Corps of Engineers recommends proceeding with a project if there is unity (1.0 to 1.0) or greater. The summary of the itemized results of the present value analysis is presented in the table that follows.

The cumulative discounted public revenues totalled \$31.2 million in constant 1986 dollars. The cumulative discounted public costs totalled \$7.9 million in constant 1986 dollars.

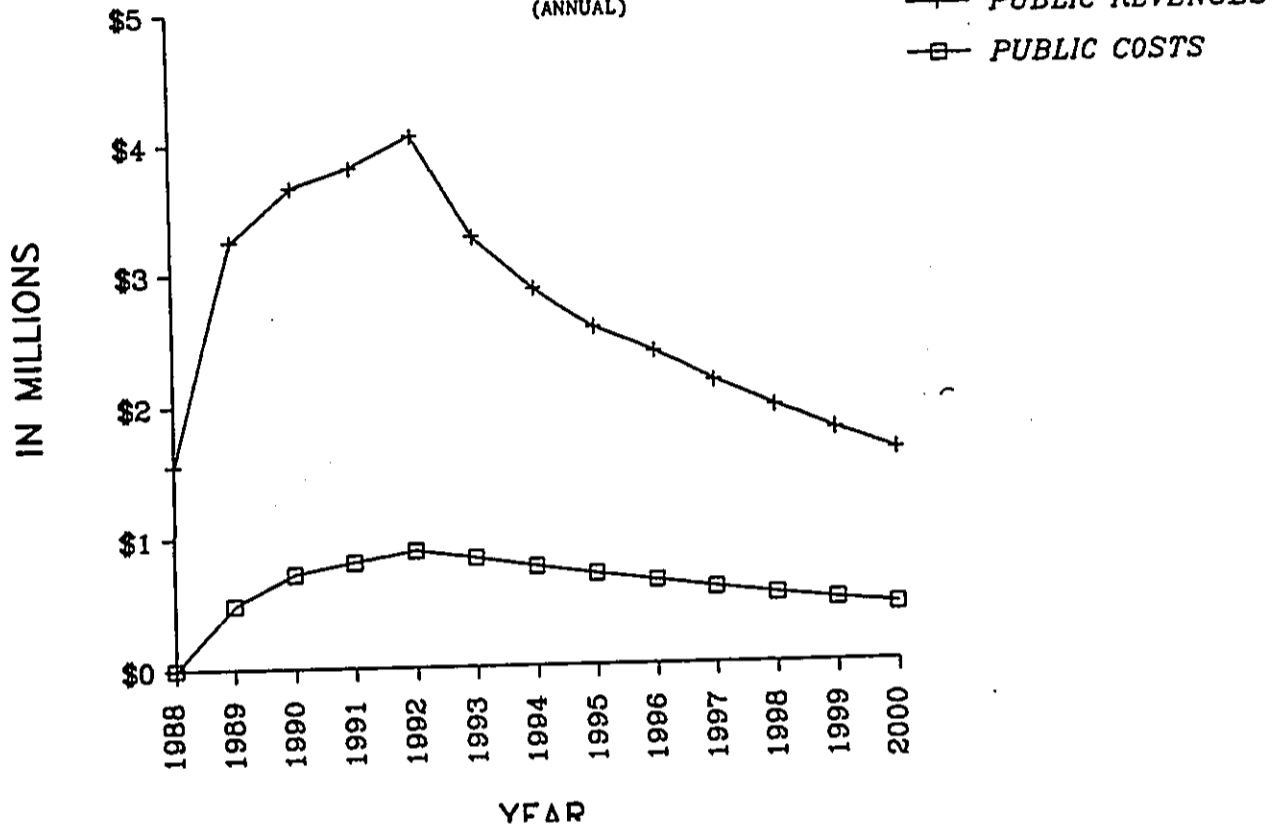
Graphs 1 and 2 illustrate the relationships of both the public revenues and public costs over time. Graph 1 depicts the annual discounted flows of public revenues and public costs, while Graph 2 plots the cumulative discounted values over time.

REVENUE-COST ANALYSIS SUMMARY  
(in 1986 dollars)

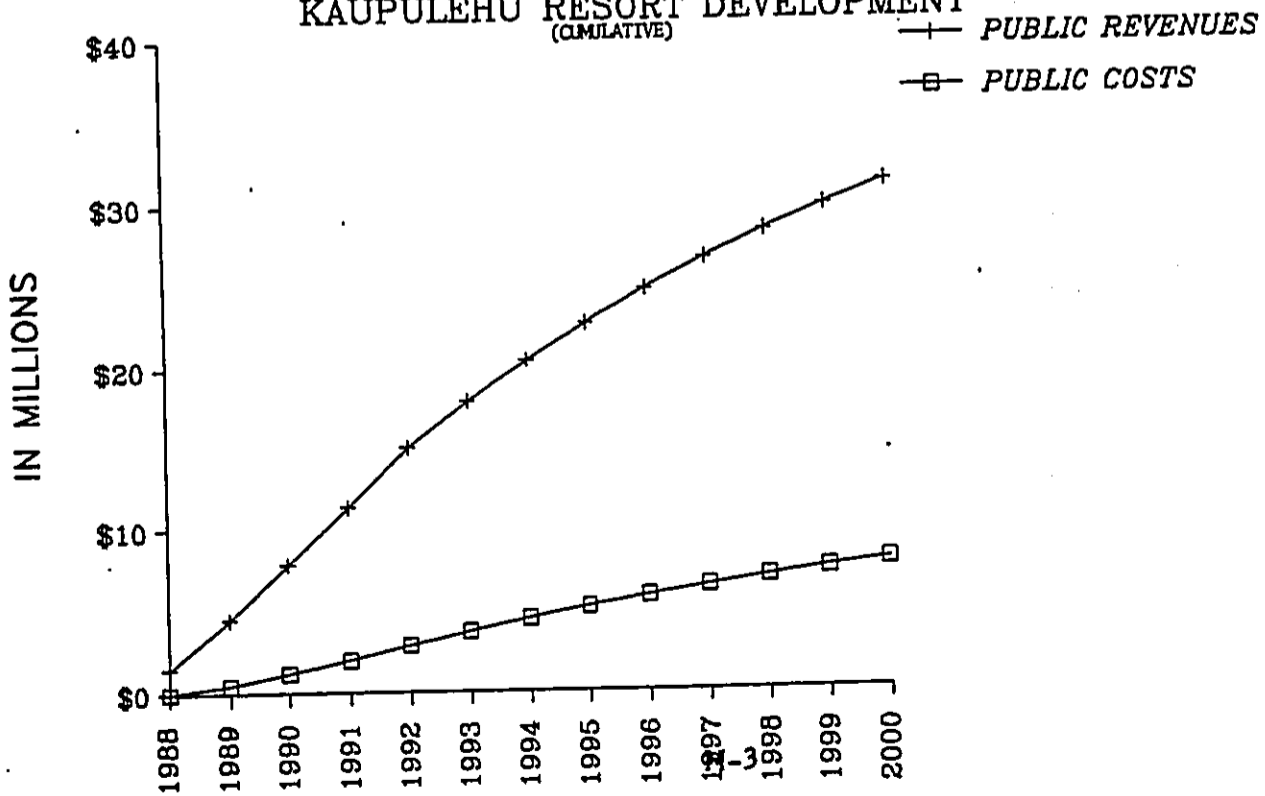
<u>VARIABLE DESCRIPTION</u>	<u>PRESENT VALUE</u>
General Excise Tax/Construction	\$ 7,678,397
General Excise Tax/Hotel & Condo	7,473,077
General Excise Tax/Golf	568,980
General Excise Tax/Personal Consumption	1,645,134
Corporate Income Tax/Condominium Sales	125,275
Corporate Income Tax/Rental & Golf	904,854
Personal Income Tax	2,774,817
Real Property Tax	10,045,660
<b>PUBLIC REVENUES</b>	<b>\$31,216,194</b>
Lower Education	\$ 3,425,586
Higher Education	2,181,925
Health Services	437,900
Mass Transit Service	84,952
Police Service	975,382
Fire Service	754,213
<b>PUBLIC COSTS</b>	<b>\$ 7,859,958</b>
<b>REVENUE - COST RATIO</b>	<b>4.0 to 1.0</b>

Source: Environment Capital Managers, Inc.

GRAPH 1  
**REVENUE-COST ANALYSIS SUMMARY**  
 KAUPULEHU RESORT DEVELOPMENT  
 (ANNUAL)



GRAPH 2  
**REVENUE-COST ANALYSIS SUMMARY**  
 KAUPULEHU RESORT DEVELOPMENT  
 (CUMULATIVE)



PUBLIC REVENUE-COST ANALYSIS

Impact Analysis

Upon full operation, it was estimated that the project would generate an average direct output of \$46.2 million per year, in constant 1986 dollars, from the operation of the hotel, condominium rentals, and the golf courses. It is estimated that the project would generate an average direct income of \$17 million per year in constant 1986 dollars and 1800 direct jobs per year. These results should be viewed as the relative magnitudes that may exist should this project be undertaken. The following summarizes the results:

<u>Impacts</u>	<u>Direct</u>	<u>Indirect</u>	<u>Induced</u>	<u>TOTAL</u>
Output (millions)	\$ 46.2	\$ 20.9	\$ 36.0	\$103.1
Income (millions)	\$ 17.0	\$ 7.7	\$ 14.5	\$ 39.2
Employment (jobs)	1,847	550	1,154	3,511

Source: Environment Capital Managers, Inc.

Introduction

Any economic activity results in certain gains and losses to the economy. In particular, an economic activity provides the public sector with additional sources of revenues and simultaneously, increases the burden on the available public resources. In order to assess the impact of this project, an estimate of the incremental revenues and costs was made, and fully charged to the project in order to calculate the revenue-cost ratio.

The approach employed in conducting the revenue-cost analysis included:

- (1) Identification of the kinds of revenue and cost elements to consider;
- (2) Estimation of the dollar amount that should be associated with each revenue and cost element; and
- (3) Comparison of the discounted present values of the various revenue and cost totals.

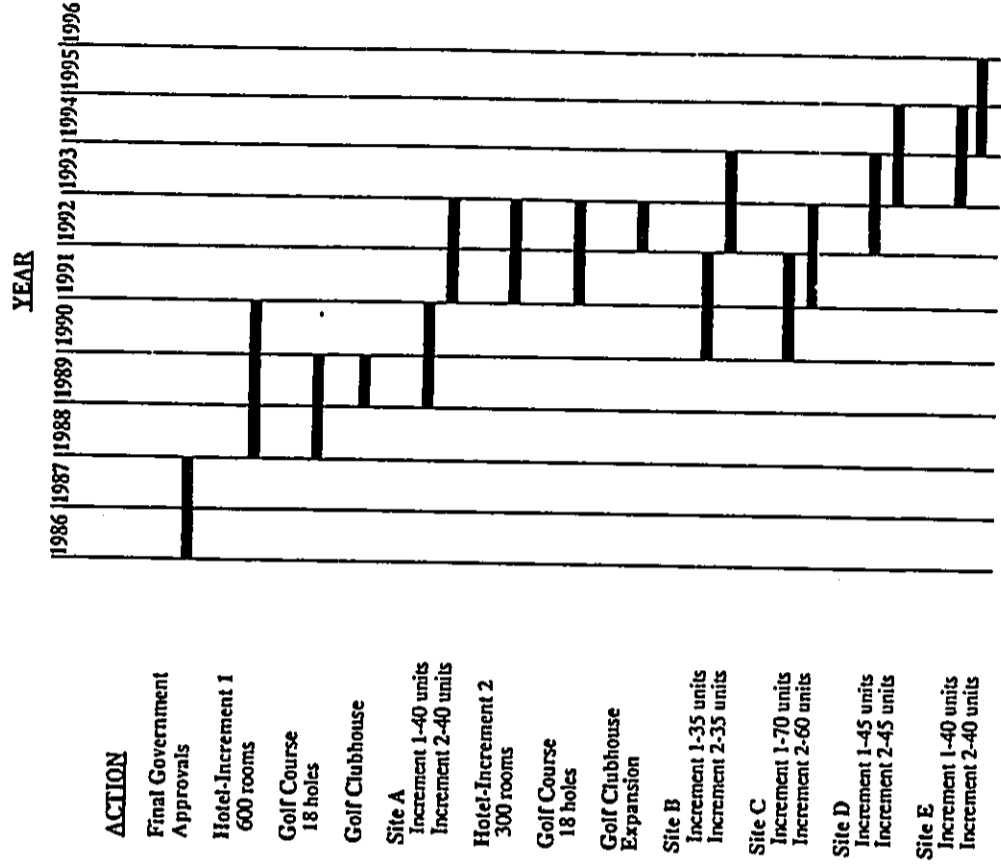
The objective of this analysis was to determine whether the additional government revenues generated as a result of the project would be sufficient to offset the additional costs incurred.

Study Parameters

Study Time Period

Based upon the draft marketing study conducted by Ming Chew Associates for Kaupulehu Development, the start year of the project will be 1988 and the end year will be 2000. For purposes of this study, the base period was set at 1986, to maintain comparability with all other base studies.

TABLE I  
**GENERAL DEVELOPMENT SCHEDULE**



**TOTAL** 900 Hotel Rooms  
450 Condominiums  
1350 Units

SOURCE: Belt, Collins & Associates

Discount Rate  
A 10% discount rate was selected to convert all the revenue and cost flows estimated to occur during this study period into a common value. This rate represents the estimated average rate of return for private investments before taxes and after inflation, as prescribed by the U. S. Office of Management and Budget, under Circular No. A-94, dated March 27, 1972.

Time Schedule  
The timing of the various flows of revenue and costs was based upon the draft marketing study and information provided by Belt, Collins & Associates. It was assumed that the construction phase would begin in 1988, and that operations would commence in the year 1989. (See Chart 1)

For purposes of cash flow timing, multi-year activities, such as the hotel construction, were averaged among those years. The exception to this involved the golf clubhouse construction. Belt, Collins & Associates estimated that 60 percent of the total outlay would be used for the initial year, and the balance in the second year.

Employee Schedule  
The following employment schedule was assumed by Environment Capital Managers, Inc.:

General and Administrative.....	35 employees/year
Hotel.....	1.0 employees/unit
Condominium (rentals).....	0.2 employees/unit
Golf Course.....	40 employees/course

Revenue and Cost variable Selection and Estimation  
For purposes of this study, those financial impacts likely to occur as a result of this project were considered to be relevant variables.

Of these, only those likely to produce a significant impact on public sector revenues and costs were estimated in this study.

Determination of which revenues and costs to consider was made after examination of the financial reports and other data sources of the State of Hawaii and the County of Hawaii. Each category listed was considered to determine whether or not a significant change was likely to occur as a direct result of the project, all other things being equal. Since the activities in the Kaupulehu Project would be new or additional to activities already taking place in the State of Hawaii and the County of Hawaii, if it was determined that a change was likely to occur and likely to produce a significant impact, its incremental amount was then estimated and fully charged to the project in order to calculate the revenue-cost ratio.

The values attached to each of the variables were calculated in a manner closely approximating the actual valuation approach. This was a difficult area in the project, due to the number of unknowns that exists, principally the composition of firms and the nature of their "business" character. The actual application of these calculations can really only be determined on a case by case basis, under actual operating conditions. Because of this, certain assumptions had to be made for this analysis on a generalized basis. This was done after consultation with the respective agencies.

#### Present Value Estimation Procedure

Public revenue and cost estimates for each of the study variables were distributed over time according to the development schedule presented above. Each of these variables were estimated in constant 1986 dollars.

In order to evaluate the "flow" of dollars over time, a method of "compressing" or "reducing" these numbers was needed. Additionally, even without inflation, a dollar 10 years from now will not be worth the same as today. To account for this "time value of money", as well as to "compress" the flow of dollars, "discounting" must be used.

To accomplish this, a standard discounting technique, known as present value analysis, was used. Basically, the value at some time period in the future is "brought back" to a base period, in this case 1986, by use of a "present worth factor". This can be represented mathematically as follows:

$$V_0 = V_t(1 + r)^{-t}$$

where

$V_0$  = value of the variable at time 0 (base year)  
 $V_t$  = value of the variable at time t  
 $r$  = discount rate (time value of money)  
 $t$  = time (year)

Once all of these calculations were completed for each variable, the results for each variable was summed to represent the cumulative effects of the project over time.

The revenue variables were added together as well as the cost variables. Then, the ratio of the total revenues to the total costs is calculated. This ratio is referred to as the "Revenue-Cost Ratio". This ratio of revenues to costs provides a relative measure of the dominance of either revenues or costs to the expected net effect of the project in total. A revenue-cost ratio of 2.0 to 1.0, for example, would imply that for every \$2.00 in public revenues generated by the project, there will be an additional public cost of \$1.00. A revenue-cost of 0.5 to 1.0 on the other hand, would imply that only 50¢ would be gained through public revenues for every dollar of public costs incurred. A ratio of 1.0 to 1.0 would indicate unity or a "breakeven" situation.

In its civil projects, the U.S. Army Corps of Engineers recommends proceeding with a project if there is unity or greater in the calculated revenue-costs ratio.

#### Study Variables

This section details the various variables which this study assessed in detail which would produce financial impacts on public sector revenues and costs. Each of the revenue and cost variables are discussed as to the nature of the variable, the rationale for its inclusion or exclusion, estimation procedure and critical assumptions that were made.

#### Public Revenue Variables

General Excise Tax/Construction. This variable was included to reflect the revenue generation that would occur as a result of the development activities. The legal basis is derived from the Hawaii Revised Statutes, Chapter 237. Under HRS 237-13(3)(8), an outside contractor would be levied a 4% general excise tax. Should the developer wish to self-contract, the same 4% general excise tax assessment would be made under HRS 237-13(3)(D).

General Excise Tax/Hotel & Condominium. The general income derived from the operations of the hotel and transient-use condominiums would be assessed general excise taxes under the Hawaii Revised Statutes, Chapter 237. The following assumption was made for this variable: all rental activity would be assessed the 4% tax, and that no foreign rental activity would occur.

The hotel's average rack rate was assumed to be \$200 per day, based on Ming Chew Associate's Market Analysis Report. However, the effective average rate was assumed to be 75% of the average rack rate. This assumption was made to consider the possible corporate discount rates and other "package" rates which may be used. It was assumed that both the hotel and condominium rental operations would exhibit similar characteristics.

General Excise Tax/Golf. The gross revenues from the operation of the two golf courses would be subject to the 4% general excise tax.

The sources of revenue would be principally from green fees, cart rentals, pro shop sales, and driving range charges.

It was estimated that upon full operation, the estimated gross revenue due to the golf courses, excluding restaurant and concession sales, would be \$3.1 million per year. However, during the extended construction/expansion phases, the annual revenues was estimated between \$1.4 million to \$2.45 million.

General Excise Tax/Personal Consumption. A portion of the wages earned would be spent on various goods and services. This variable was estimated to reflect these expenditures and their addition to the State's general revenue fund.

The employment created by the project would absorb labor from one or more of the following: existing employed labor pool, the unemployed labor pool, or external labor pool. In all cases, the assumption that the wage earnings and consumption expenditures, would be "new" to the economy is valid. This is based on the following: if the employees were hired from the local unemployed labor pool, these individuals would then be put to productive use rather than on unemployment compensation or welfare. On the other hand, if these individuals transferred from an existing job, then the job left would now be vacant for hiring, possibly from the unemployed labor pool.

The average salaries of the employees was assumed to be the following:

General & Administrative.....	\$21,300 per year
Hotel & Condominium.....	13,700 per year
Golf Course.....	15,000 per year

It was further assumed that the average employee would spend 60 percent of their gross salary on consumable goods and services.

Corporate Income Tax/Condominium Sales. The net taxable income derived from the sale of the condominium units would be subject to the corporate income tax under the Hawaii Revised Statutes, Chapter 235. Specifically, the taxable income would be assessed at the rate of 5.85 percent on the first \$25,000 and 6.435 percent thereafter.



It was assumed that the net taxable income would be 2.5 percent of gross sales. It was also assumed that the taxable earnings are independent of the other corporate income-generating activities which may occur. In addition, the calculations does not include the lease rents that would be charged.

Corporate Income Tax/Rental & Golf. This variable included the revenue generated by the hotel, condominium rentals, and the golf course operations. It was further assumed that the average rate of net taxable income to gross revenue would be a constant 7 percent. This is consistent with a letter dated December 13, 1985, from Herbert M. Dias, Director of Taxation, to Belt Collins & Associates, stating that "...the tax revenues resulting from the business of operating a luxury hotel and beach club would be significant. Such income would be subject to...the net income tax...".

The calculated net taxable income was then assessed the appropriate corporate tax rate specified under HRS 235-71(b).

Personal Income Tax. A letter dated December 13, 1985, from Herbert M. Dias, Director of Taxation, to Belt, Collins & Associates, stated that "...[t]he wages of the employees of the organization would be subject to the net income tax imposed on individual taxpayers...".

It was assumed that each employee represented individual households and that each was the sole wage-earner for that household. Furthermore, it was assumed that the average adjusted gross income would be approximately 1.2 times salary & wages, based on the 1983 average for the Third Taxation District.<sup>1</sup> In addition, it was assumed that 63.8 percent of the adjusted gross income would be taxable.<sup>2</sup>

The calculated taxable income was then subjected to the 1985 Hawaii Tax Tables, using "Married filing jointly".

Real Property Tax. The reclassification and rezoning of the property would increase the relative value of the land. In addition,

the improvements would also have value. The components of this variable included the hotel, condominium units, and the golf course.

For the hotel, the improvements was assumed to have a value of \$160,000 per unit and the land to be valued at \$5.00 per square foot.

Each condominium unit was assumed to have a value of \$150 per square foot with its land valued at \$10,000 per unit.

Finally, each of the golf courses was assumed to have improvements valued at \$6.5 million and a land value of approximately \$5,000 per acre.

#### Public Cost Variables

Lower Education. The increase in employment population will increase public education costs in areas such as additional teachers beyond the level currently being planned. Whether the incremental cost will rise proportionately with the additional population is uncertain. However, an average cost allocation to the project was made.

The variable does not include any capital expenditures. This is due to consideration of a letter dated December 13, 1985, from Francis M. Hatanaka, Superintendent, Department of Education, to Belt, Collins & Associates, stating that "[o]ur review of the subject development indicates that no significant enrollment impact is anticipated...School serving the area are Kealahou Elementary-Intermediate, K-8 and Kona High, 9-12."

It was assumed that on the average, each household would have 0.6 persons with students in grades K-12. The average cost per pupil was calculated to be \$1,000 per pupil.

In addition, the adult education and public library components of the Lower Education program was included. It was assumed that 2.3 persons per household would be assessed the average cost of \$19 per person.

Higher Education. The increase in the number of additional households in the area will probably increase the demands on the higher

<sup>1</sup>Hawaii Department of Taxation. Hawaii Income Patterns: Individuals 1983. May 1985

<sup>2</sup>ibid.

**Fire Services.** In a letter dated December 5, 1985, from Francis E. Smith, Fire Chief, it was stated that "...fire protection and rescue services to the area are provided via the Kailua Fire Station located approximately 13 miles distant from the project site. ...Private fire protection may also be provided by the volunteer fire company located on the Kona Village property." Based on this, the addition of this project will not affect the status quo.

However, the employee's homes may require the services of the Fire Department. Thus this variable was included. It was estimated that the average variable cost per household would be \$155.

#### Excluded Variables

Certain variables, such as highway maintenance and utilities, were excluded from this analysis. Although these variables might be affected by the project, they are funded through user fees which are kept solvent. Therefore, the inclusion of these costs, along with the assessed user fees would result in a "wash".

#### Results of the Present Value Analysis

The revenue-cost analysis identified the kinds of revenue and cost elements, estimated the dollars associated with each revenue and cost element, and compared the discounted present value of the various revenue and cost totals.

For the Kaupulehu project, a revenue-cost ratio of 4.0 to 1.0 was attained. This indicates that an additional \$4.00 in public revenue benefits would accrue to the State of Hawaii and/or the County of Hawaii for every dollar of public cost caused by the proposed development. This would be a definite financial gain to the State and to the County of Hawaii, should this project be implemented. As a standard for comparison, in its civil projects, the U.S. Army Corps of Engineers recommends proceeding with a project if there is unity (1.0 to 1.0) or

education services. Although there is no concrete evidence to indicate the proper amount to be charged to the project, major average cost elements for the Hilo Campus of the University of Hawaii was charged to the project.

It was assumed that approximately 4 percent of the additional resident population would attend the University. For this group, the average cost was estimated to be \$3,899 per person.

**Health Services.** This variable included the emergency medical service and Kona Hospital components. In addition, the cost of the contract awarded by the State Department of Health to the Hawaii County Fire Department to provide ambulance service was also included.

The average cost was estimated to be \$20 per person on the basis of the de facto population. This base was selected on the grounds that the "guests" at the hotel and condominiums may also require these services.

**Mass Transit.** Although the resort guests and occupants will most likely rent or will own an automobile, the employees could conceivably use mass transit services for commuting. However, since there is no basis for assuming a ratio of use, the average cost of this variable will be shared by the addition to the de facto population level.

The average variable cost per (de facto) person was estimated to be approximately \$4. This variable included the salary and wage component of the total cost, as well as selected elements such as the Hale-on Bus Services and UHHA Sec. 18 Grant components.

**Police Services.** A letter received by Belt, Collins & Associates, dated December 11, 1985, from Guy A. Paul, Chief of Police, stated that "...we foresee no adverse effect from the requested land use."

Although the project site will probably contract or employ its own security, the employment created through the project will potentially add to the workload for police services within the residential community. Therefore, the variable was included.

It was estimated that the average variable cost per household was \$214. This amount was assessed to the aggregate employee-household.

REVENUE-COST ANALYSIS SUMMARY  
(in 1986 dollars)

<u>VARIABLE DESCRIPTION</u>	<u>PRESENT VALUE</u>
General Excise Tax/Construction	\$ 7,678,397
General Excise Tax/Hotel & Condo	7,473,077
General Excise Tax/Golf	568,980
General Excise Tax/Personal Consumption	1,645,134
Corporate Income Tax/Condo Sales	125,275
Corporate Income Tax/Rental & Golf	904,854
Personal Income Tax	2,774,817
Real Property Tax	<u>10,045,660</u>
<b>PUBLIC REVENUES</b>	<b>\$31,216,193</b>
Lower Education	\$ 3,425,586
Higher Education	2,181,925
Health Services	437,900
Mass Transit Service	84,952
Police Service	975,382
Fire Service	<u>754,213</u>
<b>PUBLIC COSTS</b>	<b>\$ 7,859,958</b>

REVENUE - COST RATIO  
4.0 to 1.0

Source: Environment Capital Managers, Inc.

greater. The summary of the itemized results of the present value analysis is presented in the table that follows.

The cumulative discounted public revenues totalled \$31.2 million in constant 1986 dollars. Of these variables, the combined "general excise tax" variable contributed over \$17.3 million dollars, or over 50 percent of the total. This was followed by the "real property tax" variable.

The cumulative discounted public costs totalled \$7.9 million in constant 1986 dollars. Over \$3.4 million or 40 percent of this amount was accounted for by the "lower education" variable, followed by "higher education", contributing \$2.2 million or 28 percent.

## IMPACT ANALYSIS

### Introduction

As with any economic activity, the injection of dollars into the economy will result in direct impacts through the purchases of various goods and services from the other industries. The additional purchase made will, in turn, cause these industries to purchase more goods and services from other industries. The result is a chain reaction of purchases, or a "multiplier" effect produced by the original increase in purchases.

### The Basic Theory

The simplest way to understand the multiplier effect is to consider what would happen if you were given a "brand new dollar". It is likely that you would spend part of it and save the rest. Let's say you spent 80¢ of that dollar. For simplicity, assume that individuals and businesses were equal entities in their economic behavior. This 80¢ then, was again partially spent with the remainder saved. If this ratio was assumed to remain constant, then 64¢ would be spent and the remaining 16¢ saved, and so on. If this process were to continue until all the money was either spent or saved in this proportion, the "injection" of this additional dollar would ultimately yield \$5.00 in output for our simple economy. In other words, a multiplier effect of 5 had occurred. In essence, then, not only the direct effect of the additional dollar "injected" must be analyzed, but also the indirect effects.

### Hawaii's Input-Output Model

In 1972, the Department of Planning and Economic Development (DPED) published the State's updated Input-Output Model. This model summarized the economic activities of the State at a given moment in time, providing information on the inter-relationships between all sectors

within the economy. Its most useful application was the formulation of output, income and employment multipliers. Type I multipliers provided information on the direct-plus-indirect impacts due to changes in final demand. Type II multipliers, on the other hand, described the direct-plus-indirect-plus-induced effects due to a change in final demand. The major assumption made in using these multipliers was that technology and factor prices remained relatively stable.

### Technical Considerations

The direct output dollars were presumed to be primary or "new" due to the following factors:

1. During the development stages, the capital required to fund such a project will more than likely find its sources outside of the Hawaiian economy.
2. The expected operations of this resort development will find its clientele base largely from the westbound tourist traffic and from westcoast buyers.
3. The non-primary dollars that may flow into this project are likely to be small.

The "hotel" industry was selected for use in this analysis. Although it represents a composite of the entire industry, it is assumed to be adequate for this general analysis. The multipliers used in this analysis was based on the 1977 revised coefficients.<sup>3</sup>

### Detailed Analysis

#### Definitions

There are three effects which are relevant: the direct effects, the indirect effects, and finally, the induced effects. The direct effect is the immediate and primary impact of a given project upon the

<sup>3</sup>Hawaii. Department of Planning and Economic Development. Research and Economic Analysis Division. unpublished estimates

economy. For this project, an example would be the hotel rental fees charged.

The indirect effect, on the other hand, is the secondary impact that would be felt within the economy. It is useful to think about indirect effects in the following manner: in order for the hotels to provide the various services and amenities to their guests, they must purchase various other goods and services such as water, electricity, transportation, etc. The changes that occur in these "support" industries and the employment it creates is the indirect effect.

Finally, the induced effect is the subsequent rounds of changes in the economy which is "time-compressed" into a single value. The "new" income received by the various households employed by the project will trigger increased spending. These increased purchases will deplete existing inventory, and thus, must be restocked by their various suppliers. This in turn, informs the various producers to increase their production through their own increases in orders. The sectors within the economy affected could include supermarkets, theaters, arcades, etc. Also, the effects would be found in the business sectors, influencing increased purchases of supplies and raw materials to provide needed complementary services.

#### Analysis of Impacts

The sections below detail the various types of impacts that are expected to occur throughout the economy, as well as the relevant parameters used to calculate them. These results should be viewed as the relative magnitudes that may exist should this project be undertaken. This is due in part to the inherent assumptions built into the input-output model and other factors such as leakages, factor proportional changes, institutional policy charges, etc. As such, this is not a prediction. In addition, the effects analyzed in this section were made for the point in time when the project would be in full operation.

Output Effects. The impacts here represents the changes that could occur to the Gross State Product, that is, the effect on the total value of the goods and services produced within the State's economy.

Upon full operation, it was estimated that the project would generate an average of \$46.2 million per year, in constant 1986 dollars, from the operation of the hotel, condominium rentals, and the golf courses. The indirect and induced effects were calculated using the following multipliers for the hotel industry:

Indirect..... 0.453  
Induced..... 0.779

Based on the multipliers, the various effects are estimated as follows:

Direct.....\$ 46.2 million  
Indirect..... 20.9 million  
Induced..... 36.0 million  
TOTAL.....\$103.1 million

Income Effects. This impact represents the income changes that could occur to the household sector of the economy. The various effects were calculated using the following multipliers for the hotel industry:

Direct..... 0.369  
Indirect..... 0.167  
Induced..... 0.314

The income effects are calculated using these multipliers with the estimated direct output estimate of \$46.2 million per year. The estimate of direct income will differ from the estimates used in the public revenue-cost analysis section primarily due to: (1) the public revenue-cost estimates were based on a "partial" group of potential employees for the project; (2) the multiplier encompasses the income characteristics of the entire hotel industry, and does not differentiate between individual projects; and (3) the method of estimation will cause discrepancies, all other things being equal.

Based on the above, the estimates of the various income effects were as follows:

Direct.....\$17.0 million  
Indirect..... 7.7 million  
Induced..... 14.5 million  
TOTAL.....\$39.2 million

REFERENCES

Employment Effects. Employment opportunities should be enhanced by this proposed project. For the same reasons provided in the "income effects" section above, the direct employment figures will differ. The multipliers used to estimate these effects are as follows:

Direct.....	0.040
Indirect.....	0.012
Induced.....	0.025

The estimated number of jobs created by the project at full operation is provided below:

Direct.....	1,847 jobs
Indirect.....	550 jobs
Induced.....	1,154 jobs
TOTAL.....	3,511 jobs

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KAUPULEHU RESORT  
April, 1986

J. W. MORROW  
ENVIRONMENTAL MANAGEMENT CONSULTANT  
KAILUA, HAWAII

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## AIR QUALITY IMPACT ANALYSIS

### KAUPULEHU RESORT

#### 1. INTRODUCTION

Kaupulehu Developments is proposing to expand the existing resort on the makai Kaupulehu land into a self-contained intermediate resort/residential community. The development will include a 600-900 room luxury hotel, 400-600 condominium units, and two golf courses. In addition, the existing Kona Village is planning on constructing 50 more units.

The purpose of this report is to assess the impact of the proposed development on air quality both on a local and regional basis. The overall project is clearly an "indirect source" of air pollution as defined in the federal Clean Air Act [1] since its primary association with air pollution is due to its inherent generation of motor vehicle traffic. Thus, such of the focus of this analysis is on the project's ability to generate traffic and the resultant impact on air quality. Air quality impact was evaluated for existing (1986) and future (1995) conditions.

A resort project such as this also has off-site impacts due to increased demand for electrical energy which must be met through the combustion of some type of fuel. This combustion process also results in pollutant emissions to the air which have been addressed.

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated due to

vehicular movement, grading and general dust-generating construction activities. These impacts have also been addressed.

#### 2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 [2, 3]. Note that Hawaii's standards are not divided into primary and secondary standards as are the federal standards.

Hawaii's standards are clearly more stringent than their federal counterparts and are absolute ceiling values not to be exceeded at all. The federal standards allow one violation per year. It should also be noted that the Governor recently signed amendments to Chapter 59 (Ambient Air Quality Standards) making the state's standards for particulate matter and sulfur dioxide the same as national standards including allowance for one exceedance per year.

PRIMARY standards are intended to protect public health with an adequate margin of safety while SECONDARY standards are intended to protect public welfare through the prevention of damage to soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values [4].

In the case of the automotive pollutants [carbon monoxide (CO), oxides of nitrogen (NOx), and photochemical oxidants (Ox)], there are only primary standards. Until 1983, there was also a hydrocarbons standard which was based on the precursor role hydrocarbons play in the formation of photochemical oxidants

rather than any unique toxicological effect they had at ambient levels. The hydrocarbons standard was formally eliminated in January, 1983 [5].

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the federal standards in light of new research findings [6]. The last review resulted in the relaxation of the oxidant standard from 160 to 140 micrograms/cubic meter ( $\mu\text{g}/\text{m}^3$ ) [7]. The carbon monoxide (CO), particulate matter, sulfur dioxide ( $\text{SO}_2$ ), and nitrogen dioxide ( $\text{NO}_2$ ) standards are currently under review, but final action has not been taken yet [8].

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [9]. There simply can be no visible emissions from fugitive dust sources.

### 3. EXISTING AIR QUALITY

While there are no continuous air monitoring stations in the project area, it seems safe to assume that present air quality is good most of the time since there are no large stationary sources in the vicinity, and the area is not highly urbanized so that mobile source activity is not yet a serious problem. The nearest active State Department of Health air monitoring station is located some 60 miles east at Hilo. Recent data from that station are summarized in Table 2.

There was a monitoring station located at Honokaa for a few years which was closed down at the end of 1981. The last year's data

collected at that station are summarized in Table 3.

These data suggest that the State's standards are being met for sulfur dioxide and total suspended particulates. Unfortunately, the two principal automotive pollutants, carbon monoxide and oxides of nitrogen, are not monitored on the Island of Hawaii.  $\text{NO}_2$  was last measured in 1975 and at that time ranged  $<5 - 29 \mu\text{g}/\text{m}^3$  with an average of  $16 \mu\text{g}/\text{m}^3$  in Hilo.

It should be noted, however, that the worst air pollution episodes experienced in Hawaii County are due to the infrequent and unpredictable volcanic eruptions. While volcanic emissions are somewhat variable and have not been fully characterized, it is well known that visibility is affected by the presence of fine particulates resulting directly from volcanic activity as well as secondarily from forest fires caused by lava flows. In addition there are substantial increases in the ambient concentrations of mercury and sulfur dioxide.

Measurements of sulfur dioxide taken during the January, 1983 eruptive phase, for example, indicated 24-hour concentration as high as  $982 \mu\text{g}/\text{m}^3$  at the Volcano Observatory and  $654 \mu\text{g}/\text{m}^3$  in Hilo. Sulfur dioxide and particulate measurements made during January and March, 1983 in Kona and Hilo are presented in Table 4. Despite the volcanic activity, concentrations were relatively low on the few days that measurements were made. This was also true of the  $\text{SO}_2$  data collected as part of the normal routine monitoring in Hilo during 1983 (Table 2). The low levels may be explained by the infrequent monitoring and variable wind directions.

Analysis of the airborne particulate matter during the eruption revealed some rather interesting results as unusually high concentrations of selenium, arsenic, indium, gold, and sulfur were found along with strikingly high concentrations of iridium [10].

#### 4. CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The project area is typical of Hawaii's climate with little seasonal or diurnal temperature variation. Monthly temperature averages vary by only about 6 degrees from the warmest months (July and August) to the coolest (January and February) [11]. Table 5 provides historical temperature data.

An 18-year rainfall record also indicates that the area is rather dry with an annual average of only 10.65 inches. Monthly means range from 2.63 inches in January to 0.14 inch in July. Table 5 also includes a summary of this precipitation data.

4.2 Surface Winds. Raw data collected at the Mauna Kea Beach Hotel in 1967 have been previously reduced to produce an annual wind rose [12]. The period of data collection ran from March through December, 1967, and totaled 3,785 hours. The annual wind rose is presented in tabular form in Table 6 and graphical form in Figure 1.

The data clearly indicate an east-west dichotomy. Closer examination of the raw data reveals the fact that the ESE-ENE winds generally occur during night, early morning and evening

hours while the WNW-W winds predominate during the daytime hours.

This suggests a strong land-seabreeze regime which apparently dominates air movement in the area. To demonstrate this more clearly, windroses were prepared for 8 a.m. and 2 p.m. These are displayed in Tables 7 and 8 and Figures 2 and 3.

#### 5. HIGHWAYS AND TRAFFIC

The principal highway serving the area is the Queen Ka'ahumanu Highway which connects Kailua-Kona some 11 miles to the south with the Kawaihae-Hailea Highway about 13 miles to the north. These are both two-lane rural highways with capacities of about 2,000 vehicles per hour. The Queen Ka'ahumanu Highway is designed with a 24-foot pavement width. In the project area, a new access road to the Queen Ka'ahumanu Highway will be constructed.

Existing and projected peak-hour traffic data used in this analysis were provided by Belt, Collins and Associates [13], and are based on traffic counts along Queen Ka'ahumanu Highway and traffic generation factors for the proposed hotel and condominium units. The average daily traffic (ADT) values were computed based on historical PM peak/ADT ratios on Queen Ka'ahumanu Highway and the hotel access road.

#### 6. LONG-TERM IMPACT

6.1 Emission Factors. Automotive emission factors for carbon monoxide (CO), oxides of nitrogen (NOx), and nonmethane

hydrocarbons (MMHC) were generated for calendar years 1986 through 1995 using the Mobile Source Emissions Model (MOBILE-2) [14]. To localize emission factors as much as possible, the August, 1983 age distribution for the City & County of Honolulu [15] was input in lieu of the national statistics normally used.

6.2 Microscale Analysis. Analyses such as this generally involve estimation of concentrations of non-reactive pollutants. This is due to the complexity of modeling pollutants which undergo chemical reactions in the atmosphere and are subject to the effects of numerous physical and chemical factors which affect reaction rates and products. For projects involving motor vehicles as the principal air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (about 1 month) [16], and it comprises the largest fraction of automotive emissions.

In this instance, microscale screening analyses were performed for the Kaupulehu access road intersection with Queen Ka'ahumanu Highway. The EPA computer model PAL [17] was employed with an array of receptors spaced at 10 meter intervals around the intersection. Since a review of the traffic data indicated that the peak traffic hours tended to be during the afternoon, worst case meteorological conditions were selected accordingly. A wind speed of 1 meter per second, an acute wind/road angle, and neutral stability (Pasquill-Gifford Class "D") [18], were all selected to maximize concentration estimates in the vicinity of the intersections. Had peak traffic occurred in the early morning hours (6:00 - 8:00 a.m.), a more stable (P-G Class "F") would have been input. In this case, the resort community is not typified by that early morning work trip.

One-hour carbon monoxide (CO) concentrations were computed for 1986 and 1995. The results of these computations are depicted in Figures 4, 5, 6, and 7.

6.3 Mesoscale Analysis. A mesoscale or regional impact analysis based on annual emissions was performed as another means of evaluating the impact of the proposed project. Using the aforementioned emission factors and traffic projections, it was possible to estimate future annual emissions of the principal pollutants associated with this project. The results of this analysis are depicted in Figures 8 and 9, and may be compared with the 1980 emissions inventory for the Island of Hawaii (Table 9).

The estimated 37 million kilowatt hours of annual electrical demand by the ultimate development will necessitate the generation of electricity by power plants. Currently, Big Island electricity is generated primarily by the burning of high sulfur fuel oil, diesel oil, and bagasse, with a small amount also coming from the HGP-A geothermal plant. With the exception of the geothermal plant which emits primarily hydrogen sulfide, all of these result in the emission of various quantities of sulfur oxides, nitrogen oxides, particulates, and hydrocarbons. Coal has also recently been introduced to Hawaii for use in sugar mills during the off-season to replace more expensive oil. This too will result in emissions of the aforementioned major pollutants. And the Hilo Electric Light Company (HELCO) has

that is brought in may well have a silt content greater than the 30% cited above. This in conjunction with the relatively dry local climate (P/E Index = 12), suggests a potential for even greater fugitive dust emissions.

## 8. DISCUSSION AND CONCLUSIONS

**8.1 Microscale Analysis.** The 1-hour concentration estimates at the Kaupulehu Access Road - Queen Ka'ahumanu Highway intersection indicated compliance with federal and state 1-hour standards under both current and projected traffic conditions.

Compliance with the federal and state 8-hour standards can also be inferred from these 1-hour concentration estimates. By applying a "persistence" factor of 0.6 to the maximum 1-hour concentration (7.0 mg/m<sup>3</sup>) one can generate a maximum 8-hour estimate (4.2 mg/m<sup>3</sup>). This "persistence" factor is recommended in an EPA publication on indirect source analysis [21] and was further corroborated by analysis of carbon monoxide monitoring data in Honolulu which indicates the same 8-hour to 1-hour ratio [22].

**8.2 Mesoscale Analysis.** The mesoscale analysis results suggest, not surprisingly, that the traffic generated by the proposed development will result in a net increase in emissions of all three major automotive pollutants in the project area.

Since the federal motor vehicle emission control program depends on new cars with lower emissions gradually replacing older, more polluting vehicles, the reason for rising emissions is that the increase in traffic volumes exceeds the decrease in per vehicle

recently signed an agreement with Thermal Power Company [19] to provide 25 megawatts of power by about 1993. By the time Kaupulehu Resort reaches its full development, it is uncertain how the electrical supply market will be divided among the various types of power plants. There will, however, certainly be additional air pollutant emissions external to the Kaupulehu site but attributable to it because of its increased electrical demand.

## 7. SHORT-TERM IMPACT

The principal sources of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along Queen Ka'ahumanu Highway as well as in the vicinity of the project site itself. Because of the relatively low existing traffic volumes, the additional construction vehicle traffic should not exceed road capacities although the presence of large trucks can reduce a roadway's capacity as well as lower average travel speeds.

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and a precipitation/evaporation (P/E) index of 50 [20].

Although there is little or no soil on the project site, the soil

emissions. The difference between pollutants is due to the different standards and compliance dates for each thereby resulting in different rates of improvement. In this particular case, a rise in emissions is not surprising since a rather substantial increase in traffic volume is projected to occur in an area which is presently almost pristine. When compared to the 1980 county emissions inventory, the projected increases range from about 0.7% for non-methane hydrocarbons to about 1.7% for nitrogen oxides.

8.3 Short-Term Impact. Since as noted in Section 7, there is a significant potential for fugitive dust due to the dry climate and fine soils, it will be very important for adequate dust control measures to be employed during the construction period. There will be existing occupied units downwind of construction areas, and particularly during the drier, windier summer months fugitive dust could be the source of complaints not to mention possible violations of the state or federal standards.

Dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. Dust barriers near existing dwellings might be considered if problems arise from wind-driven dust. The soonest possible landscaping of completed areas will also help.

8.4 Conclusions. Based on the foregoing analysis, the following conclusions may be drawn:

- o The proposed project will result in increased air pollutant emissions due to its inherent traffic generation ability and its requirement for electrical power.
- o Traffic generated emissions of carbon monoxide, nitrogen oxides, and hydrocarbons will increase by 1.7% or less as compared to the county's 1980 pollutant inventory.
- o Ambient levels of carbon monoxide in the vicinity of the Kaupulehu Access Road - Queen Ka'ahumanu Highway intersection are projected to meet both state and federal ambient air quality standards through 1995.
- o Due to the dry climate and fine soils in the area, dust control measures during construction will be important to prevent violations of state fugitive dust standards.

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TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS		STATE STANDARDS
		PRIMARY	SECONDARY	
1. Total Suspended Particulate Matter (TSP) (micrograms per cubic meter)	Annual Geometric Mean	75	60	60
	Maximum Average in Any 24 Hours	260	150	150
2. Sulfur Dioxide (SO2) (micrograms per cubic meter)	Annual Arithmetic Mean	80	--	80
	Maximum Average in Any 24 Hours	365	--	365
3. Nitrogen Dioxide (NO2) (micrograms per cubic meter)	Maximum Average in Any 3 Hours	1,300	1,300	1,300
	Annual Arithmetic Mean	100		70
4. Carbon Monoxide (CO) (milligrams per cubic meter)	Maximum Average in Any 8 Hours	10		5
	Maximum Average in Any 1 Hour	40		10
5. Photochemical Oxidants (as O3) (micrograms per cubic meter)	Maximum Average in Any 1 Hour	240		100
	Maximum Average in Any Calendar Quarter	1.5		1.5

SOURCES: State of Hawaii, Title 11, Chapter 59, Air Quality Standards Title 40, Code of Federal Regulations, Part 50

TABLE 2

AIR MONITORING DATA HILO, HAWAII 1984

MONTH	Total Suspended Particulates (TSP) 24-Hour Concentrations (ug/m3)			Sulfur Dioxide (SO2) 24-Hour Concentrations (ug/m3)		
	SAMPLES	MIN.	MAX.	SAMPLES	MIN.	MAX.
Jan 84	6	9	17	6	7	0
Feb 84	3	10	15	2	0	0
Mar 84	4	12	20	2	0	0
Apr 84	4	13	24	2	0	6
May 84	5	9	23	5	0	5
Jun 84	5	12	24	4	0	0
Jul 84	5	11	20	5	0	0
Aug 84	4	10	17	5	0	7
Sep 84	4	7	14	5	0	0
Oct 84	5	10	20	5	0	0
Nov 84	5	9	27	5	0	0
Dec 84	5	11	23	4	0	5
ANNUAL	55	7	27	50	0	7

SOURCES: Department of Health



TABLE 3

AIR MONITORING DATA  
HONOLULU, HAWAII  
1981

Total Suspended Particulates (TSP)				
24-Hour Concentration (ug/m3)				
MONTH	SAMPLES	MINIMUM	MAXIMUM	MEAN
Jan 81	2	13	33	23
Feb 81	5	12	40	25
Mar 81	2	24	24	24
Apr 81	4	20	25	21
May 81	5	18	33	26
Jun 81	5	26	49	39
Jul 81	5	27	66	39
Aug 81	4	14	28	22
Sep 81	5	13	29	20
Oct 81	6	14	19	16
Nov 81	5	12	25	18
Dec 81	4	14	24	17
ANNUAL	52	12	66	24

SOURCE: Department of Health

TABLE 4

SPECIAL AIR MONITORING DATA  
KONA & HILO, HAWAII  
1983

Date	24-Hour Concentrations (ug/m3)			
	Kona		Hilo	
	SO2	TSP	SO2	TSP
08 Jan 83	---	---	654.7	22.6
09 Jan 83	---	---	447.7	30.6
12 Jan 83	27.0	23.4	0.6	6.9
14 Jan 83	12.0	22.2	---	---
19 Jan 83	---	---	12.2	17.6
20 Jan 83	18.9	---	---	---
04 Mar 83	4.4	39.1	32.9	53.6
05 Mar 83	0	28.4	---	30.1
07 Mar 83	---	---	0.6	37.0
08 Mar 83	0	11.9	0.6	27.5
10 Mar 83	0	12.8	21.3	38.5
11 Mar 83	---	---	0	28.2

Notes: SO2= sulfur dioxide  
TSP= total suspended particulates

SOURCE: Department of Health

TABLE 5

TEMPERATURE & RAINFALL DATA  
PUAKO, HAWAII

MONTH	TEMPERATURE (deg F)	RAINFALL (in)
Jan	73.10	2.63
Feb	72.90	1.50
Mar	73.80	0.67
Apr	76.70	0.83
May	77.00	0.69
Jun	78.30	0.45
Jul	78.30	0.14
Aug	79.10	0.41
Sep	77.70	0.39
Oct	77.30	0.54
Nov	75.40	0.74
Dec	73.80	1.66
Mean:	76.12	10.65

- NOTES: 1. Temperature data based on a 1974 summary of the National Oceanographic and Atmospheric Administration (NOAA)(Reference 10).  
2. Rainfall data based on the 1966-83 period.

TABLE 6

10-MONTH WIND ROSE  
MAUNA KEA BEACH HOTEL  
MARCH - DECEMBER, 1967

DIRECTION	Wind Speed (mph)							All Speeds
	<1 - 2	3 - 7	8 - 18	19 - 24	>24			
N	0.0005	0.0008	0.0000	0.0000	0.0000	0.0000	0.0013	
NNE	0.0082	0.0092	0.0008	0.0000	0.0000	0.0000	0.0182	
NE	0.0034	0.0209	0.0003	0.0000	0.0000	0.0000	0.0246	
ENE	0.0362	0.0671	0.0367	0.0085	0.0000	0.0000	0.1485	
E	0.0042	0.0040	0.0005	0.0000	0.0000	0.0000	0.0087	
ESE	0.0412	0.0948	0.1052	0.0196	0.0000	0.0000	0.2608	
SE	0.0048	0.0320	0.0092	0.0000	0.0000	0.0000	0.0460	
SSE	0.0079	0.0048	0.0040	0.0000	0.0000	0.0000	0.0167	
S	0.0040	0.0021	0.0000	0.0000	0.0000	0.0000	0.0061	
SSW	0.0008	0.0021	0.0003	0.0000	0.0000	0.0000	0.0032	
SW	0.0003	0.0011	0.0003	0.0000	0.0000	0.0000	0.0017	
WSW	0.0016	0.0050	0.0003	0.0000	0.0000	0.0000	0.0069	
W	0.0098	0.0235	0.0045	0.0000	0.0000	0.0000	0.0378	
WNW	0.0476	0.2201	0.0962	0.0000	0.0000	0.0000	0.3639	
WV	0.0011	0.0029	0.0000	0.0000	0.0000	0.0000	0.0040	
WNW	0.0135	0.0132	0.0008	0.0000	0.0000	0.0000	0.0275	
All Directions:	0.1851	0.5036	0.2591	0.0281	0.0000	0.0000	0.9759	
Calms:	0.0241							

SOURCE: U.S. Army  
Corps of Engineers  
Pacific Ocean Division

TABLE 7

8:00 A.M. WIND ROSE  
 MAUNA KEA BEACH HOTEL  
 MARCH - DECEMBER, 1967

DIRECTION	Wind Speed (mph)					All Speeds
	<1 - 2	3 - 7	8 - 18	19 - 24	>24	
N	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NNE	0.0637	0.0127	0.0000	0.0000	0.0000	0.0764
NE	0.0191	0.0000	0.0000	0.0000	0.0000	0.0191
ENE	0.1465	0.0573	0.0382	0.0000	0.0000	0.2420
E	0.0064	0.0000	0.0064	0.0000	0.0000	0.0128
ESE	0.1146	0.1019	0.1338	0.0510	0.0000	0.4013
SE	0.0064	0.0000	0.0000	0.0000	0.0000	0.0064
SSE	0.0127	0.0000	0.0127	0.0000	0.0000	0.0254
S	0.0000	0.0064	0.0000	0.0000	0.0000	0.0064
SSW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WSW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
W	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WNW	0.0828	0.0064	0.0000	0.0000	0.0000	0.0892
W	0.0064	0.0000	0.0000	0.0000	0.0000	0.0064
WNW	0.0510	0.0000	0.0000	0.0000	0.0000	0.0510
All Directions:	0.5096	0.1847	0.1911	0.0510	0.0000	0.9364

Calms: 0.0636

SOURCE: U.S. Army  
 Corps of Engineers  
 Pacific Ocean Division

TABLE 8

2:00 P.M. WIND ROSE  
 MAUNA KEA BEACH HOTEL  
 MARCH - DECEMBER, 1967

DIRECTION	Wind Speed (mph)					All Speeds
	<1 - 2	3 - 7	8 - 18	19 - 24	>24	
N	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NNE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ENE	0.0000	0.0000	0.0120	0.0060	0.0120	0.0300
E	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ESE	0.0000	0.0000	0.0060	0.0060	0.0000	0.0120
SE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SSE	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SSW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
WSW	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
W	0.0000	0.0060	0.0000	0.0000	0.0000	0.0060
WNW	0.0361	0.4759	0.4217	0.0000	0.0000	0.9337
W	0.0000	0.0060	0.0000	0.0000	0.0000	0.0060
WNW	0.0060	0.0060	0.0000	0.0000	0.0000	0.0120
All Directions:	0.0421	0.4939	0.4397	0.0120	0.0120	0.9997

SOURCE: U.S. Army  
 Corps of Engineers  
 Pacific Ocean Division

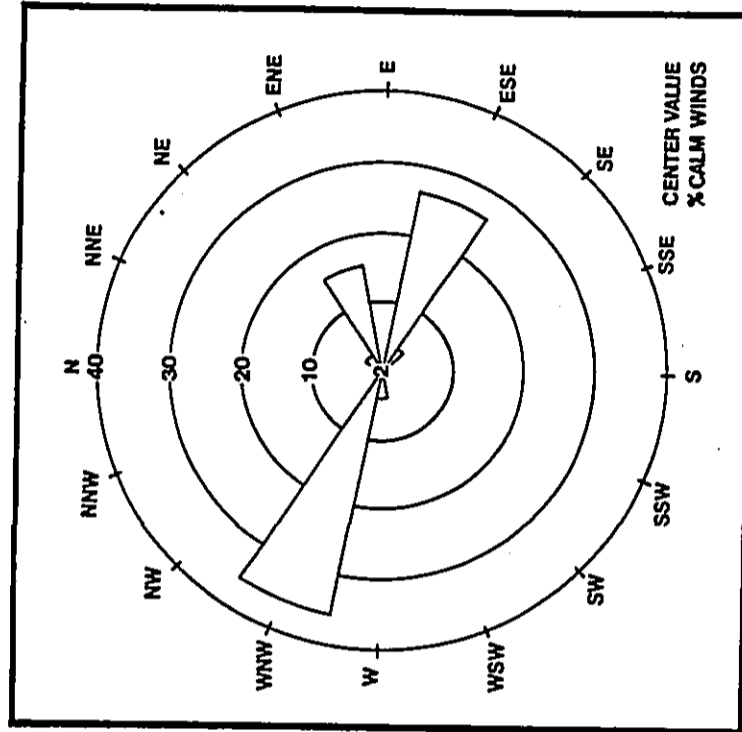
TABLE 9

EMISSIONS INVENTORY  
COUNTY OF HAWAII  
1980

SOURCE CATEGORY	EMISSIONS (Tons/Year)				
	TSP	SOx	NOx	CO	HC
Steam Electric Power Plants	262.9	3232.9	1308.9	65.9	21.8
Gas Utilities	0.0	0.0	11.5	0.0	0.0
Fuel Combustion in Agricultural Industry	2251.7	995.8	798.0	0.0	7.3
Refinery Industry	0.0	0.0	0.0	0.0	0.0
Petroleum Storage	0.0	0.0	0.0	0.0	391.9
Metallurgical Industries	0.0	0.0	0.0	0.0	0.0
Mineral Products Industry	1080.1	13.6	11.5	0.0	0.0
Municipal Incineration	0.0	0.0	0.0	0.0	0.0
Motor Vehicles	262.9	177.3	3088.5	42177.3	4035.4
Construction, Farm and Industrial Vehicles	40.0	31.8	453.5	1515.7	152.4
Aircraft	5.7	4.5	45.9	1449.8	174.2
Vessels	11.4	90.9	63.2	65.9	29.0
Agricultural Field Burning	1800.2	0.0	0.0	20627.3	2445.9
<b>TOTAL IN TONS PER YEAR:</b>	<b>5715</b>	<b>4547</b>	<b>5741</b>	<b>65902</b>	<b>7258</b>

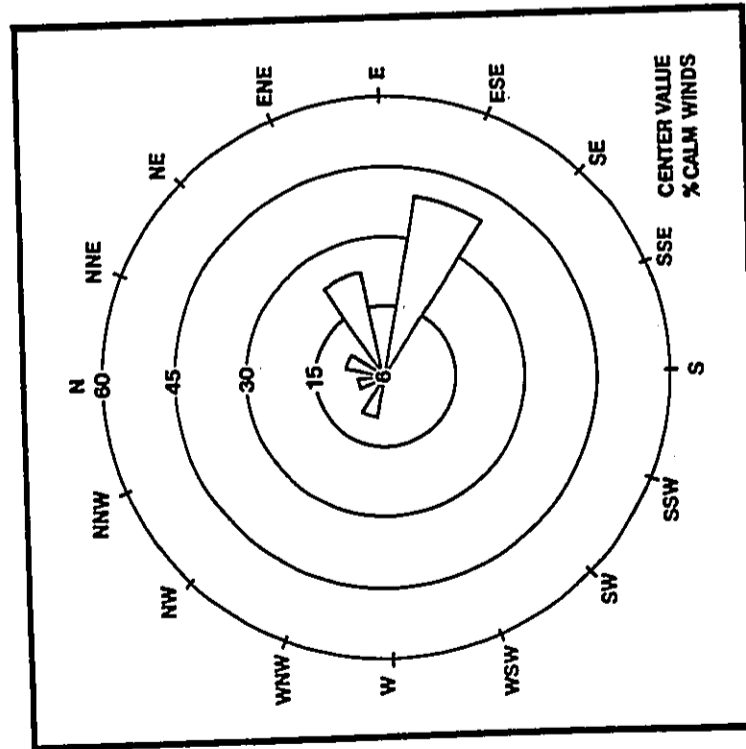
SOURCE: State of Hawaii  
Department of Health

FIGURE 1  
FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT  
MAUNA KEA BEACH HOTEL  
MARCH-DECEMBER, 1967



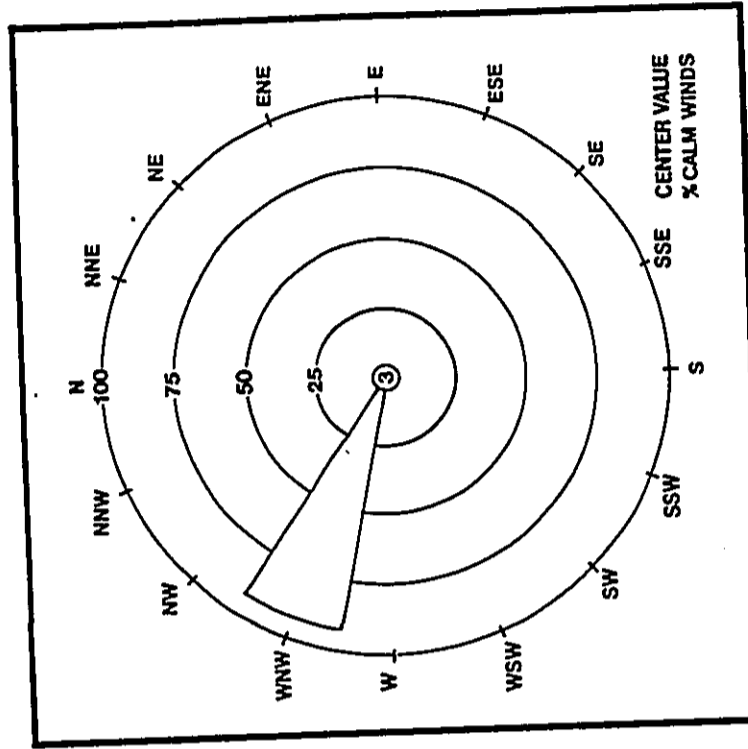
SOURCE: U.S. ARMY  
CORPS OF ENGINEERS  
1967

FIGURE 2  
 FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT  
 MAUNA KEA BEACH HOTEL  
 8:00 A.M.



SOURCE: U.S. ARMY  
 CORPS OF ENGINEERS  
 1967

FIGURE 3  
 FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT  
 MAUNA KEA BEACH HOTEL  
 2:00 P.M.



SOURCE: U.S. ARMY  
 CORPS OF ENGINEERS  
 1967

FIGURE 4

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS  
IN THE VICINITY OF THE PROPOSED KAUFULERU ACCESS ROAD  
AND QUEEN KAAHUNANU HIGHWAY  
P.M. PEAK TRAFFIC HOUR  
EXISTING CONDITIONS (1986)



0.2	0.1	0.1	0.0	0.0	0.0	0.0
0.4	0.4	0.3	0.2	0.1	0.1	0.1
1.0	1.0	0.9	0.7	0.6	0.5	0.5

QUEEN KAAHUNANU HIGHWAY

- NOTES:
1. CO concentrations in milligrams/cubic meter.
  2. Receptor spacing is 10 meters.
  3. Wind direction = 100 degrees (true)
  4. Wind speed = 1 m/sec
  5. Stability Category = "D" (neutral)

FIGURE 5

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS  
IN THE VICINITY OF THE PROPOSED KAUFULERU ACCESS ROAD  
AND QUEEN KAAHUNANU HIGHWAY  
P.M. PEAK TRAFFIC HOUR  
EXISTING CONDITIONS (1986)



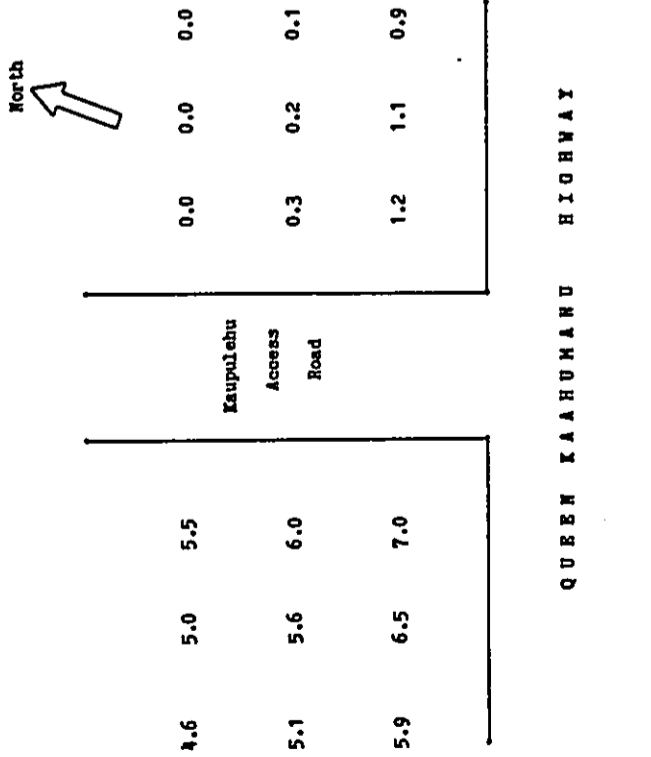
1.0	1.0	0.9	0.7	0.6	0.5
0.5	0.4	0.3	0.2	0.1	0.1
0.2	0.1	0.1	0.0	0.0	0.0

QUEEN KAAHUNANU HIGHWAY

- NOTES:
1. CO concentrations in milligrams/cubic meter.
  2. Receptor spacing is 10 meters.
  3. Wind direction = 80 degrees (true)
  4. Wind speed = 1 m/sec
  5. Stability Category = "D" (neutral)

FIGURE 6

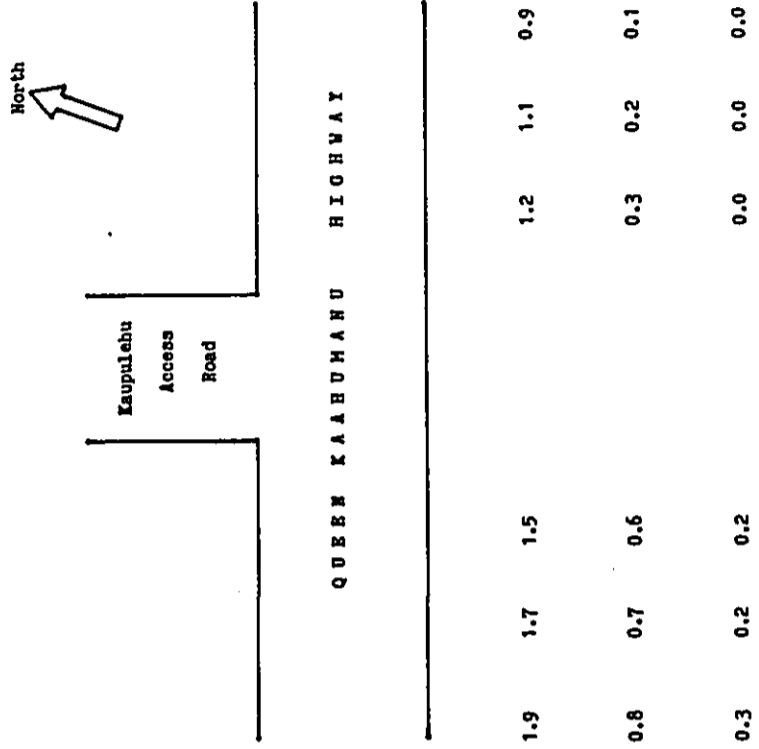
MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS  
KAUPULEHU ACCESS ROAD AND QUEEN KAAHUMANU HIGHWAY  
P.M. PEAK TRAFFIC HOUR  
FUTURE CONDITIONS (1995)



NOTES: 1. CO concentrations in milligrams/cubic meter.  
2. Receptor spacing is 10 meters.  
3. Wind direction = 100 degrees (true)  
4. Wind speed = 1 m/sec  
5. Stability Category = "D" (neutral)

FIGURE 7

MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS  
KAUPULEHU ACCESS ROAD AND QUEEN KAAHUMANU HIGHWAY  
P.M. PEAK TRAFFIC HOUR  
FUTURE CONDITIONS (1995)



NOTES: 1. CO concentrations in milligrams/cubic meter.  
2. Receptor spacing is 10 meters.  
3. Wind direction = 80 degrees (true)  
4. Wind speed = 1 m/sec  
5. Stability Category = "D" (neutral)

FIGURE 8  
ESTIMATES OF MOTOR VEHICLE EMISSIONS  
CARBON MONOXIDE  
1986 - 1995

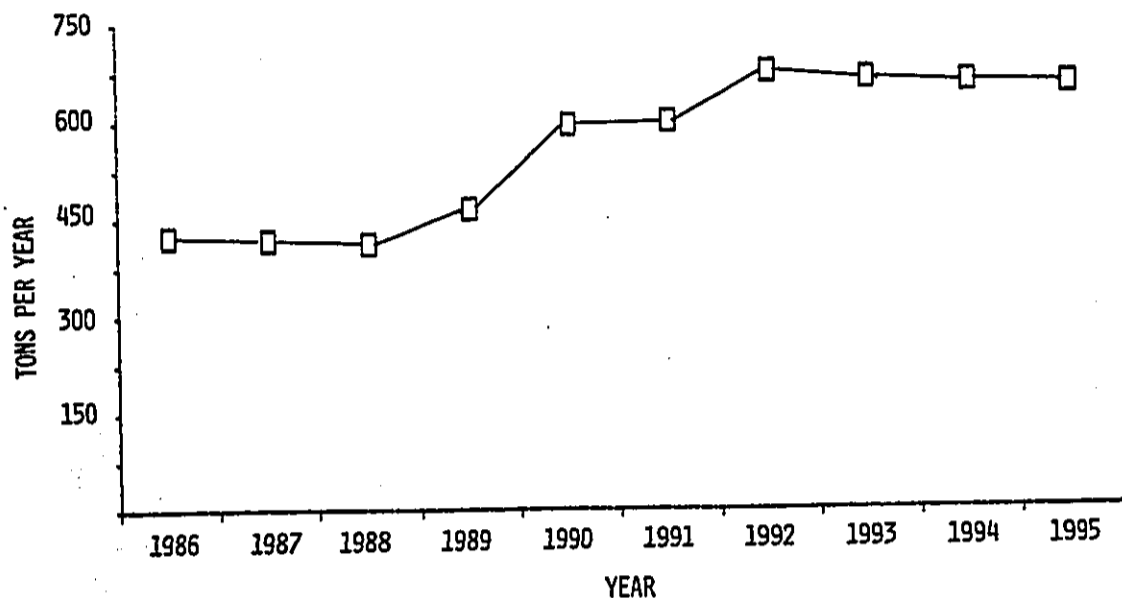


FIGURE 9  
ESTIMATES OF MOTOR VEHICLE EMISSIONS  
NITROGEN OXIDES & HYDROCARBONS  
1986 - 1995

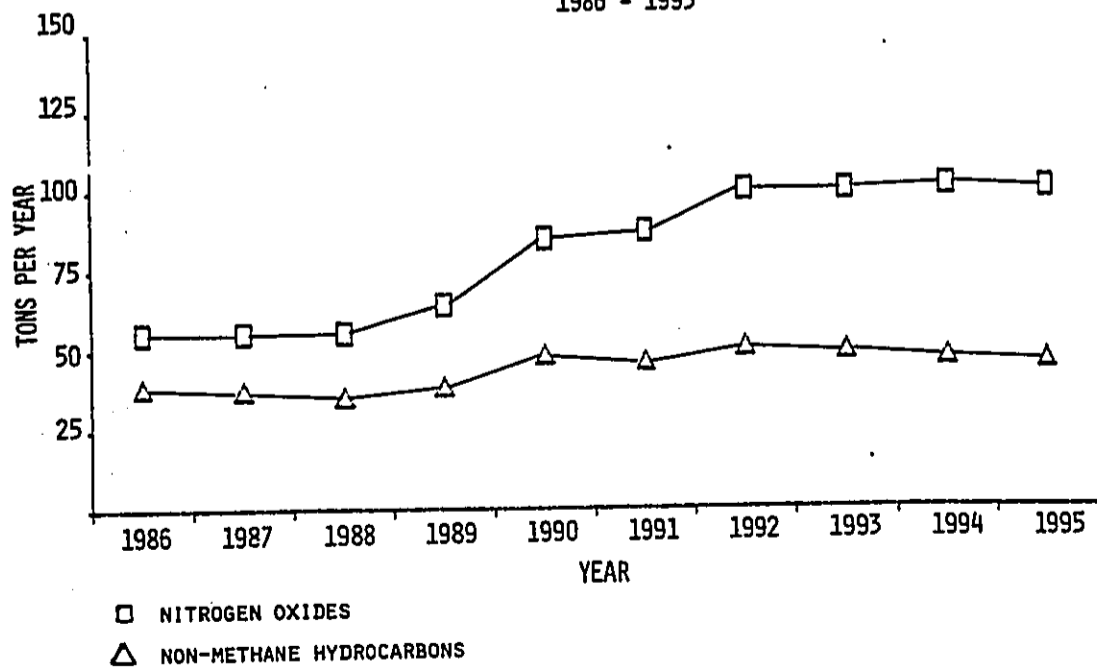




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NOISE STUDY FOR  
RESORT DEVELOPMENT  
KAUPULEHU, NORTH KONA, HAWAII

PREPARED FOR  
KAUPULEHU DEVELOPMENTS

BY  
Y. EBISU & ASSOCIATES

APRIL, 1986

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## I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed resort at Kaupulehu were evaluated for their potential impact on future residents and visitors. The future traffic noise levels on Queen Ka'ahumanu Highway and on internal roadways of the resort were calculated for the entire development period, under a worst case, 100 percent occupancy assumption. Significant increases in traffic noise (as much as 4.8 Ldn) are predicted to occur between now and the period of full development in 1995. Approximately 38 percent of this predicted increase is associated with project traffic, and 62 percent is associated with non-project traffic growth. Because the existing highway noise levels are moderate and the lands bordering the highway in the project environs are currently vacant, increases in traffic noise of 4.8 Ldn are manageable.

Additional development and expansion of the neighboring Kona Village Resort is also planned during the Kaupulehu Development period. For the purposes of this study, the additional traffic (approximately 28 trips during the PM peak hour) associated with the planned Kona Village Resort expansion has been combined with the project traffic associated with the Kaupulehu Development, and the total considered to be project related traffic.

Future traffic noise impacts will be minimized by the use of buffer zones of adequate depth along Queen Ka'ahumanu Highway, and along the internal roadways of the proposed resort. The proposed Development Plan incorporates 250 to 600 FT wide setbacks of noise sensitive areas from Queen Ka'ahumanu Highway and from the internal roadways within the development area. A 700 FT wide buffer zone is included from the proposed internal roadways to the neighboring Kona Village Resort. For these reasons traffic noise impacts attributable to the proposal are not anticipated.

The site of the proposed Kaupulehu Resort is sufficiently removed from major noise sources and urban areas such that background ambient noise is in the "Minimal Exposure, Unconditionally

Acceptable" category, with minimal risks of adverse noise impacts from noise sources external to the project. The most significant adverse noise impacts are expected to occur during the construction period. Because noise from construction activities are predicted to be audible at long distances of 500 to 2,000 FT, the quality of the acoustic environment at the proposed resort and at the neighboring Kona Village Resort may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. For this reason, advisories of the construction activities should be provided to prospective resort visitors.

## II. PURPOSE AND METHODOLOGY

The objectives of this study were to describe the existing and future noise environment in the vicinity of the proposed resort development at Kaupulehu, North Kona, Hawaii. Traffic noise level increases and impacts associated with the proposal were to be determined within the resort as well as along Queen Ka'ahumanu Highway. A specific objective was to determine setback requirements of proposed residential and resort units for minimizing future noise impacts from the projected volumes of project and non-project traffic. Assessments of future noise impacts from aircraft operating at Keahole Airport, and from construction activities at the resort were also included in the noise study objectives.

Traffic noise predictions were performed using the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 1). Traffic data and forecasts used in the noise prediction model were obtained from the traffic study for the project (Reference 2). Project traffic volumes used were those generated under the worst case assumption of 100 percent hotel and condominium unit occupancy factor. Historical traffic counts obtained by the State Department of Transportation at stations north and south of the project on Queen Ka'ahumanu Highway (References 3 and 4) were used to develop the relationship between hourly (Leq) and daily (Ldn) traffic noise levels.

Existing traffic noise measurements along Queen Ka'ahumanu Highway were made in May, 1985 to calibrate the FHWA Noise Prediction Model and to refine predictions of future traffic noise levels. These existing traffic noise measurements were also used to describe the Base Year ambient noise levels along roadways in the project environs. For the purposes of the noise study, 1984 was used as the Project Base Year, with changes in the ambient noise levels between 1984 and 1986 believed to be insignificant. Calibration of the FHWA Noise Prediction Model was performed by measuring traffic noise levels at 50, 100, and 300 FT

distances from Queen Ka'ahumanu Highway, and by adjusting the model's source noise level assumptions for autos, medium trucks, and heavy trucks/buses. Single event (Lmax and Lse) noise levels associated with the above vehicle categories were also obtained in the field, since past measurements in 1984 at the Mauna Kea Beach Resort suggested that traffic source levels may be diminishing. Measurements at 50 FT distance from the centerline of the entrance road to Mauna Lani Resort were also made to calibrate the model for the lower speed, internal roadway condition.

Background ambient noise measurements at the existing Kona Village Resort were also made in November, 1985 to determine existing ambient noise levels at large setback distances from the highway, and to estimate future background noise levels in the proposed resort.

For the Base Year (existing) and future years to the ultimate project development (estimated at the year 1995), traffic noise vs. distance tables were developed to numerically depict the increases in traffic noise along internal and external roadways. Setback distances from the roadways' centerlines to the 65 and 55 Ldn iso-noise contour lines were also calculated and presented in table format.

Because the existing traffic noise levels are relatively low (with narrow traffic noise contours), only the 55 Ldn traffic noise contour was developed for the existing condition along Queen Ka'ahumanu Highway. For the future condition in the Year 1995, traffic noise contours were also constructed using the FHWA traffic noise model. Inputs to the noise model included: future traffic volumes, vehicle mix, and speeds; highway as-built plans and elevation profile; and locations and elevations of natural obstructions (cuts, mounds, etc.) along the highway. Receptor elevation was assumed to be 5 FT above existing ground level at the highway Right-of-Way, and was reduced at a rate of 2.5 FT per 50 FT increase in horizontal distance from the highway. Because the final grading plans for the project site along the highway were not available, the future noise contours developed apply for

### III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE

#### COMPATIBILITY

the case where the existing topography is not significantly altered. The addition of berms or other obstructions between the highway and the project development would tend to reduce the size of the future traffic noise contours developed.

Traffic noise impact zones, defined by the 55 Ldn contours for the year 1995, were developed along Queen Ke'ahumanu Highway and along the internal roadways of the project. For existing and planned noise sensitive developments within traffic noise impact zones, possible noise mitigation measures are described. These measures included the use of minimum setback distances, and the use of sound attenuating berms to reduce future traffic noise.

Two noise descriptors currently used to relate traffic noise levels to land use compatibility, and to assess environmental noise in general, are the Equivalent Noise Level (Leq) and the Day-Night Average Sound Level (Ldn). Both of these descriptors are averages of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. In traffic noise evaluations, the averaging period for the Leq descriptor is usually an hour, and more specifically, the peak hour of traffic. In all evaluations, the minimum averaging period for the Ldn descriptor is 24 hours (by definition). Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the Ldn descriptor. A more complete list of noise descriptors is provided in APPENDIX B of this report.

TABLE 1, derived from Reference 5, presents current federal standards and acceptability criteria for residential land uses exposed to various levels of environmental noise. FIGURE 1, extracted from Reference 6, presents suggested land use compatibility guidelines for residential and nonresidential land uses. As a general rule, noise levels of 55 Ldn or less occur in rural areas, or urbanized areas which are shielded from high volume streets. Noise levels typical of communities on Oahu are shown in FIGURE 2. In urbanized areas, Ldn levels generally range from 55 to 65 Ldn, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 Ldn, and as high as 72 Ldn when the roadway is a high speed freeway. Due to noise shielding effects from intervening structures, residences which are located within interior lots are exposed to lower noise levels of 55 Ldn or less. For the purposes of determining noise acceptability for funding assistance from federal agencies (PHA/HUD and VA), an exterior noise level of 65 Ldn or lower is considered acceptable.

TABLE 1  
EXTERIOR NOISE EXPOSURE CLASSIFICATION  
(RESIDENTIAL LAND USE)

Noise Exposure Class	Day-Night Sound Level	Equivalent Sound Level	Federal Standard (1)
Minimal Exposure	Not Exceeding 55 Ldn	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 Ldn But Not Above 65 Ldn	Above 55 Leq But Not Above 65 Leq	Acceptable (2)
Significant Exposure	Above 65 Ldn But Not Above 75 Ldn	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 Ldn	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours.

Source: Reference 5.

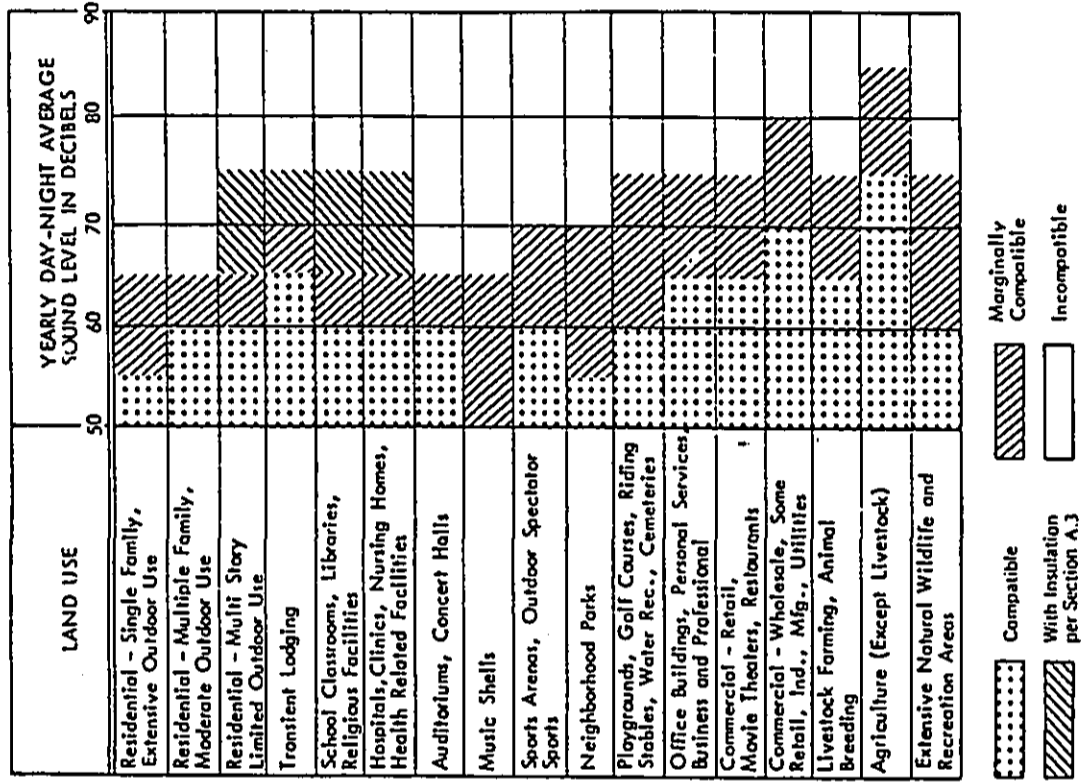
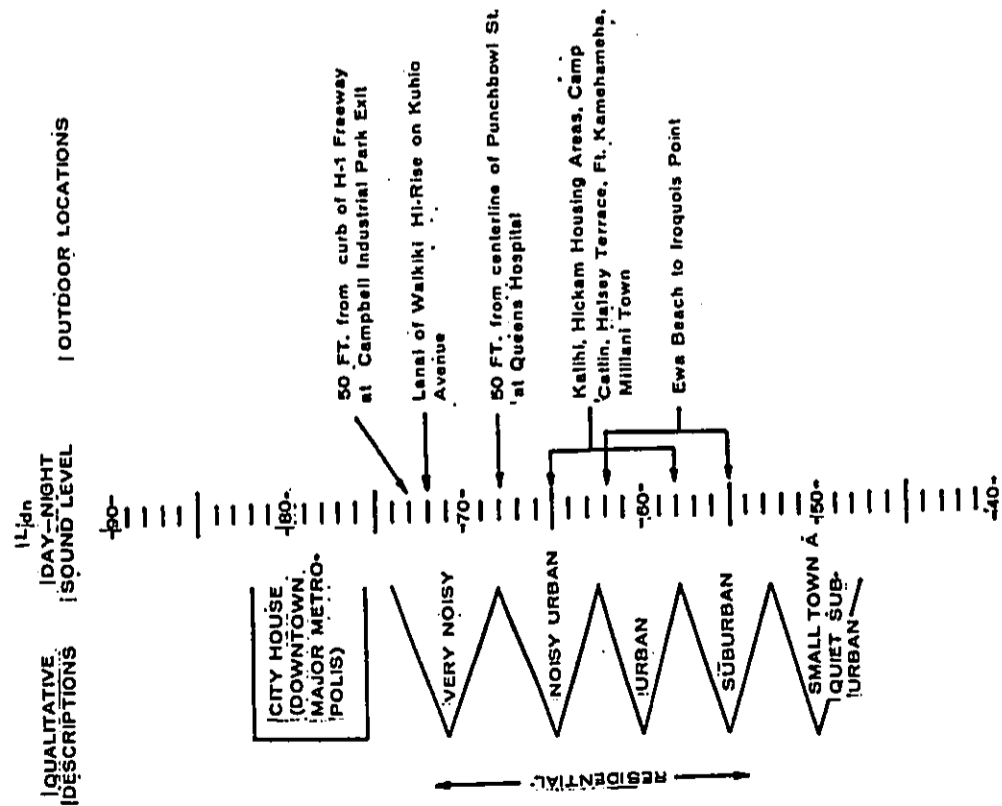


FIG. 1. Land use compatibility with yearly day-night average sound level at a site for buildings as commonly constructed. [For information only; not a part of American National Standard for Sound Level Descriptors for Determination of Compatible Land Use S1.23-1980.]

FIGURE 2  
RANGE OF EXTERIOR BACKGROUND AMBIENT NOISE LEVELS



This standard is applied nationally (see Reference 7), including Hawaii. Because of our open living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior to interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 Ldn does not eliminate all risks of noise impacts. For these reasons, and as recommended in Reference 8, a lower level of 55 Ldn is considered as the "Unconditionally Acceptable" (or "Near Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 Ldn, government agencies such as FHA/HUD and VA have selected 65 Ldn as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 Ldn are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 Ldn.

For the purposes of this study, the level of 55 Ldn was used to define the noise impact zones along the sides of a roadway, and to define the maximum acceptable level of background ambient noise. This lower level was considered appropriate due to the resort character of the project and due to the relatively low ambient noise levels in the area. Also, at an exterior noise level of 55 Ldn, the noise attenuation characteristics of typical naturally ventilated dwellings produce acceptable noise levels within the dwellings (approximately 45 Ldn).

IV. EXISTING NOISE ENVIRONMENT

A. Traffic Noise. The existing noise environment along Queen Ka'ahumanu Highway in the area of the proposed resort is controlled by vehicular traffic. Noise levels are in the "Minimal Exposure, Unconditionally Acceptable" category, with traffic noise below 55 Ldn at 100 FT or greater setback distances from the highway's centerline.

The results of the May, 1985 traffic noise measurements are summarized in TABLE 2. Locations 1 and 2 were on flat terrain in the vicinity of the Puako Beach Road intersection and the existing pumping station. Locations 3 and 4 were makai of the highway, and in the Kona Village Resort area. Location 5 was along the Mauna Lani Resort's entrance road between the highway and Kaniku Drive. Measured traffic noise levels were 5 to 7 dB lower than FHWA model source levels, which was consistent with 1984 traffic noise measurements previously obtained in the Mauna Kea Resort area. Therefore, the model source levels were reduced to obtain the best fit between the "Measured" and "Predicted" Leq's of TABLE 2 at all measurement locations. Minimum background ambient noise at Locations 3 and 4 ranged from 27 to 30 dB. The reason for these low minimum noise levels was the lack of natural noise caused by winds acting upon foliage and the absence of birds.

The reason for the lower traffic noise levels in the project area is believed to be related to the higher percentage of late model street vehicles, and the lower percentage of off road vehicles and older vehicles. Although no detailed classification counts by car type were made, the newer street vehicles (as rented to tourists) did not produce audible tire hum (as characteristic of off road tires) or engine exhaust noise (as characteristic of poor mufflers). Therefore, it is likely that the lower traffic noise levels measured are indicative of an ongoing reduction in vehicular source levels, which should spread as older vehicles are replaced within the resident

TABLE 2  
MAY 3-4, 1985 NOISE MEASUREMENT RESULTS

Location	Time of Day (HRS)	Ave. Speed (MPH)	Equivalent Hourly Traffic Volume—Auto, Heavy Truck	Measured Leq (dB)	Predicted Leq (dB)*
1. 50 FT from centerline of Q.K. Highway at Puako Beach Road intersection.	1245 to 1405	50	224	58.0	61.6
2. 300 FT from centerline of Q.K. Highway at Puako Beach Road intersection.	1405 to 1440	50	208	44.0	44.8
3. 50 FT from centerline of Q.K. Highway at entrance to Kona Village Resort.	1720 to 1742	50	299	60.9	62.0
4. 100 FT from centerline of Q.K. Highway at entrance to Kona Village Resort.	1748 to 1832	50	262	52.5	52.6
5. 50 FT from centerline of Mauna Lani Resort's entrance road.	1112 to 1209	35	116	52.5	52.6

\* Adjusted for local traffic conditions as explained in report text.



IV. EXISTING NOISE ENVIRONMENT

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TABLE 2  
MAY 3-4, 1985 NOISE MEASUREMENT RESULTS

Location	Time of Day (HRS)	Ave. Speed (MPH)	Equivalent Traffic Volume			Measured Leq (dB)	Predicted Leq (dB)*
			Auto	Med.Truck	Heavy Truck		
1. 50 FT from centerline of Q.K. Highway at Puako Beach Road intersection.	1245 to 1354	50	224	2	8	58.0	61.6
2. 300 FT from centerline of Q.K. Highway at Puako Beach Road intersection.	1405 to 1440	50	208	12	8	44.0	44.8
3. 50 FT from centerline of Q.K. Highway at entrance road to Kona Village Resort.	1720 to 1742	50	299	0	8	60.9	62.0
4. 100 FT from centerline of Q.K. Highway at entrance road to Kona Village Resort.	1748 to 1832	50	262	0	4	52.5	52.6
5. 50 FT from centerline of Mauna Lani Resort's entrance road.	1112 to 1209	35	116	2	2	52.5	52.6

\* Adjusted for local traffic conditions as explained in report text.

population.

Results of calculations of existing PM peak hour traffic noise levels at 50 FT distance from the centerline of Queen Ka'ahumanu Highway north and south of the proposed resort at Kaupulehu are shown in TABLE 3. Calculated setback distances to the existing 65 Ldn and 55 Ldn contours are shown in TABLE 4. FIGURES 3 and 4 depict the existing Ldn vs. distance curves for Queen Ka'ahumanu Highway north and south of the proposed resort at Kaupulehu. The traffic noise levels shown in the tables and figures only apply when unobstructed line of sight conditions exist to the roadways. These conditions would generally occur at short (50 to 100 FT) distances to a roadway, within any flat, open space along the roadway, and at distant, but elevated locations above the roadway. The existing traffic noise levels shown in the tables and figures should be reduced by 3 to 5 dB if partial shielding (line of sight obstruction) exists between the roadway and receptor location. If the receptor location is behind an obstruction (berm or hill), the noise levels in the tables and figures should be reduced by 5 to 10 dB. FIGURE 5 depicts the calculated location of the existing 55 Ldn traffic noise contour, which was superimposed on the proposed resort development plan.

B. Other Background Noise. In areas removed from Queen Ka'ahumanu Highway, existing ambient noise levels are controlled by wind and foliage, surf, birds, and/or intermittent flyby events of helicopters and aircraft. At the adjacent Kona Village Resort, measured background ambient noise levels ranged from 44 to 50 dBA, and were controlled by wind, foliage, and birds. At 100 FT from the edge of the surf, measured ambient noise levels ranged from 50 to 65 dBA for 1 to 3 FT waves. Helicopter and light aircraft flyby events (no overflights observed) ranged from 55 to 70 dBA. Distant jet aircraft noise (probably from aircraft operating to/from Keahole Airport) ranged from 45 to 55 dBA. Estimated background ambient noise levels in the populated areas of the Kona Village resort probably range from 50 to 55 Ldn. In the nov

TABLE 3  
COMPARISONS OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS IN PROJECT ENVIRONS

LOCATION	SPRND (MPH)	VPH	** HOURLY LEQ IN DB @ 50' ***	AUTO	MT	HT	ALL VEH
Q. Ka'ahumanu Hwy.(North)	50	336	59.5	54.7	59.1	63.0	63.1
Q. Ka'ahumanu Hwy.(South)	50	346	59.6	54.8	59.2	63.1	63.1
Q. Ka'ahumanu Hwy.(North)	50	1,007	64.3	59.5	63.9	67.8	67.8
Q. Ka'ahumanu Hwy.(South)	50	1,021	64.3	59.5	63.9	67.8	67.8
Resort Entrance Rd. @ Hwy	35	770	57.3	50.8	56.6	60.0	60.0
Resort Roadway @ R & C	35	687	56.8	50.3	56.1	60.0	60.0
Resort Roadway @ Hotel	25	495	49.8	43.9	51.1	54.0	54.0

YEAR 1995 PM PEAK HOUR TRAFFIC (100% Occupancy):

LEQ(1995) - 4.8  
LEQ(EXIST) - 4.7

Note: Assumed traffic mix of 95% autos, 2.5% medium trucks, and 2.5% heavy vehicles on Q.K. Hwy., and 97% autos, 1.5% medium trucks, and 1.5% heavy vehicles on internal streets.

population.

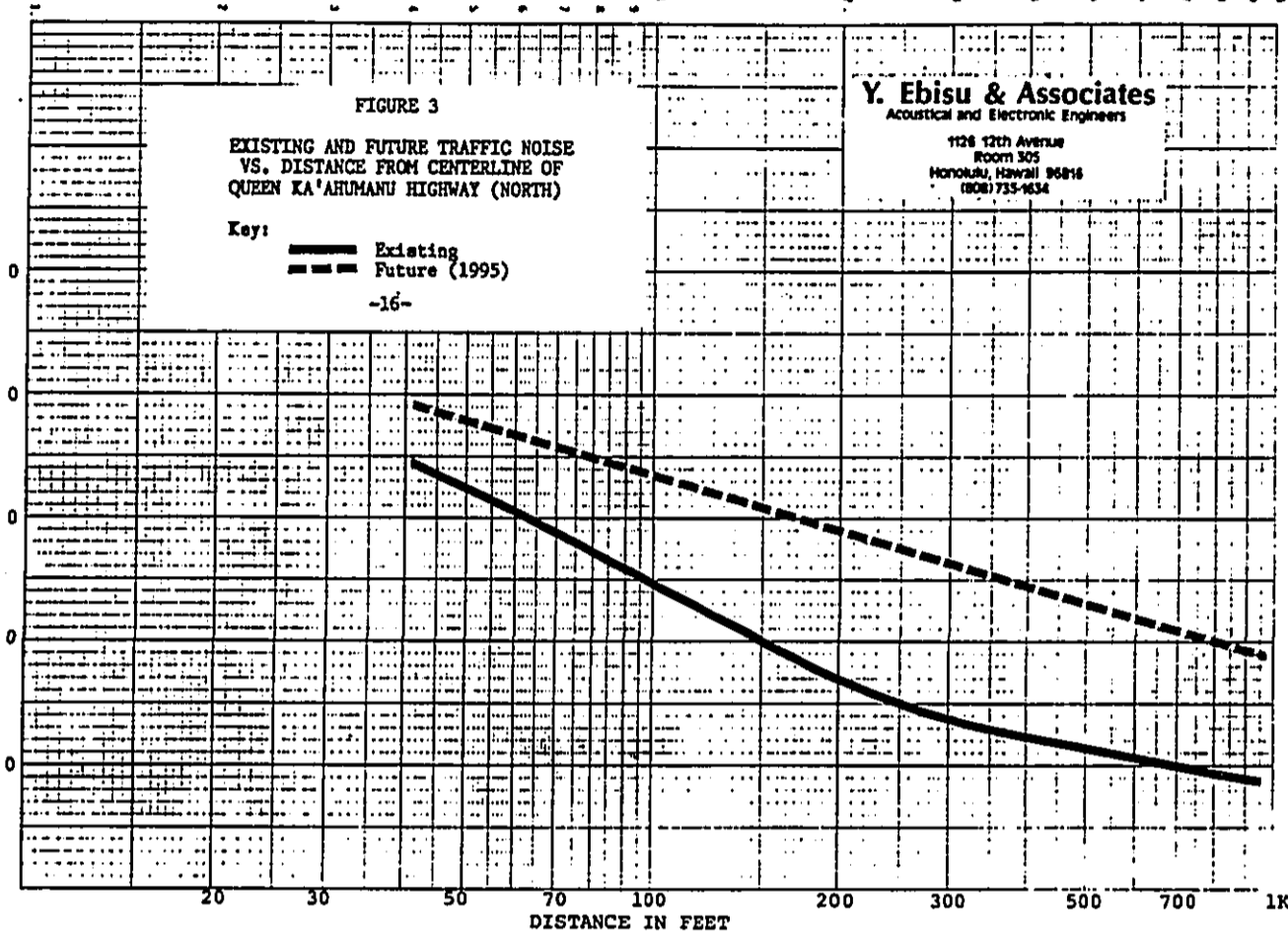
Results of calculations of existing PM peak hour traffic noise levels at 50 FT distance from the centerline of Queen Ka'ahumanu Highway north and south of the proposed resort at Kaunalehu are shown in TABLE 3. Calculated setback distances to the existing 65 Ldn and 55 Ldn contours are shown in TABLE 4. FIGURES 3 and 4 depict the existing Ldn vs. distance curves for Queen Ka'ahumanu Highway north and south of the proposed resort at Kaunalehu. The traffic noise levels shown in the tables and figures only apply when unobstructed line of sight conditions exist to the roadway. These conditions would generally occur at short (50 to 100 FT) distances to a roadway, within any flat, open space along the roadway, and at distant, but elevated locations above the roadway. The existing traffic noise levels shown in the tables and figures should be reduced by 3 to 5 dB if partial shielding (line of sight obstruction) exists between the roadway and receptor location. If the receptor location is behind an obstruction (berm or hill), the noise levels in the tables and figures should be reduced by 5 to 10 dB. FIGURE 5 depicts the calculated location of the existing 55 Ldn traffic noise contour, which was superimposed on the proposed resort development plan.

**B. Other Background Noise.** In areas removed from Queen Ka'ahumanu Highway, existing ambient noise levels are controlled by wind and foliage, surf, birds, and/or intermittent flyby events of helicopters and aircraft. At the adjacent Kona Village Resort, measured background ambient noise levels ranged from 44 to 50 dBA, and were controlled by wind, foliage, and birds. At 100 FT from the edge of the surf, measured ambient noise levels ranged from 50 to 65 dBA for 1 to 3 FT waves. Helicopter and light aircraft flyby events (no overflights observed) ranged from 55 to 70 dBA. Distant jet aircraft noise (probably from aircraft operating to/from Keanohe Airport) ranged from 45 to 55 dBA. Estimated background ambient noise levels in the populated areas of the Kona Village resort probably range from 50 to 55 Ldn. In the now

LOCATION	SPEED (MPH)	VPH	** HOURLY LEQ IN dB @ 50' ***			LEQ(1995)-LEQ(EXIST)
			AUTO	MT	HT	
EXISTING PM PEAK HOUR TRAFFIC:						
Q. Ka'ahumanu Hwy.(North)	50	336	59.5	54.7	59.1	63.0
Q. Ka'ahumanu Hwy.(South)	50	346	59.6	54.8	59.2	63.1
YEAR 1995 PM PEAK HOUR TRAFFIC (100% Occupancy):						
Q. Ka'ahumanu Hwy.(North)	50	1,007	64.3	59.5	63.8	67.8
Q. Ka'ahumanu Hwy.(South)	50	1,021	64.3	59.5	63.9	67.8
Resort Entrance Rd. @ Hwy	35	770	57.3	50.8	56.6	60.5
Resort Roadway @ E & C	35	687	56.8	50.3	56.1	60.0
Resort Roadway @ Hotel	25	495	49.8	43.9	51.1	54.0

Note: Assumed traffic mix of 95% autos, 2.5% medium trucks, and 2.5% heavy vehicles on Q.K. Hwy., and 97% autos, 1.5% medium trucks, and 1.5% heavy vehicles on internal streets.

TABLE 3  
COMPARISONS OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS IN PROJECT ENVIRONS



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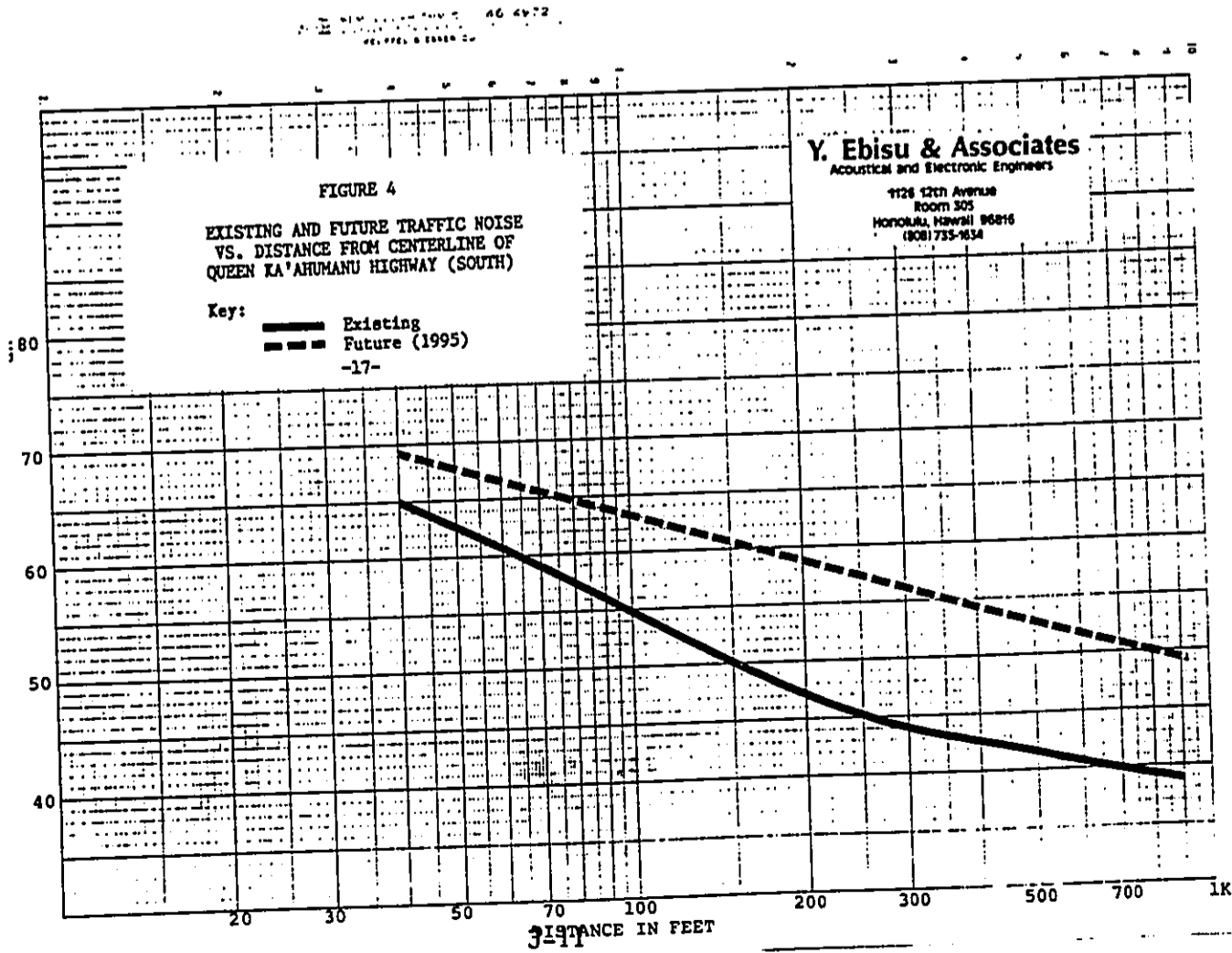
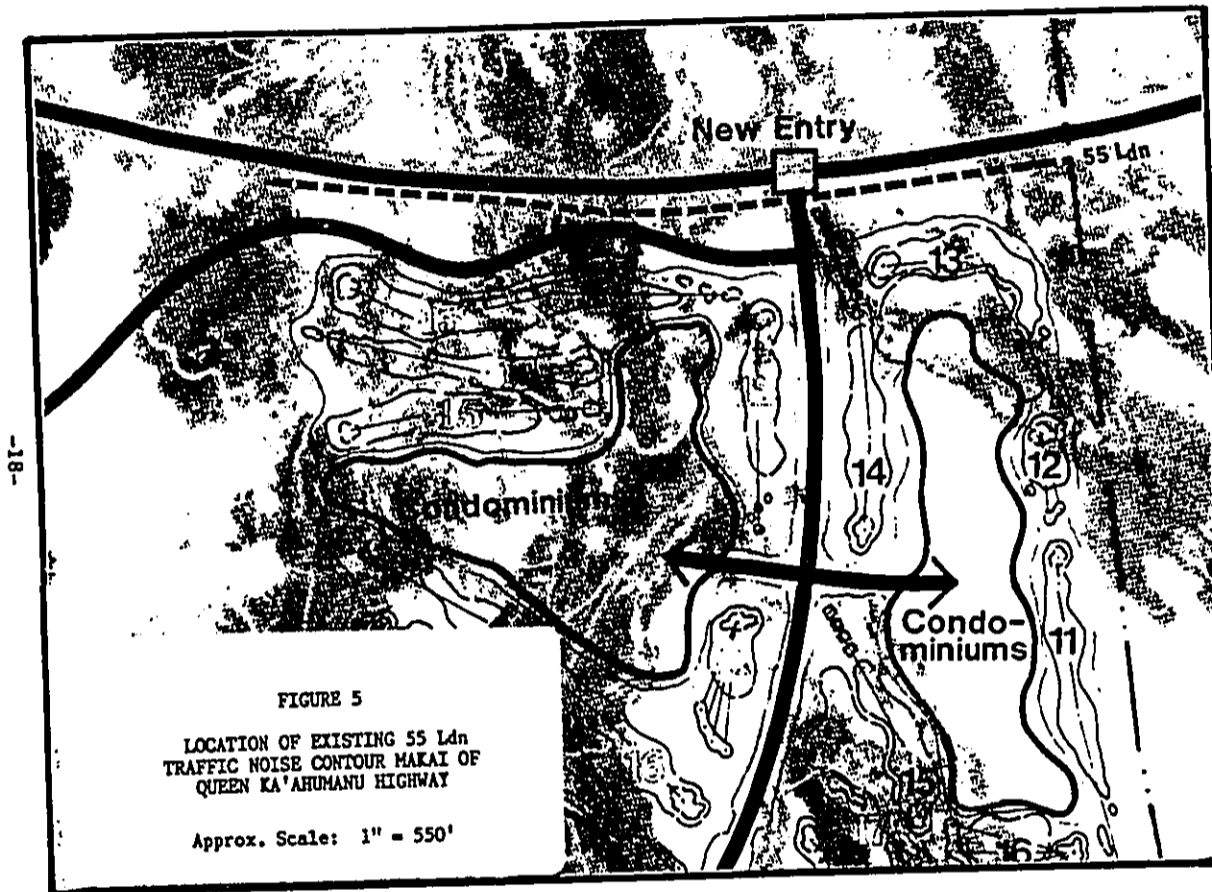
**FIGURE 3**  
 EXISTING AND FUTURE TRAFFIC NOISE  
 VS. DISTANCE FROM CENTERLINE OF  
 QUEEN KA'AHUMANU HIGHWAY (NORTH)

Key:  
 — Existing  
 - - - Future (1995)  
 -16-

**TABLE 4**  
 EXISTING AND FUTURE DISTANCES TO 65 AND 55 Ldn CONTOURS

ROADWAY SECTION	65 Ldn SETBACK (FT) EXISTING	65 Ldn SETBACK (FT) 1995	55 Ldn SETBACK (FT) EXISTING	55 Ldn SETBACK (FT) 1995
Q. Ka'ahumanu Hwy. (North)	37	76	100	353
Q. Ka'ahumanu Hwy. (South)	37	77	100	357
Resort Entrance Rd. @ Hwy	-	25	-	116
Resort Roadway @ E & C	-	23	-	107
Resort Roadway @ Hotel	-	9	-	42

Notes: All setback distances are to the roadway centerlines. See TABLE 3 for traffic assumptions. Ldn assumed to be equal to PM Peak Hour Leq. See Worksheets in APPENDIX C for hourly traffic volumes and noise levels.



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vacant lands of the proposed Kaupulehu resort, estimated background ambient noise levels are 40 to 50 Ldn in areas removed from surf and traffic noise, and from 55 to 65 Ldn within 100 FT of the surf. These levels are in the "Minimal Exposure, Unconditionally Acceptable" category (with the high surf noise levels excluded).

#### V. FUTURE NOISE ENVIRONMENT

A. Traffic Noise. Worst case predictions of future traffic noise levels were made using the traffic volume predictions for years from initial development of the Golf Course in 1989 to the year of maximum resort development in 1995. TABLES 3 thru 5, and FIGURES 3 and 4, present the future traffic noise levels and noise contour setback distances which are predicted to be applicable by 1995. For comparison with the future traffic noise levels, existing traffic noise levels were also included in the tables and figures. The predicted incremental increases in traffic noise levels from the present to the period of ultimate development in 1995 are shown in TABLE 5. Approximately 38 percent of the total traffic noise increases shown in TABLE 5 for Queen Ka'ahumanu Highway are predicted to be attributable to project traffic, and 62 percent of the total increases are predicted to be attributable to non-project traffic.

From TABLE 3, traffic noise increases of approximately 5 Ldn are predicted to occur along the Queen Ka'ahumanu Highway as a result of project and non-project traffic by the Year 1995. This level of increase is considered to be significant, as indicated by the enlargement of the 65 and 55 Ldn contour setback distances in TABLE 4 by factors of 2 to 3.6, respectively.

From FIGURES 3 and 4, the shape of the traffic noise vs. distance curves are also expected to change due to the predicted change in roadway source characteristics from a series of intermittent traffic noise events to a nearly continuous level of traffic noise. This change is due to the increase in traffic volumes predicted by the year of ultimate development in 1995. At setback distances beyond 50 FT, traffic noise level increases are anticipated to be larger (by as much as 10 to 12 Ldn) than those indicated in TABLE 3 for the 50 FT setback condition.

The 55 Ldn traffic noise contours

TABLE 5  
TRAFFIC NOISE INCREASES DURING THE PROJECT DEVELOPMENT PERIOD  
FROM PROJECT AND NON-PROJECT TRAFFIC

LOCATION	EXISTING LDN	FUTURE LDN			
		1989	1991	1993	1995
Q. Ka'ahumanu Hwy.(North)	63.0	65.0	66.6	67.5	67.8
Q. Ka'ahumanu Hwy.(South)	63.1	65.0	66.6	67.5	67.8
Resort Entrance Rd. @ Hwy	-	52.7	58.5	60.3	60.5
Resort Roadway @ E & C	-	48.1	57.7	59.8	60.0
Resort Roadway @ Hotel	-	-	52.2	54.0	54.0

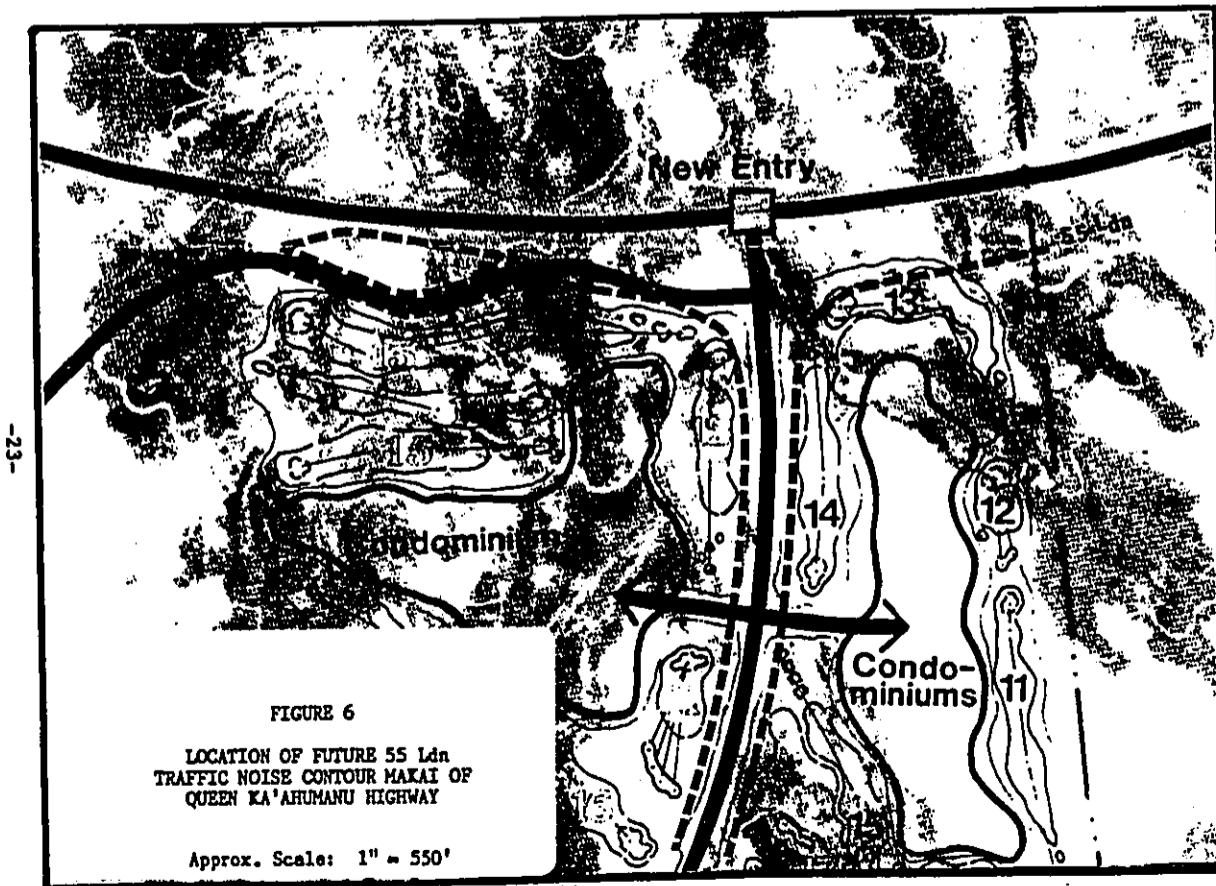
Note: All Ldn values are at 50 FT distance from roadways' centerlines.

applicable to the future conditions under the fully developed, 100 percent occupancy assumptions are shown in FIGURE 6. The contours were developed under the assumption that the existing terrain within 500 FT of the freeway would not be significantly altered. By 1995, traffic noise levels within 80 FT of the centerline of Queen Ka'ahumanu Highway will be in the "Significant Exposure, Normally Unacceptable" category. From FIGURE 6, the proposed resort condominiums are outside the 55 Ldn contours. At the proposed minimum setback distance of approximately 600 FT from the highway for these condominium units, traffic noise levels should be below 55 Ldn, which coincides with the "Minimal Exposure, Unconditionally Acceptable" noise exposure category.

Along the internal roadways of the project, and beyond 120 FT from the centerlines of these roadways, future traffic noise levels are predicted to be in the "Minimal Exposure, Unconditionally Acceptable" category. TABLE 4 indicates the setback distances from the centerlines of the various roadways which are required to be in the "Minimal Exposure, Unconditionally Acceptable" category (or below 55 Ldn) under unobstructed line of sight conditions. The setback distances shown in TABLE 4 were derived from the results of TABLE 3 for the Year 1995, at 100 percent resort occupancy factor.

B. Other Background Noise. With the development of the Kaupulehu Resort, background ambient noise levels will naturally rise due to the introduction of foliage, resort occupants, visitors, employees, mechanical support equipment, and transportation vehicles. However, in order to maintain the desired resort characteristics of the area, it is expected that background ambient noise levels will be controlled to levels in the 50 to 55 Ldn range by site planning and engineering controls. An example of this type of ambient noise control is the remote location and silencing equipment applied to the electrical engine generators at the Kona Village Resort. The addition of foliage to the primarily barren area is expected to increase the natural background ambient noise levels as a result of wind effects and the attraction of

birds. Overall, minimum background ambient noise levels are predicted to rise from the 30 dB range to the 40 dB range, but it should be possible to limit total background ambient noise to levels of 50 to 55 Ldn.





## VI. DISCUSSION OF FUTURE NOISE IMPACTS

A. Traffic Noise. Traffic noise impacts along Queen Ka'ahumanu Highway to the north and south of the project are expected to be minimal due to the wide buffers which exist between the highway and noise sensitive developments. Future traffic noise levels at planned residential and visitor condominiums of the resort are predicted to not exceed 55 Ldn along Queen Ka'ahumanu Highway and along internal roadways of the proposed resort. The proposed development plan for the Kaupulehu Resort includes the use of minimum 600 FT wide buffers between Queen Ka'ahumanu Highway and residential condominiums, and the use of minimum 250 FT wide buffers between residential condominiums and internal circulation roadways of the resort. If a 50 MPH average speed continues along Queen Ka'ahumanu Highway, and if a 35 to 25 MPH speed limit is imposed along the internal roadways, the setback distances to the 65 and 55 Ldn contours indicated in TABLE 4 should be applicable for the full resort development in 1995. Because of the generous setback distances provided for condominiums and other noise sensitive developments along the resort's internal roadways, noise impacts from motor vehicle traffic on these roadways are predicted to be minimal.

Future traffic noise impacts on the adjacent Kona Village Resort are also expected to be minimal due to the 700 FT wide buffer between the access roadway to the Kaupulehu "A" Condominium and the Kona Village Resort property line. Peak hour traffic on that roadway is expected to not exceed 25 VPH, with the resulting width of the 55 Ldn traffic noise contour predicted to be less than 20 FT.

B. Intrusive Noise. The proposed development plan for the Kaupulehu Resort also includes: the use of a minimum 700 FT wide buffer between resort roadways and the neighboring Kona Village Resort; and the use of a minimum 275 FT wide buffer between proposed Kaupulehu condominiums and the neighboring Kona Village Resort structures. Also, the center of the resort's pro-

posed Hotel and Beach Club activities are located approximately a half mile from the neighboring Kona Village Resort. The resort's proposed condominium development units are separated from each other and from the Hotel and Beach Club by minimum 350 FT wide buffers. Because of the large setback distances incorporated into the development plan, risks of adverse noise impacts on future Kaupulehu Resort residents and Kona Village Resort visitors are considered minimal.

C. Aircraft Noise. The proposed resort is approximately 6 miles and sufficiently removed from the existing Keahole Airport runway, and airport noise impacts are predicted to be minimal, with levels below 50 Ldn. The noise from transiting rotary and fixed wing aircraft will be audible above background ambient noise in the resort at flyby distances of a half to two miles, but should not generate serious adverse noise impacts. Flybys within a half to 1 mile from the resort may generate complaints. However, the frequency of these short distance flyby events are expected to remain low, and are controllable by pilot flight procedures.

D. Construction Noise: Audible construction noise may be unavoidable during the planned project construction period from 1988 through 1995. Although the total time period for construction is anticipated to be a minimum of 7 to 8 years, the actual work will be moving from one location of the site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be in the order of 2 years. These receptor locations will be those within the project which are planned to be completed first (hotel, and condominium increments at sites A, B, and C), and those within the neighboring Kona Village Resort. Depending on the type of construction activity, distances at which outdoor construction noise are predicted to be audible (levels as low as 45 to 50 dBA) range from 500 to 2,000 FT. The more intense (90 to 70 dBA) noise levels, however, are expected to be limited to receptor distances of 50 to 500 FT. Adverse impacts from construction noise are not expected to be in

VII. POSSIBLE NOISE MITIGATION MEASURES

the "public health and welfare" category. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environments at both resorts.

Possible noise mitigation measures which would minimize noise impacts from external or internal roadway traffic at the resort include measures such as: the use of buffer zones of sufficient depth as indicated in FIGURE 6 and/or TABLE 4; construction of sound attenuation berms where adequate setbacks cannot be achieved at noise sensitive locations; the enforcement of posted speed limits of 35 to 25 MPH within the proposed resort; and the use of air conditioning. The applicability of each mitigation measure depends upon other considerations besides noise, such as economic cost, aesthetics, and technical feasibility.

The use of buffer zones along Queen Ka'ahumanu Highway and along the internal roadways has been incorporated into the proposed Development Plan for the project. FIGURE 6 or TABLE 4 may be used as a guide to adjust setback distances as desired should changes in the Development Plan occur. Additional noise mitigation measures are not considered mandatory by federal or local standards and guidelines, but can be implemented as desired to minimize audible traffic noise from the internal roadways.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dBA at 50 FT distance), and due to the exterior nature of the work (grading and earth moving, trenching, concrete pouring, etc.). The use of properly muffled construction equipment should be required on the job site. The early phasing of the construction of landscaped buffers/berms between noise sensitive receptors and the job sites of later phases of construction is another possible noise mitigation measure. As a minimum, prospective clientele of both the existing Iona Village Resort and the future Kaupulehu Resort should be advised of any ongoing construction activities within audible distances. The minimum audible distances to construction noise will be more accurately determinable during the early phases of the hotel construction.



EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

**Descriptor Symbol Usage**  
The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I. Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressures, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E, ...). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the L<sub>eq</sub> with the L<sub>10</sub>.

Although not included in the tables, it is also recommended that "L<sub>10</sub>" and "L<sub>50</sub>" be used as symbols for perceived noise levels and effective perceived noise level, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:  
The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature  
With regard to accuracy averaging over time, the term "average" should be discouraged in favor of the

term "equivalent". Hence, L<sub>eq</sub> is designated the "equivalent sound level". For L<sub>10</sub>, L<sub>50</sub>, and L<sub>50</sub>, equivalent need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively. The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labeled peak. In that sound level meters have "peak" settings, this distinction is most important. "Background", "ambient", "residual", or "indigenous" describe the level characteristic of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated db) be used without modification. Hence, dBA, dB(A), and dBN are not to be used. Examples of this preferred usage are: the Perceived Noise Level (PNL) was found to be 75 db. L<sub>50</sub> = 75 db. This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of db except for prefixes indicating its multiples or submultiples (e.g., deci).

**Noise Impact**  
In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives. Further, when appropriate, "Noise Impact Index" (NI) and "Population Weighted Loss of Hearing" (PWL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:  
The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature  
With regard to accuracy averaging over time, the term "average" should be discouraged in favor of the

A. REFERENCES

1. Barry, T. and J. Reagan; "FHWA Highway Traffic Noise Prediction Model," FHWA-RD-77-108; Federal Highway Administration; Washington, D.C.; December 1978.
2. Transmittals of 1989 to 1995 Traffic Projections for 100 Percent Occupancy from Belt, Collins & Associates; April 9, 1986.
3. August 13-14, 1984 Traffic Counts, Station 8-H, Queen Ka'ahumanu Highway at Waikoloa Rd.; State Department of Transportation.
4. August 9-10, 1984 Traffic Counts, Station 8-P, Queen Ka'ahumanu Highway at Keahole Airport Road; State Department of Transportation.
5. "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.
6. American National Standard; "Sound Level Descriptors for Determination of Compatible Land Use;" ANSI S3.23-1980; Acoustical Society of America.
7. "Environmental Criteria and Standards, Noise Abatement and Control," 24 CFR, Part 51, Subpart B; U.S. Department of Housing and Urban Development; July 12, 1979.
8. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety;" Environmental Protection Agency; EPA 550/9-74-004; March 1974.

TABLE I: A-Weighted Recommended Descriptor List

Term	Symbol
1. A-Weighted Sound Level	L <sub>A</sub>
2. A-Weighted Sound Power Level	L <sub>WA</sub>
3. Maximum A-Weighted Sound Level	L <sub>max</sub>
4. Peak A-Weighted Sound Level	L <sub>pk</sub>
5. Level Exceeded x% of the time	L <sub>x</sub>
6. Equivalent Sound Level	L <sub>eq</sub>
7. Equivalent Sound Level over time (t)	L <sub>eq(t)</sub>
8. Day Sound Level	L <sub>d</sub>
9. Night Sound Level	L <sub>n</sub>
10. Day-Night Sound Level	L <sub>dn</sub>
11. Yearly Day-Night Sound-Level	L <sub>dn(y)</sub>
12. Sound Exposure level	L <sub>sf</sub>

(1) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is L<sub>eq(1)</sub>). Time may be specified in non-quantitative terms (e.g., could be specified a L<sub>eq(MASS)) to mean the washing cycle noise for a washing machine.)</sub>

TABLE 11: Recommended Descriptor List

TERM	A-WEIGHTING	ALTERNATIVE (1) A-WEIGHTING	OTHER WEIGHTING	(2) UNWEIGHTED
1. Sound (Pressure) Level	L <sub>A</sub>	L <sub>pA</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>p</sub>
2. Sound Power Level	L <sub>WA</sub>	L <sub>WB</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>p</sub>
3. Max. Sound Level	L <sub>max</sub>	L <sub>max</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>pmax</sub>
4. Peak Sound (Pressure) Level	L <sub>pk</sub>	L <sub>pk</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>pk</sub>
5. Level Exceeded x% of the time	L <sub>x</sub>	L <sub>x</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>px</sub>
6. Equivalent Sound Level	L <sub>eq</sub>	L <sub>eq</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>peq</sub>
7. Equivalent Sound Level Over Time (T)	L <sub>eq(T)</sub>	L <sub>eq(T)</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>peq(T)</sub>
8. Day Sound Level	L <sub>d</sub>	L <sub>Ad</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>pd</sub>
9. Night Sound Level	L <sub>n</sub>	L <sub>An</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>pn</sub>
10. Day-Night Sound Level	L <sub>dn</sub>	L <sub>Adn</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>pdn</sub>
11. Yearly Day-Night Sound Level	L <sub>dn(y)</sub>	L <sub>Adn(y)</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>pdn(y)</sub>
12. Sound Exposure Level	L <sub>S</sub>	L <sub>SA</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>Sp</sub>
13. Energy Average value over (non-time domain) set of observations	L <sub>eq(e)</sub>	L <sub>eq(e)</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>peq(e)</sub>
14. Level exceeded x% of the total set of (non-time domain) observations	L <sub>x(e)</sub>	L <sub>x(e)</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>px(e)</sub>
15. Average L <sub>A</sub> value	L <sub>A</sub>	L <sub>A</sub>	L <sub>g</sub> , L <sub>pb</sub>	L <sub>px</sub>

(1) "Alternative" symbols may be used to assure clarity or consistency.  
 (2) Only B-weighting shown. Applies also to C, D, E, etc. weighting.  
 (3) The term "pressure" is used only for the unweighted level.  
 (4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is L<sub>eq(h)</sub>). Time may be specified in non-quantitative terms (e.g., could be specified as L<sub>eq(WASH)</sub> to mean the washing cycle noise for a washing machine).

HOOR	SPEED (MPH)	VPH	% AUTOS	% HT	% HT	AUTO	LEQ(h) IN dB @ 50'	HT	ALL VEH
0000-0100	55	27	95	2.5	2.5	50.1	45.1	49.1	53.4
0100-0200	55	11	95	2.5	2.5	46.2	41.2	45.2	49.5
0200-0300	55	4	95	2.5	2.5	41.8	36.8	40.8	45.1
0300-0400	55	5	95	2.5	2.5	42.8	37.8	41.8	46.0
0400-0500	55	20	95	2.5	2.5	48.8	43.8	47.8	52.1
0500-0600	55	47	95	2.5	2.5	52.5	47.5	51.5	55.8
0600-0700	55	167	95	2.5	2.5	58.0	53.1	57.0	61.3
0700-0800	55	230	95	2.5	2.5	59.4	54.4	58.4	62.7
0800-0900	55	186	95	2.5	2.5	58.5	53.5	57.5	61.8
0900-1000	55	235	95	2.5	2.5	59.5	54.5	58.5	62.8
1000-1100	55	261	95	2.5	2.5	60.0	55.0	59.0	63.2
1100-1200	55	252	95	2.5	2.5	59.8	54.8	58.8	63.1
1200-1300	55	199	95	2.5	2.5	58.8	53.8	57.8	62.0
1300-1400	55	251	95	2.5	2.5	59.8	54.8	58.8	63.1
1400-1500	55	297	95	2.5	2.5	60.5	55.6	59.5	63.8
1500-1600	55	300	95	2.5	2.5	60.6	55.6	59.6	63.8
1600-1700	55	336	95	2.5	2.5	61.1	56.1	60.1	64.3
1700-1800	55	232	95	2.5	2.5	59.5	54.5	58.5	62.7
1800-1900	55	172	95	2.5	2.5	58.2	53.2	57.2	61.4
1900-2000	55	121	95	2.5	2.5	56.6	51.7	55.6	59.9
2000-2100	55	91	95	2.5	2.5	55.4	50.4	54.4	58.6
2100-2200	55	51	95	2.5	2.5	52.9	47.9	51.9	56.1
2200-2300	55	56	95	2.5	2.5	53.3	48.3	52.3	56.5
2300-2400	55	49	95	2.5	2.5	52.7	47.7	51.7	56.0

QUEEN KAHRUHANU HWY. @ WAIKOLOA RD., SOUTHWEST LEG TOWARD KONA  
 STATION 8-B, AUGUST 13-14, 1984

TOTAL VPD: 3,600 LDK @ 50 FT: 60.5 55.5 59.5 63.8

C. WORKSHEET #1.

HOUR	SPEED (MPH)	VPH	% AUTOS	% HT	% HT	**** LEO(h) IN dB @ 50' ****		ALL VEH	
						AUTO	HT		
0000-0100	55	25	95	2.5	2.5	49.8	44.8	48.8	53.0
0100-0200	55	5	95	2.5	2.5	42.8	37.8	41.8	46.1
0200-0300	55	3	95	2.5	2.5	40.6	35.6	39.6	43.8
0300-0400	55	8	95	2.5	2.5	44.8	39.9	43.9	48.1
0400-0500	55	15	95	2.5	2.5	47.6	42.6	46.6	50.8
0500-0600	55	41	95	2.5	2.5	51.9	47.0	51.0	55.2
0600-0700	55	210	95	2.5	2.5	59.0	54.1	58.0	62.3
0700-0800	55	216	95	2.5	2.5	59.2	54.2	58.2	62.4
0800-0900	55	209	95	2.5	2.5	59.0	54.0	58.0	62.3
0900-1000	55	237	95	2.5	2.5	59.6	54.6	58.6	62.8
1000-1100	55	297	95	2.5	2.5	60.5	55.6	59.6	63.8
1100-1200	55	272	95	2.5	2.5	60.2	55.2	59.2	63.4
1200-1300	55	245	95	2.5	2.5	59.7	54.7	58.7	63.0
1300-1400	55	285	95	2.5	2.5	60.4	55.4	59.4	63.6
1400-1500	55	342	95	2.5	2.5	61.2	56.2	60.2	64.4
1500-1600	55	346	95	2.5	2.5	61.2	56.2	60.2	64.5
1600-1700	55	318	95	2.5	2.5	60.8	55.9	59.8	64.1
1700-1800	55	280	95	2.5	2.5	60.3	55.3	59.3	63.5
1800-1900	55	211	95	2.5	2.5	59.1	54.1	58.1	62.3
1900-2000	55	165	95	2.5	2.5	58.0	53.0	57.0	61.2
2000-2100	55	78	95	2.5	2.5	54.7	49.8	53.7	58.0
2100-2200	55	81	95	2.5	2.5	54.9	49.9	53.9	58.1
2200-2300	55	75	95	2.5	2.5	54.6	49.6	53.6	57.8
2300-2400	55	46	95	2.5	2.5	52.4	47.5	51.5	55.7

TOTAL VPD: 4,010 LDM @ 50 FT: 61.0 56.0 60.0 64.2

QUEEN KAAMUAMU HWY. @ KEAHOLE AIRPORT RD., NORTH LEG TOWARD KAWAIIAE  
STATION 8-P, AUGUST 9-10, 1984

C. WORKSHEET #2.