Waikoloa Beach Resort

Environmental Impact Statement

For Boise Cascade Home and Land Corp.'s Planned Resort Community at 'Anaeho'omalu, South Kohala, Island of Hawai'i

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4 May 1977

PUBLIC NOTICE NO. PODCO-O 1358-S

TO WHOM IT MAY CONCERN:

1. Notice is hereby given that Boise Cascade Home and Land Corporation, Suite 1801, 130 Merchant Street, Honolulu, Hawaii 96813, has applied to the Department of the Army for a permit to perform work in the navigable waters of the United States, island of Hawaii, State of Hawaii, and to discharge fill material into navigable waters. This application will be evaluated under Section 10 of the River and Harbor Act, approved 3 March 1899 (33 U.S.C. 403); and Section 404 of the Federal Water Pollution Control Act (33 U.S.C. 1344).

2. The applicant proposes to fill selected tidal ponds at the Waikoloa Beach Resort area, Anaehoomalu Bay, island of Hawaii. The tidal ponds would be filled to enable construction of a hotel on Site 12 and access road construction. The proposed work consists of filling 21 ponds out of approximately 180 total ponds found within the resort area. Only those tidal ponds where actual hotel and access road construction is planned would be filled. The hotel and roadway have been designed to minimize the number of ponds that must be filled. Approximately 260 cubic yards of on-site clinker and aa lava would be used to fill the 21 ponds. These tidal ponds are brackish water pools found throughout the leeward coast of the island of Hawaii. They are generally dry at mean sea level and are generally small, around 100 square feet, and shallow, about 3 feet deep. All work will conform to the attached drawings (6 sheets) entitled "Proposed Tidal Pond Fill, Waikoloa Beach Resort, South Kohala, County of Hawaii, State of Hawaii, Application by Boise Cascade Home and Land Corporation," dated 17 March 1977.

3. The latest published version of the National Register of Historic Places has been consulted and there are no registered properties or properties eligible for inclusion therein involved in the proposed project. Presently unknown archaeological, scientific, prehistoric, or historic data may be lost or destroyed by work to be accomplished under the requested permit.

The Bernice P. Bishop Museum has carried out an extensive archaeological survey in the Waikoloa area and has found no visible archaeological or historic sites in the immediate vicinity of the ponds, nor around their perimeters.

16. MAINTENANCE: The subbase course shall be maintained in a satisfactory condition until accepted.

17. QUALITY CONTROL: The contractor shall establish and maintain quality control for this section to assure compliance with contract requirements and maintain records of his quality control for all construction operations including, but not limited to the items listed hereinbelow. Two copies of Construction Quality Control report and tests, as well as the records of corrective action taken will be furnished as required by SPECIAL PROVISION CONTRACTOR QUALITY CONTROL.

Preparation of subgrade

Materials

Placing including edges and lift thickness (depth measurement may be made in conjunction with density test).

Compaction: One maximum density at optimum moisture determination with one sieve analysis for each material used for each month of operation. One sand density test for each lift for each 5,000 square feet or a fraction thereof as approved.

Grade control, smoothness tests, and thickness tests.

-0-

4 May 1977

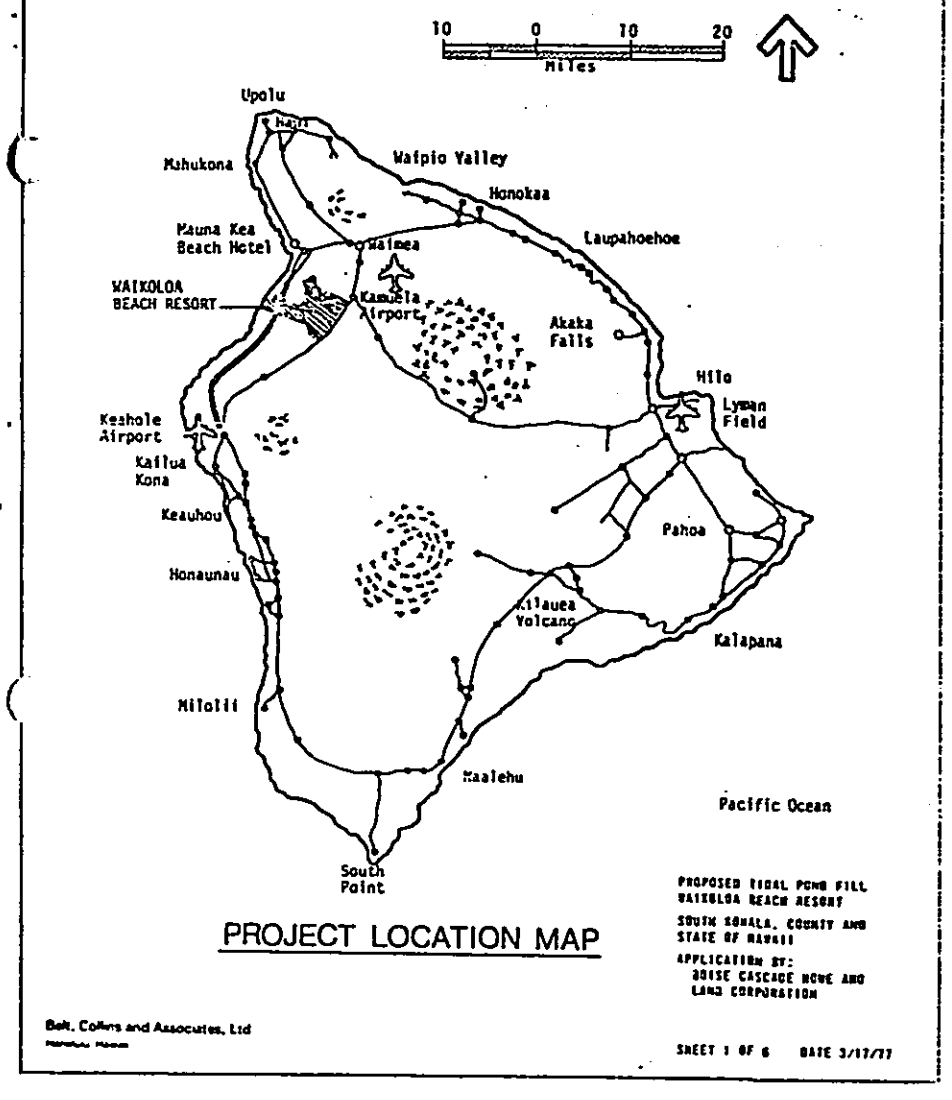
be considered; among these are conservation, economics, aesthetics, general environmental concerns, historic values, fish and wildlife values, flood damage prevention, land use classification, navigation, recreation, water supply, water quality and, in general, the needs and welfare of the people. No permit will be granted unless its issuance is found to be in the public interest.

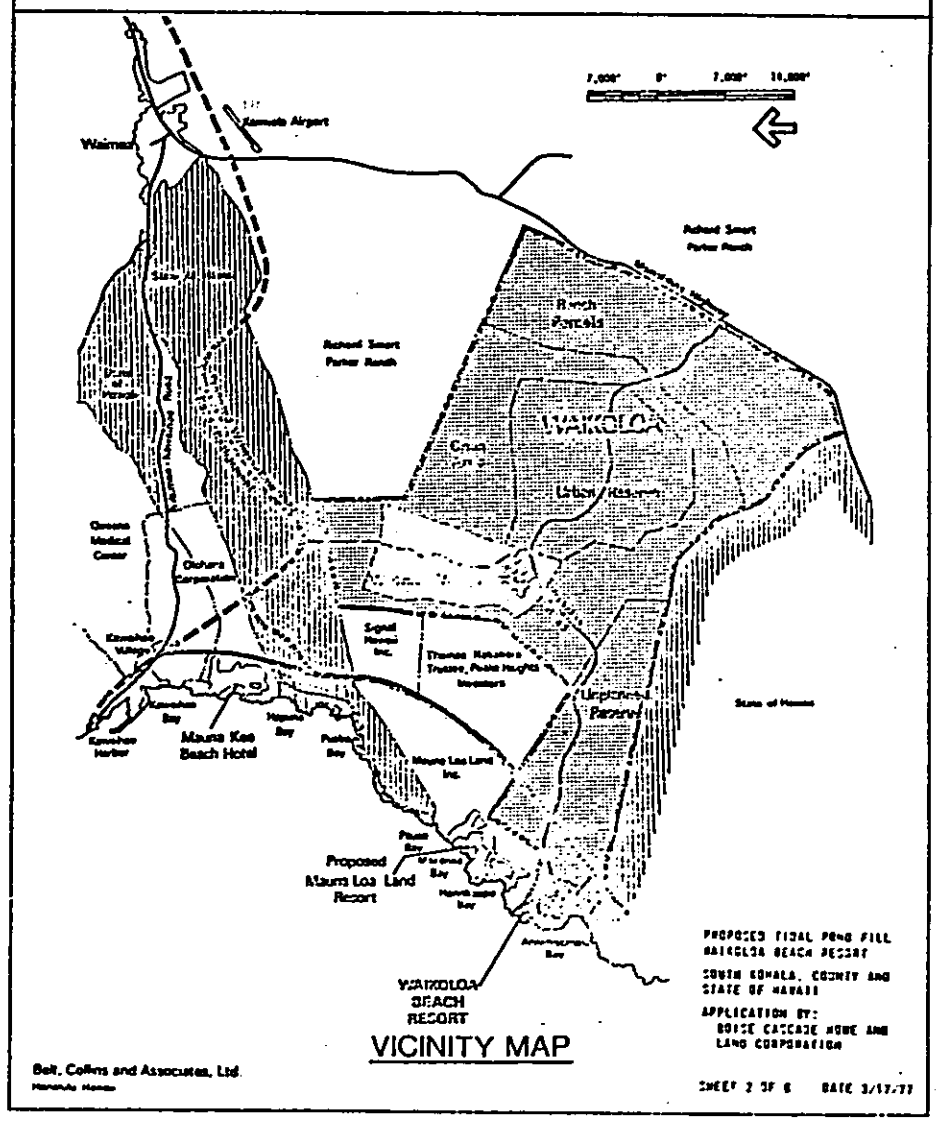
8. Interested parties may submit in writing any comments that they may have on the proposed work. Comments should be forwarded so as to reach this District no later than thirty (30) days from the date of this notice.

9. Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

1 Incl
Drawings (6 sheets)

F. M. PENDER
Colonel, Corps of Engineers
District Engineer


10 0 10 20
Miles
Upolu
Waipio Valley
Honokaa
Mahukona
Mauna Kea Beach Hotel
Waimea
Laupahoehoe
WAIKOLOA BEACH RESORT
Kamuela Airport
Akaka Falls
Hilo
Lyman Field
Keahole Airport
Kailua Kona
Keauhou
Pahoa
Honaunau
Kilauea Volcano
Kalapana
Milolii
Naalehu
Pacific Ocean
South Point
PROJECT LOCATION MAP
PROPOSED TIDAL POND FILL
WAIKOLOA BEACH RESORT
SOUTH KOHALA, COUNTY AND
STATE OF HAWAII
APPLICATION BY:
BOISE CASCADE HOME AND
LAND CORPORATION
Belt, Collins and Associates, Ltd
SHEET 1 OF 6 DATE 3/17/77


Waimea
Kamuela Airport
Richard Smart Parker Ranch
Ranch Parcels
WAIKOLOA
Urban/Reserve
Mauna Kea Beach Hotel
Proposed Mauna Loa Land Resort
WAIKOLOA BEACH RESORT
VICINITY MAP
PROPOSED TIDAL POND FILL
WAIKOLOA BEACH RESORT
SOUTH KOHALA, COUNTY AND
STATE OF HAWAII
APPLICATION BY:
BOISE CASCADE HOME AND
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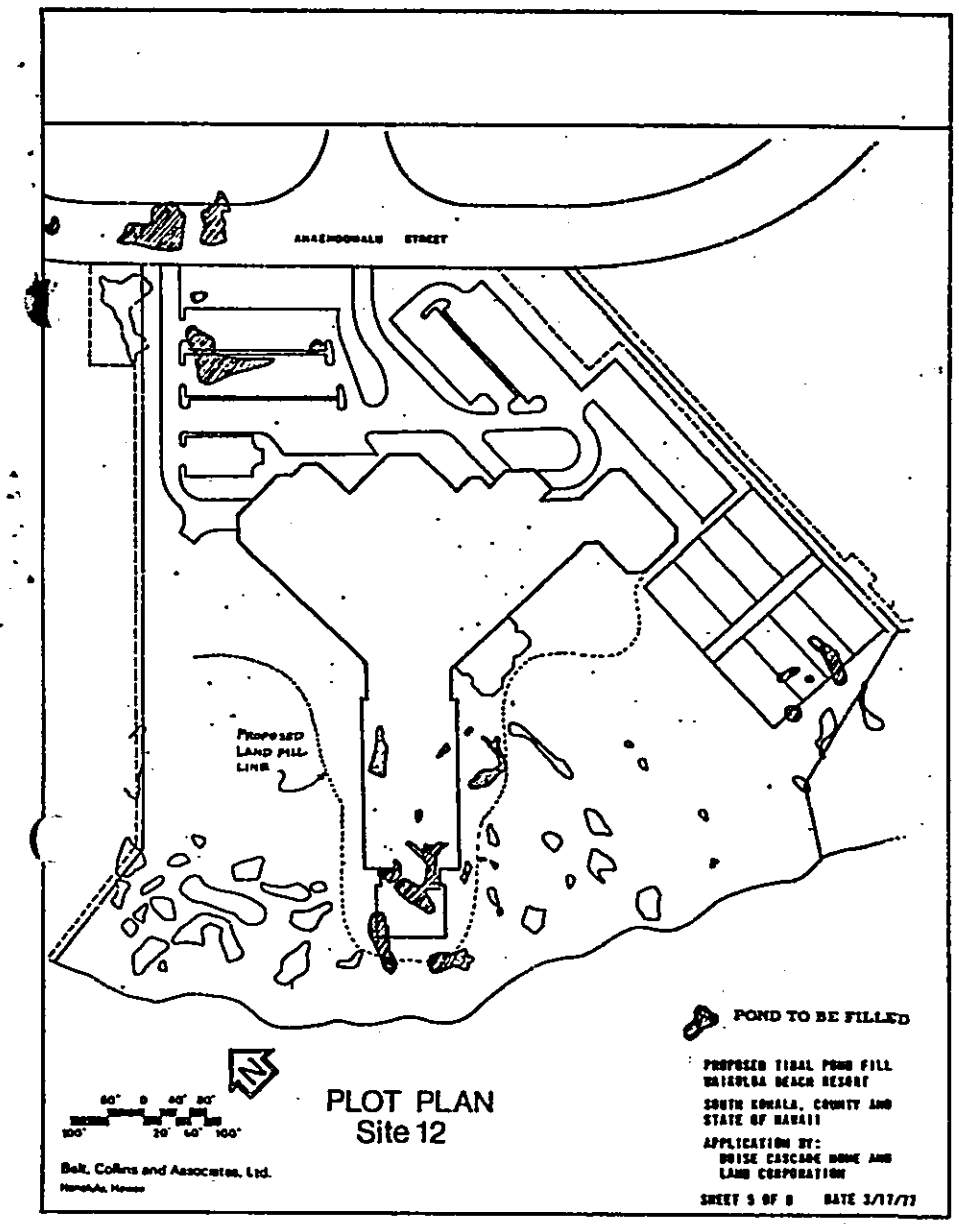
ANAEHOOMALU STREET
PROPOSED LAND FILL LINE
POND TO BE FILLED
PLOT PLAN
Site 12
PROPOSED TIDAL POND FILL
WAIKOLOA BEACH RESORT
SOUTH KOHALA, COUNTY AND
STATE OF HAWAII
APPLICATION BY:
BOISE CASCADE HOME AND
LAND CORPORATION
SHEET 5 OF 8 DATE 3/17/77
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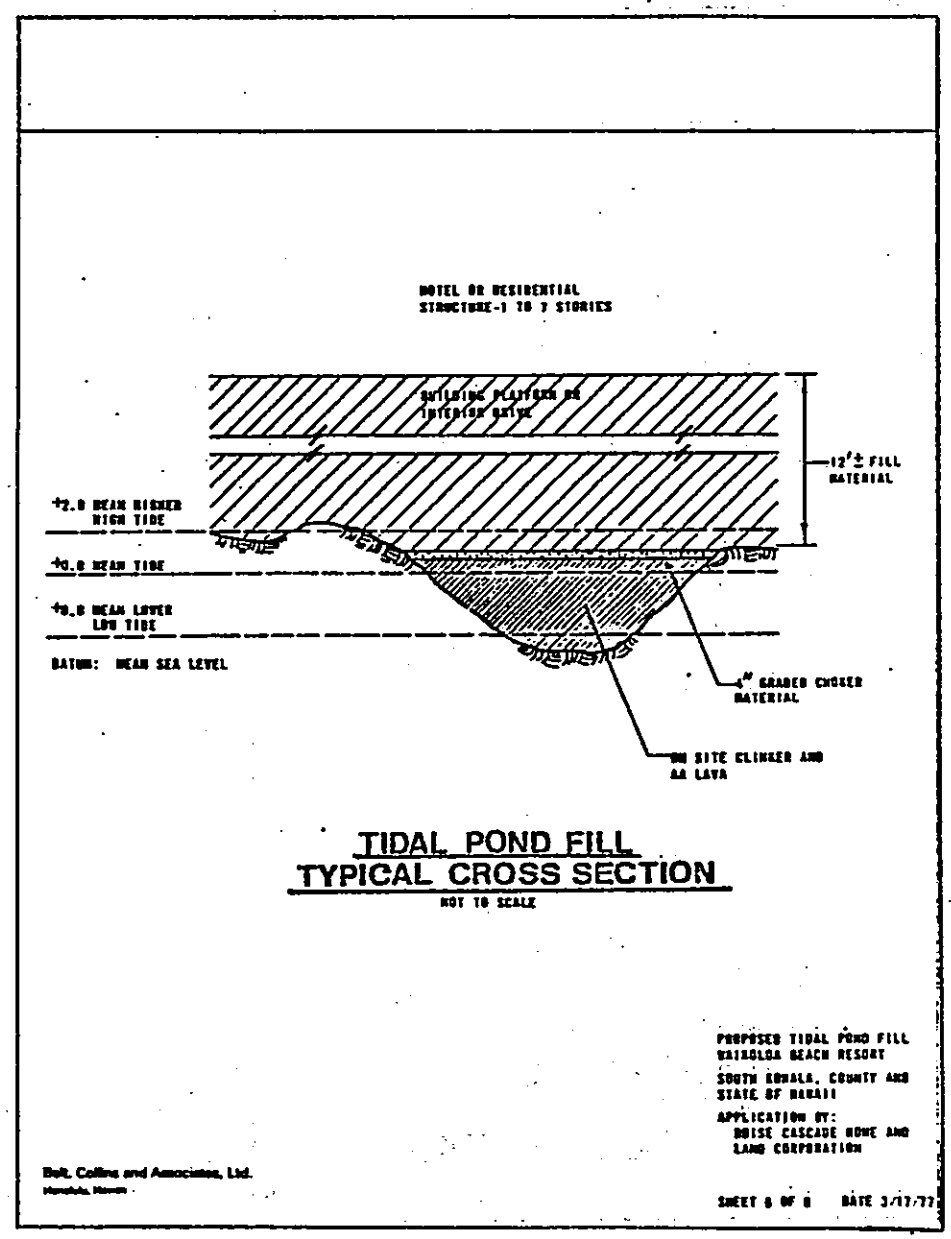
HOTEL OR RESIDENTIAL
STRUCTURE-1 TO 7 STORIES
BUILDING PLATFORM OR
INTERIOR DRIVE
12'± FILL
MATERIAL
+2.0 MEAN HIGHER
HIGH TIDE
+0.0 MEAN TIDE
-0.0 MEAN LOWER
LOW TIDE
DATUM: MEAN SEA LEVEL
4" GRADED CINDER
MATERIAL
ON SITE CLINKER AND
AA LAVA
TIDAL POND FILL
TYPICAL CROSS SECTION
NOT TO SCALE
PROPOSED TIDAL POND FILL
WAIKOLOA BEACH RESORT
SOUTH KOHALA, COUNTY AND
STATE OF HAWAII
APPLICATION BY:
BOISE CASCADE HOME AND
LAND CORPORATION
SHEET 6 OF 8 DATE 3/17/77
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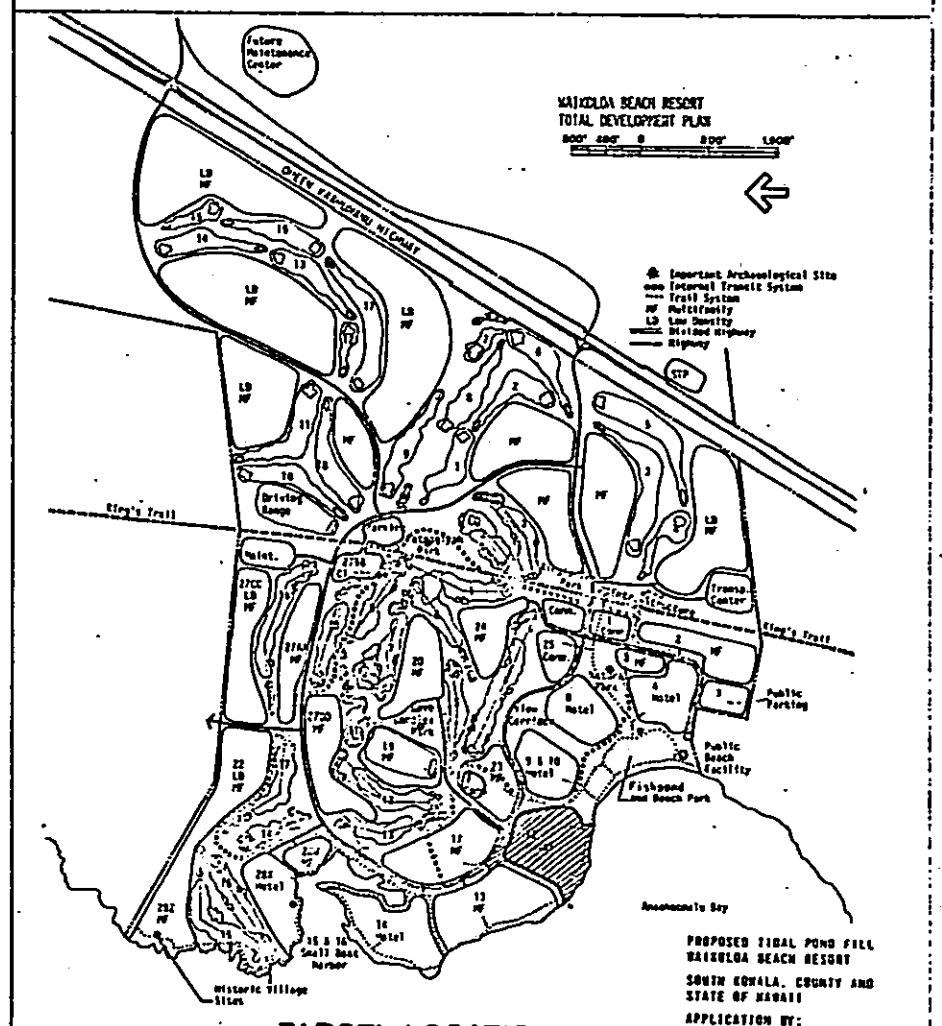
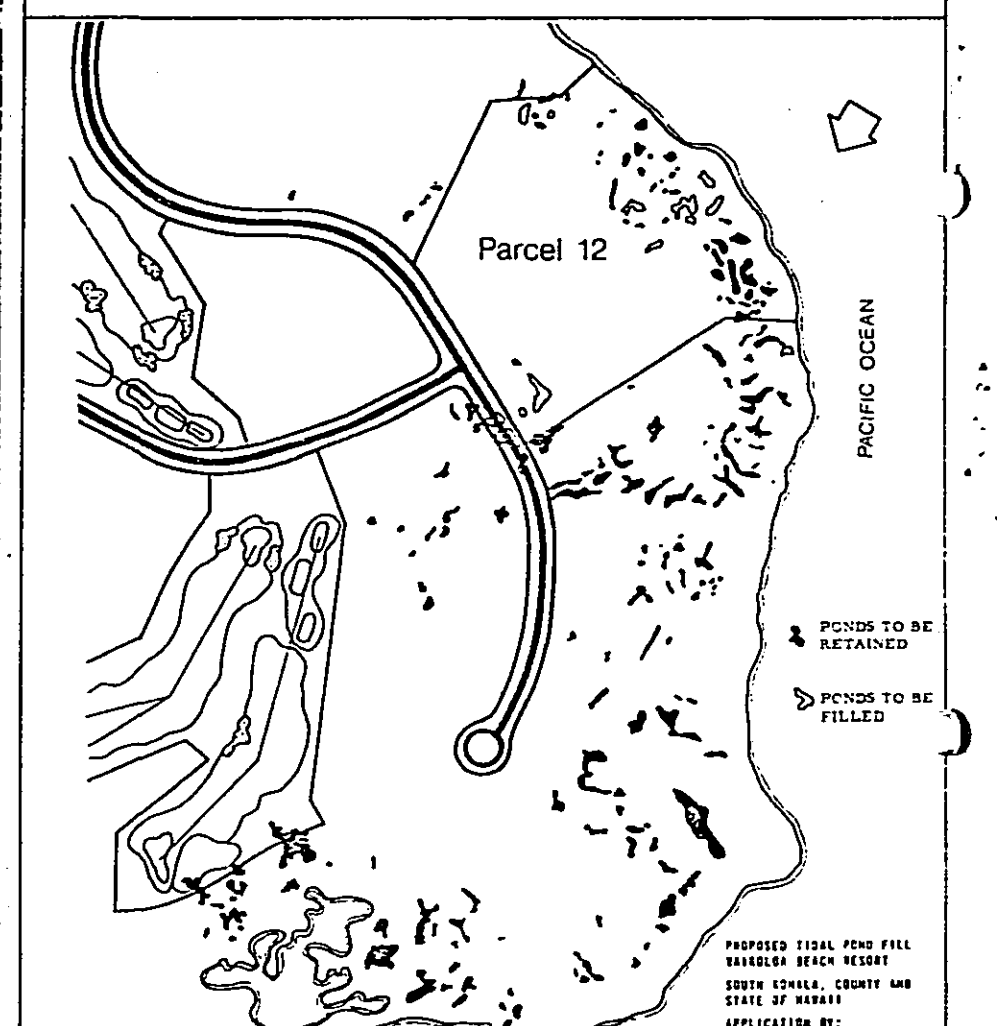


PARCEL LOCATION MAP



TOTAL PONDS MAP

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This Environmental Impact Statement for the Waikoloa Beach Resort was prepared by The Boise Cascade Home and Land Corp., with the assistance and cooperation of the following consultants:

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Hastings, Martin, Hallstrom and Chew, Ltd.,
Consulting Land Economists,
Honolulu, Hawai'i

JHK Tanaka, Inc., Engineering, Construction Management, Hilo, Hawai'i

Sept. 76

Introduction and Summary

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A. PURPOSE OF DOCUMENT

This Environmental Impact Statement (EIS) covers Boise Cascade Home and Land Corporation (Boise)'s Waikoloa Beach Resort (WBR) at 'Anaeho'omalu Bay, South Kohala District, County of Hawai'i, State of Hawai'i.

Boise recognizes that as a result of its planned destination resort development certain environmental changes will be brought about that have varying degrees of impact on the physical, cultural and economic facets of the land and its surrounding regional setting and population.

This EIS presents an evaluation and assessment of the physical, economic, asthetic, social and environmental impacts associated with the WBR, and sets forth ways and approaches in which Boise will attempt to minimize any adverse effects.

An EIS must assess and predict the future. As a result, an EIS necessarily contains many projections, plans, intentions, and assumptions which may or may not come to pass. To state applicable limitations and disclaimers each time the future is discussed in this EIS would be awkward and repetitive.

Therefore, in addition to any limitations which common sense may suggest as to any particular discussion in this Statement, the following limitations apply:

1. Hotels, condominiums and commercial business structures are expected to be built by developers who purchase lots at the Waikoloa Beach Resort in the future. Boise may, but probably will not, itself develop any hotels, condominiums or commercial structures.

2. As development of the Waikoloa Beach Resort is presently conceived, offsite improvements are expected to be installed consistent with the actual rate of growth of the development and most likely will be financed either by Improvement Assessment District or by Boise, and recreational facilities will probably be installed by Boise based on the development's growth.

3. This Statement contains not only projections and estimates concerning the growth of the Waikoloa Beach Resort, but also concerning its impact on a growing and changing South Kohala region and on the County of Hawai'i. Estimates concerning the rates of development for the project, the region and the County, and their interrelating impacts on one another, are very difficult to make with accuracy, and there can be no assurance that events will occur as predicted. Nothing in this Statement shall be construed as a warranty, representation or commitment (financial or otherwise) by Boise to bring about the development of the Waikoloa Beach Resort as conceived herein.

4. While the above limitations are probably common to the vast majority, if not all, environmental impact statements, we hope that by setting out these limitations in one place we can clarify the nature of the material within this Statement, and avoid any misunderstandings in its interpretation.

B. NECESSARY APPROVALS

Princess Hotels is undertaking to develop a luxury hotel at the Waikoloa Beach Resort. Boise Cascade Home and Land Corporation, either directly or through an improvement district, is undertaking to install very substantial improvements at the Waikoloa Beach Resort, including an 18-hole golf course, clubhouse facilities and an infrastructure of roads, offsite water distribution lines, sewer collection lines, underground electrical installations, offsite parking, landscaping and open space improvements, all extended to serve several hotel, multi-family and commercial lots, and all designed and sized to serve not only these lots but either the entire ongoing development of Waikoloa Beach Resort or a portion thereof.

These improvements are at a cost to Boise far in excess of the proceeds from the sale or lease of one hotel lot for the Princess Hotel. These initial installations and improvements are only incremental steps in a larger total undertaking--the development of the entire Waikoloa Beach Resort. Boise's immediate installation of improvements is a necessary precedent to getting the entire project underway, and represents a financial investment by Boise which is only economically justifiable if Boise's expectation of a complete and successful development of the overall Waikoloa Beach Resort is realized.

Because the development of the entire Waikoloa Beach Resort is fundamentally a single significant environmental decision and a unified ongoing action, both as a matter of environmental law[1] and of economic planning, the following governmental approvals are sought as a complete package and a condition precedent to Boise initiating development in the Waikoloa Beach Resort:

1. Acceptance of Environmental Impact Statement ("EIS") for WBR. This is a specific determination by the County Planning Commission, being the "approving agency" with which this EIS is initially filed and which has jurisdiction over the approvals listed below, and by the Mayor of the County of Hawai'i, that this EIS for the development of the entire[2] Waikoloa Beach Resort is accepted in accordance with Chapter 343 of the Hawai'i Revised Statutes, and that it does adequately describe identifiable environmental impacts, and does satisfactorily respond to comments received during the review of the Statement, and complies fully with all requirements

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[1]State of Hawai'i Environmental Quality Commission, Environmental Impact Statement Regulations Sections 1:22b and 1:12b (Effective June 2, 1975.)

[2]Increment Three has not been zoned for resort development. The proposed small boat harbor has not been approved from a navigation and water quality standpoint. As to these two items, the present approvals sought are conceptual, and it is understood that EIS supplements and hearings on the specifics of these two items might be required as development reaches these phases.

for such EIS under County and State law.

2. Granting of Shoreline Management Area Use Permit for WBR. This is a permit granted by the County Planning Commission, approving the development of the entire[1] WBR as described in the Environmental Impact Statement, and specifically determining that the development of the WBR will not have any substantial adverse environmental or ecological effect except as such adverse effect is clearly outweighed by public health, safety and welfare, and that such development is consistent with the findings and the policies of the Planning Commission.

3. Granting of Planned Development Permit for WBR. This is a specific determination by the County Planning Commission that each lot within the Waikoloa Beach Resort zoned, based on Boise's pending zoning amendment application, so as to permit use for hotel and/or condominium development upon receipt of a Planned Development Permit, is granted a Planned Development Permit. This Permit is based upon, among other things, a finding by the County Planning Commission that hotel and/or condominium use for each appropriately zoned resort, multi-family and commercial lot within WBR does conform to the County General Plan and other related ordinances.

4. Zoning Amendment Approval for WBR. This is an approval by the Planning Commission and County Council of minor adjustments in zoning district boundaries within Increment One and Increment Two of Waikoloa Beach Resort. As shown in Boise's application, these amendments maintain approximately the same acreage provided in Ordinance 392[2] for each permited use, and are designed primarily to permit a slightly changed configuration in the golf course and road area for the Waikoloa Beach Resort. The boundary between Increment One and Increment Two of the Waikoloa Beach Resort will be maintained as provided in Ordinance 392, and the same provision as stated in Section 4, Ordinance 392 shall determine the effective date for Increment Two.

5. Subdivision Final Approval for WBR. This is an approval by the Planning Director of the subdivision changes set forth in Boise's present application to the Planning Depart-

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[1]Ibid.

[2]County Ordinance 392, effective April 27, 1971, is incorporated in the Hawai'i County Code 1975 as Chapter 8, Article 2, Section 7.06 (f). (The area of Waikoloa Beach Resort subject to incremental zoning is clearly designated in Ordinance 392, Section 3, although not so designated in the Hawai'i County Code 1975 due to a clerical omission of section numberings.)

ment, so as to make subdivision boundaries and zoning boundaries coincide. These changes do not increase the number of lots existing prior to this resubdivision.

6. Planned Unit Development Approval. Specific Planned Unit Development approval for the Princess Hotel to be constructed on Lot 12 includes approval of both the initial structure of approximately 350 rooms, and of the future additional story increase to over 400 rooms, all as shown in the plans and drawings submitted in this EIS as Appendix 1. This Planned Unit Development approval is a determination, among other things, that the proposed hotel meets the requirements of Article 23 of the Hawai'i County Zoning Code, as amended, and that the building's height, including its planned future incremental height shown in the plans and drawings submitted, meets the requirements of Rule 7 of the Planning Commission. Boise is also requesting partial Planned Unit Development approval on hotel sites 4, 8, 9-10, 14 (Increment One) and hotel site 28W (Increment Two).

7. Plan Approval for Hotel on Lot 12. This is a determination by the Planning Director that the Planned Unit Development to be constructed on Lot 12 meets the requirements stated in Article 22 of the Hawai'i County Zoning Code.

8. Special Permit: This permit is for a temporary construction and maintenance yard on Lot 3, File Plan 1435. This facility is necessary during the development period and may be relocated when and if a permanent facility is built in conjunction with a possible second 18-hole golf course. It is estimated this site will be needed for approximately 10 years. The issuance of this Special Permit requires approval, after hearing, by the County Planning Commission and the State Land Use Commission.

It is Boise's intention and understanding that the hearing and approval process for items 1 through 8 above will definitely determine, once and for all, whether the Waikoloa Beach Resort as conceived herein is consistent with governmental considerations. Assuming that the governmental permits and approvals listed above are granted for the WBR, future development consistent with this EIS[1] should not require further hearings before the Planning Commission or County Council.

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[1]See Note 2, supra.

C. PROJECT DESCRIPTION SUMMARY

Present resort and community development along the South Kohala Coast centers on projects being undertaken by Laurance S. Rockefeller's 'Olohana Corporation, Boise's Waikoloa, and Mauna Loa Land Inc.'s planned resort at Kalahuipua'a. 'Olohana Corporation has completed the Mauna Kea Beach Hotel and golf course and first increments of Kawaihae Village and Fairway homesites. The Mauna Kea Beach Hotel complex is internationally known as one of the finest destination resorts in the world. Mauna Loa Land's development is still in the planning stages.

Boise's development to date has been centered on Waikoloa Village and includes condominiums and single family residential units, an 18-hole golf course and clubhouse facility, stables, and other recreational facilities as well as water, sewerage and road systems, Boise's activities at the WBR have included the provision of water, extensive beach improvements, archaeological research and grading for road and golf course alignments.

The work done to date and planned for the future by these developers, together with what the State and County have done and are committed to do along the Kohala Coast is transferring what was once a barren, unproductive, inaccessible area into a well planned, productive and accessible major destination resort where residents throughout the State and visitors to the area can enjoy not only the beaches and coves, but develop an understanding of the history and culture of the area.

Boise's objective at the WBR is the same as that of the County of Hawai'i and the State of Hawai'i, to create a viable destination resort - a resort with hotels, residential properties, and commercial areas to accommodate retail and service facilities. The focal points are "Sun, Surf, and Sand", which along with the history and culture of the area, are the basic natural ingredients essential for a successful destination resort in Hawai'i.

Along with the natural amenities, the WBR will have other recreational and historical facilities such as a championship golf course and archaeological preserves all harmonized to create a resort that will provide long term enjoyment, a variety of activities and experiences, environmental quality and an opportunity to live in the "Big Country" of Hawai'i. In addition, the WBR will satisfy a very basic need for the Kohala region and the County of Hawai'i - employment, and, concomitantly, economic diversification and stability.

Development in the past has been hindered in part due to access and availability of water. The new Queen Ka'ahumanu Highway solves the access problem and Boise has provided its own water source for the WBR. The WBR is in a position to develop now.

Due to the magnitude of the WBR, development will be in increments and stages. The increments will tie in with the incremental zoning established by the County of Hawai'i in Ordinance No. 392 in 1971.

This EIS covers certain immediate construction plans and certain conceptual plans for various increments and stages of development which include: major support facilities of roads, water, sewer, power, telephone, T.V. cables, and natural gas; hotel, multi-family residential, and commercial property development; golf course construction with clubhouse, landscaping, fertilizing, irrigation from Maui wells, potable water and sewage treatment plant effluent; landscaping for pedestrian paths, shoreline trails, roads, beach and ponds, open space and other public areas; landscaping, security and access treatment to archaeological sites which include burial cave complex, petroglyph field, King's Trail, the Camel, and the Mua and Hale Noa structures adjacent to the fishponds; project nursery; small boat harbor development; temporary golf course maintenance facility and construction yard; centralized parking for the public, employees, guests, and residents, and certain land use changes that will require rezoning to improve not only the golf course design and play, but vehicular traffic flow. The zoning changes proposed are shifts only and do not alter the zoning densities.

D. DEVELOPMENT JUSTIFICATION SUMMARY

Both the State and County have recognized the prospective resort development at WBR in their various plans. The State through its Land Use Plan has placed the land in an Urban District, and the County of Hawai'i has in its General Plan designated WBR as a major resort area. A portion of WBR has also received resort zoning. The State and County through their capital investment programs have spent or committed over $81 million to provide public facilities and services which will foster resort and tourism development in the Kohala Coast Resort Region.

These endeavors are consistent with the fact that Hawai'i is a tourism destination area in the minds of a very large segment of the national and international overseas travel market. In addition to being extraordinarily blessed with excellent climate, attractive white sand beaches with safe swimming water and beautiful scenery, the traditional requisites of successful tropical resorts, the State is renowned for the "Aloha Spirit" exuded by its people. As tourists have been attracted to the State in increasing numbers, there has been a greater recognition of the need to disperse tourism to the Neighbor Islands, away from Waikiki and O'ahu. The efforts by the State and County support this dispersion policy. Further, the amenities of "Sun, Surf, and Sand" at WBR amply justify its selection for resort development.

As an indication of the importance of tourism, visitor expenditures are estimated to be the largest source of income to the State of Hawai'i. In 1974, an estimated 2,786,489 visitors staying overnight and longer spent $1,070,000,000. Visitor arrivals are estimated at 2,800,000 for 1975, and expenditures at $1,180,000,000.

From 1960 to 1970, the tourist volume to the State of Hawai'i increased at an average rate of 20 per cent per year. Since then tourism has slowed to a 5.9 per cent increase in 1974 over 1973, and showed almost no gain from 1974 to 1975. Tourism forecasts are in line with the State's proposed policy of achieving a five per cent per year growth rate.

Tourism in Hawai'i County is expected to gain at a rate of 5.7 per cent per year between 1974 and 1990 which is faster than the State as a whole. The Kohala Coast in particular is expected to be a major destination area for visitors. The competitive strength of the Kohala Coast in the future will be the sizable amount and variety of recreation facilities and activities which will be available. In addition, the Kohala Coast possesses superior environmental amenities of a high percentage of sunny days, white sand beaches, safe swimming beaches, dry climate, excellent views of water and mountains and ample open land to permit flexible planning.

With these competitive advantages, it is projected that 70 to 90 per cent of the Big Island demand for transient accommodations projected for areas outside of Hilo and Kona can be attracted to the Kohala Coast region. Applying this to the forecasted demand for transient accommodations results in an estimated demand for 2,520 to 3,250 more units in

the Kohala Coast region over the next 15 years. This is an average of 170 to 220 additional units per year. These forecasts show that the demand for transient accommodations from 1975 to 1980 will be sufficient to support development of from three to four projects of viable economic sizes.

Rising family incomes of visitors indicate an increasing demand for first class and luxury accommodations. Because the Kohala Coast region possesses the requisite amenities of high quality resorts, it is expected to attract 80 to 100 per cent of the first class and luxury demand for the island. Application of these capture rates indicates that demand is sufficient to support two to three economically-sized high quality hotels in the Kohala Coast region in the period from 1975 to 1980 and two more from 1980 to 1985.

At present, the major potential competitors for the market demands will be the projects planned at WBR, those planned on the adjacent property by Mauna Loa Land, Inc., and possibly some planned by Laurance Rockefeller's 'Olohana Corporation near the Mauna Kea Beach Hotel in the area from Hapuna Beach to Kawaihae. Of these WBR has the competitive advantage of having both water and a white sand, safe swimming beach.

The demand for condominium units is directly influenced by hotel patronage in the area. Although condominium sales in Kona have not been as spectacular as that experienced on West Maui, it is expected that condominium sales on the Kohala Coast will be similar to West Maui because of its white sandy swimming beaches and planned physical and recreational facilities, features which the Kona Coast lacks. It is estimated that there will be a demand for 390 to 480 vacation homes during the period from 1978 to 1980 with a total demand for 2,990 to 3,830 by 1990. Waikoloa presently has a competitive advantage for capturing this market because of water availability at the site and its white sand beach. It is estimated that the annual demand for condominium units at Waikoloa will range between 100 and 160 units for the period of 1978 to 1980 and will increase in later years. Commercial facilities will be a necessary part of the WBR to provide additional activities for visitors, to satisfy their requirements for goods and services, to add to and diversify economic sub-activities, and to increase employment. It is estimated that each 300 room hotel increment should support 7,500 square feet of commercial space and additional commercial space will be needed to service condominium units. The first 350 unit hotel will support 8,800 square feet.

Recreational facilities are traditional and requisite components of successful destination resort areas. They not only draw visitors to an area, but also serve to retain visitors in an area for longer periods of time, thereby enhancing the economic impact of the visitors they attract.

Development at WBR not only could accommodate market demands effectively, but such a development in the region would enhance the local economy and thereby strengthen the community fabric. New jobs will be created not only during the initial construction phases, but also a

wide range of jobs will be generated to operate the resort facilities. Expanding tourism to diversify the region's economic base mitigates the effects of secular swings in the economy by providing more overall stability to the community. For example, had the regional economy been more diversified and better balanced when the Kohala Sugar Company's operations terminated, the affected workers might have been able to find alternative employment in an expanding sector within the region with minimal social and community disruption.

It is emphasized that the tourism industry should not be relied upon solely for the economic salvation of the region. To do so would result in the same dependence upon a single industry, as was the case with the Kohala Sugar Company.

Subsequent sections deal in detail with impacts on employment, income, housing, population, and revenues to the State and local governments. Only a short synopsis of each will be presented at this juncture.

Direct jobs will be created as a result of construction requirements as well as the need to operate and maintain the resort and recreation facilities. During the initial construction phase, approximately 300 jobs contributing $4,393,000 in annual salaries and wages in terms of 1975 dollars will be filled. Upon completion of the first hotel, and after the first full year of its operations in 1978, annual direct income from the resort and construction jobs will amount to $6,664,000, again in terms of 1975 dollars for 710 direct jobs. By the estimated time the project is completed in the year 2005, it is anticipated there will be 3,870 new direct jobs generating $31,874,000 in annual salaries and wages.

Including an increment for secondary employment, the WBR when completed should generate a total of 4,680 new jobs in the region. Of this 2,880 are expected to be filled by current residents in Kohala, or by their future family members. Only 1,800, or about 38 per cent are expected to be filled by in-migrants. Even so, almost half of the in-migrants would be management or special skilled workers normally brought in for construction or operations of such remote resort facilities.

Net new housing demand in the region is estimated to be 2,210 units by the time of completion. However, available housing in Waikoloa in the form of dormitory units, proposed resort condominium apartments, and likely Waikoloa Village housing should satisfy the Waikoloa employee housing needs to about 1985. Even after that, there would still be ample land in Waikoloa Village upon which to develop housing as dictated by market demands.

E. SUMMARY OF PROJECT IMPACTS

1. Beneficial Impacts

The creation of the WBR will transform a heretofore inaccessible area into an oasis which will provide recreational opportunity for all with economic and social benefits for the Kohala District.

Such a development in the region will enhance the local economy and thereby strengthen the community fabric. Expanding tourism to diversify the region's economic base will provide more overall stability to the community.

In addition to the jobs generated by the construction activity, a wide range of new jobs will be created by the operation of the resort facility. The effects of obtaining needed employees from the ranks of the presently unemployed are all positive:

> New jobs for the unemployed reduce the social costs of welfare, unemployment compensation, and other public expenditures associated with unemployed workers.
>
> New jobs greatly reduce or remove the frustrations, anxieties and apprehensions characteristic of families when the head of the household is unemployed or underemployed. Employment, by reducing the family's economic burdens, restores family stability.
>
> New jobs reduce idleness typically associated with unemployment. Prolonged periods of worker idleness have been in many instances directly related to increased crime, juvenile delinquency, and other social disorders.
>
> New jobs contribute to a reversing of out-migration trends often associated with limited or non-existent new employment opportunities.
>
> New jobs in a growing industry within the region will generally retain a high proportion of young adult employees. Without increased employment opportunities, many, if not most, of these young workers would be forced to migrate outside the region to seek employment opportunities.
>
> The retention of these young adults within the region, and the attraction of other young workers to the region for employment opportunities, would maintain a balanced demographic composition of the population, which in turn would tend to reinforce a normal population-growth situation.
>
> Family income can be augmented with two or more wage earners per family and increased buying power.

As a result of in-migration, the interaction of different cultural backgrounds is educational and is beneficial in that it provides exposure to

each group's culture.

The exposure of local employees and residents to visitors from outside the region and State promotes the opportunity for social and cultural interactions.

Visitors to the region present numerous opportunities to perpetuate local talents in singing, dancing, and related arts and in encouraging the continuation or re-establishment of traditional handicraft skills and arts. This interest in turn can be instrumental in strengthening a sense of pride in the heritage and ethnic backgrounds of the local people.

The archaeological investigations and salvage work done by the Bishop Museum at the WBR has resulted in a re-creation of the history of 'Anaeho'omalu. This, together with the preservation of major sites will enable the residents of Hawai'i and visitors to Hawai'i the opportunity to better understand the history and culture of the area.

One of the most beautiful shorelines in Hawai'i is located at the WBR. Boise has already opened this formerly inaccessible oasis to all the residents of Hawai'i. When the WBR is constructed, public access will be further improved.

The cost-benefit analysis suggests that the WBR will produce significantly more additional income in the form of taxes than expenditures for all levels of government. This additional income could be used to either reduce the tax burden on other taxpayers or to expand government-provided public services.

Finally, it is important to note that the WBR is located in an environment that is relatively insensitive to changes associated with the types of activities that are proposed. There is no complex terrestrial system to be disrupted; there is a very low soil-erosion potential; there is very little rainfall and, therefore, very little surface runoff; adequate supplies of fresh water are available; and the transportation network designed to accommodate all of the growth which might occur is in place.

2. Potentially Negative Impacts

Less responsible and less stable members of the traditional families living in the region will be exposed to different value systems and life styles, which in turn may cause marital and other family problems.

Supervision of children could become a problem as mothers leave the house for part or full-time work. This problem can lead to increased juvenile delinquency and crime.

Immigrant employees and their families may well have different cultural backgrounds and life styles from existing residents and this could cause conflicts and social disruption as the new and existing individuals and families interact within local communities and in schools and other public facilities.

Additional visitors to the North and South Kohala region may change various aspects of the present life styles found within the region's communities. While some changes are desirable, many are considered adverse in nature. One example would be an accelerated shift from the slow-paced, person-oriented life style characteristics of rural communities to emphasis on commercialism and commercial activities which cater to "strangers" or "outsiders".

The presence of visitors, and particularly the more affluent visitors, may stimulate higher prices or costs for items that appeal to only the tourist or to both tourists and local residents.

The increased number of visitors -- particularly tour groups, which are typically characterized as more impersonal and less sensitive to local customs, traditions and life styles -- could erode the warm and friendly personalities that are characteristic of the local people.

The presence of a sizable number of visitors and new residents in the area will add, in varying degrees, to the use of public services and facilities.

The construction of the WBR will result in the loss of a number of archaeological sites identified in the Bishop Museum's survey of the property. Because of the salvage operations commissioned by Boise, however, the artifacts and other information they contained have been preserved for study and possible inclusion in public displays.

The introduction of soil cover and, to a lesser extent, vegetation will permanently change the character of the lava flows that now cover the property. While it would be possible to remove most of the introduced vegetation, some would inevitably survive, and the presence of a soil mantle will allow other plants to gain a foothold on the land.

The urbanization of 'Anaeho'omalu will have an effect on the visual and social texture of what has been, until quite recently, a very isolated area. The expansion of the 'Anaeho'omalu oasis will, together with the other developments planned for this portion of the South Kohala coastline, eliminate it as an isolated locale.

Finally, the development of WBR will commit the people and government of the State and County to the provision of some of the services necessary to support urban use of the area.

I. Project Description

A. DEVELOPMENT CONCEPT

1. The Waikoloa Community Concept

The overall objective of the development of Waikoloa is a planned community. The Waikoloa property is a 31,000 acre site in the South Kohala District of the Island of Hawai'i. As shown in Figure A, the site ranges from the temperate grasslands environment typical of the Waimea area to the warm dry beach area at 'Anaeho'omalu Bay.

Included in the master plan for the community are:

Waikoloa Beach Resort (WBR): A major destination resort complex at 'Anaeho'omalu Bay consisting of a cluster of resort hotels, resort residential areas and recreational facilities. The objective of the resort complex is to provide the economic and employment base of the community. The WBR is the subject of this environmental impact statement.

Waikoloa Village: A residential village already partially completed in the grassy central portion of the site. The village is zoned to accommodate approximately 5,800 single family and approximately 1,700 multi-family units. There is also zoning for commercial uses. One objective of the village is to provide support for the resort in the form of housing, schools and commercial functions. The village core is already established, with a population in excess of 100 people. A total of 968 single family lots have been developed in the village and are substantially sold.

Urban Reserve: Adjacent to Waikoloa Village is a 4,653 acre urban reserve designed to accommodate future village expansion.

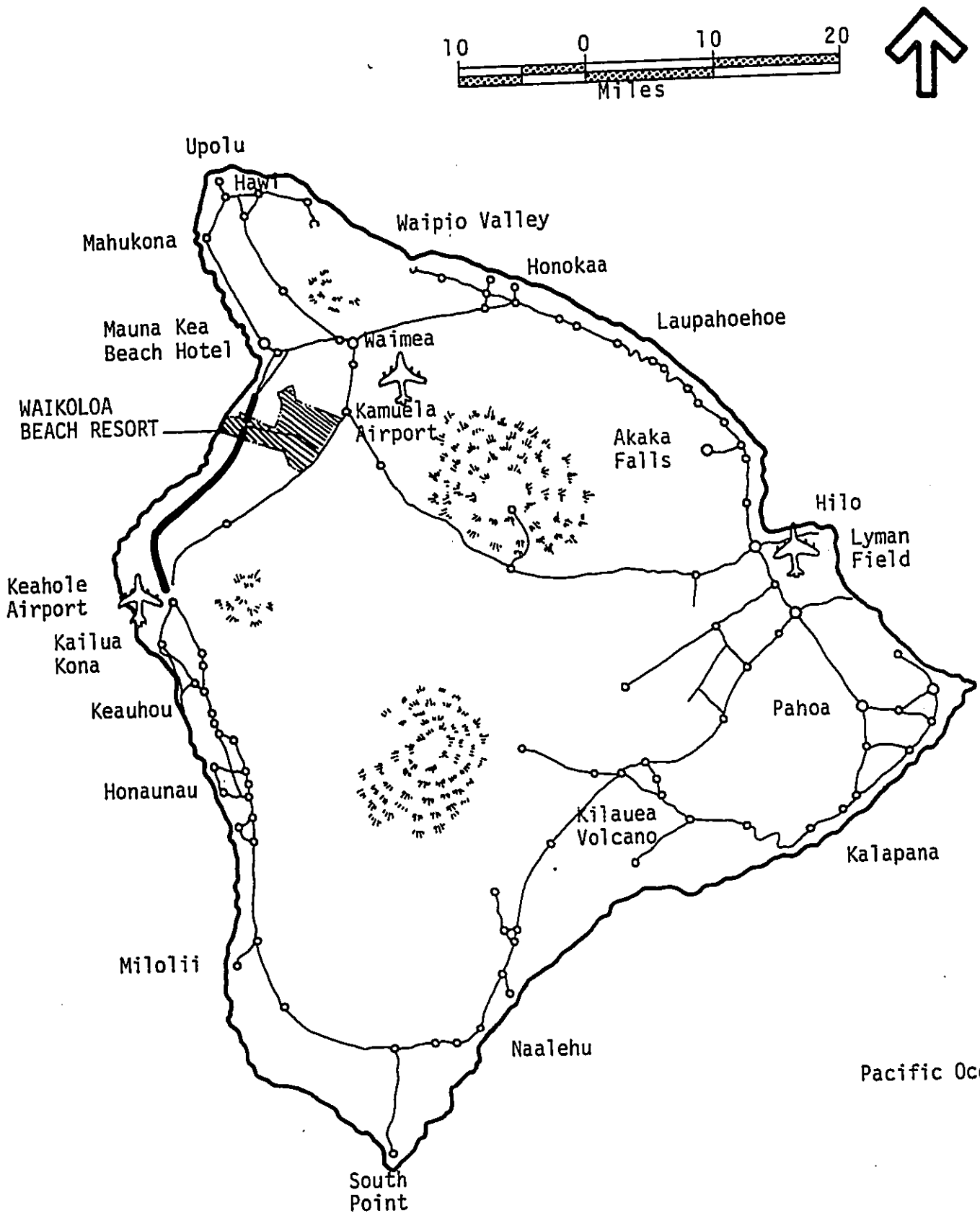
Ranch Parcels: The mauka portion of Waikoloa is divided into large (800 acres on the average) ranch parcels. Some of these have been sold.

Open Space: A permanent open recreation space of 10,000 acres surrounds the village and the urban reserve area.

Unplanned Reserve: An unplanned reserve of 4,725 acres extends in a narrow belt from the village down to the Waikoloa Beach Resort area, part of which is included in the plan for the WBR.

Roads have already been constructed connecting the village and the resort; these are being dedicated to the County of Hawai'i. Electricity and telephone lines are installed underground for the first subdivision unit of the village and the village commercial center. Overhead transmission lines will be completed to the beach resort area. Individual cesspools have been approved for single family homes in the village and a sewage treatment system for the condominium and commercial areas in the village has been installed. Water is now available from two high elevation wells at approximately two million gallons per day. A water distribution system has been constructed within the village and a transmission main to the beach resort area is in place.

FIGURE A
WAIKOLOA BEACH RESORT
SITE LOCATION MAP



2. The Relationship of Waikoloa to the Region

Waikoloa is located in South Kohala on the west side of the Island of Hawai'i. The area is approximately nine miles southwest of the ranching community of Waimea and approximately 24 miles north of Kailua-Kona.

As shown in Figure B, the Waikoloa area is bordered on the south by land owned by the State of Hawai'i, on the west by the Pacific Ocean and on the east by Parker Ranch land. The Parker Ranch also borders a portion of the north boundary, as does the State, Thomas Nakahara and Mauna Loa Land, Inc.

Two coastal resort areas are located north of 'Anaeho'omalu. One, the Mauna Kea Beach Resort, has 310 hotel rooms, a golf course, tennis courts and single family home sites along the golf course fairways. The other, Mauna Loa Land, Inc.'s Kalahuipua'a Resort, is in the planning stage. It will have one luxury hotel, 50 condominium units and a golf course in its first increment, planned for 1978.

Access to the region is provided by the Mamalahoa Highway, the Waimea-Kawaihae Road and the Queen Ka'ahumanu Highway, recently completed by the State of Hawai'i, along the coast. Ke-ahole Airport is about 16 miles to the south on the Queen Ka'ahumanu Highway; the Waimea-Kohala Airport is located about the same distance to the northeast at Waimea and an auxiliary landing field is located at 'Upolu Point in North Kohala. A major deep water and recreational harbor is eight miles to the north at Kawaihae.

3. The Waikoloa Beach Resort Development Concept

'Anaeho'omalu Bay is a natural oasis featuring a white sand beach and two fishponds set against black, unweathered lava. It is Boise's intent to extend the natural vegetation around the ponds to form a landscaped setting for carefully scaled resort hotels and resort residential areas focusing on the natural ponds and beach area. The natural amenities of the area will be enhanced by the addition of a championship golf course, a small boat harbor and a series of developed archaeological sites.

Four primary hotel sites are oriented so that their focal point becomes the pond and beach area. Two additional hotel sites focus around Waiulua Bay.

The majority of the resort residential areas will be clustered along the edges of the 18-hole golf course to take advantage of the extension of the oasis atmosphere afforded by the golf course landscaping. The shorelines between 'Anaeho'omalu and Waiulua Bays features indigenous tide pools and beach plants. These will be incorporated into a major pedestrian activity link to connect the series of coastal hotel sites into a unified entity.

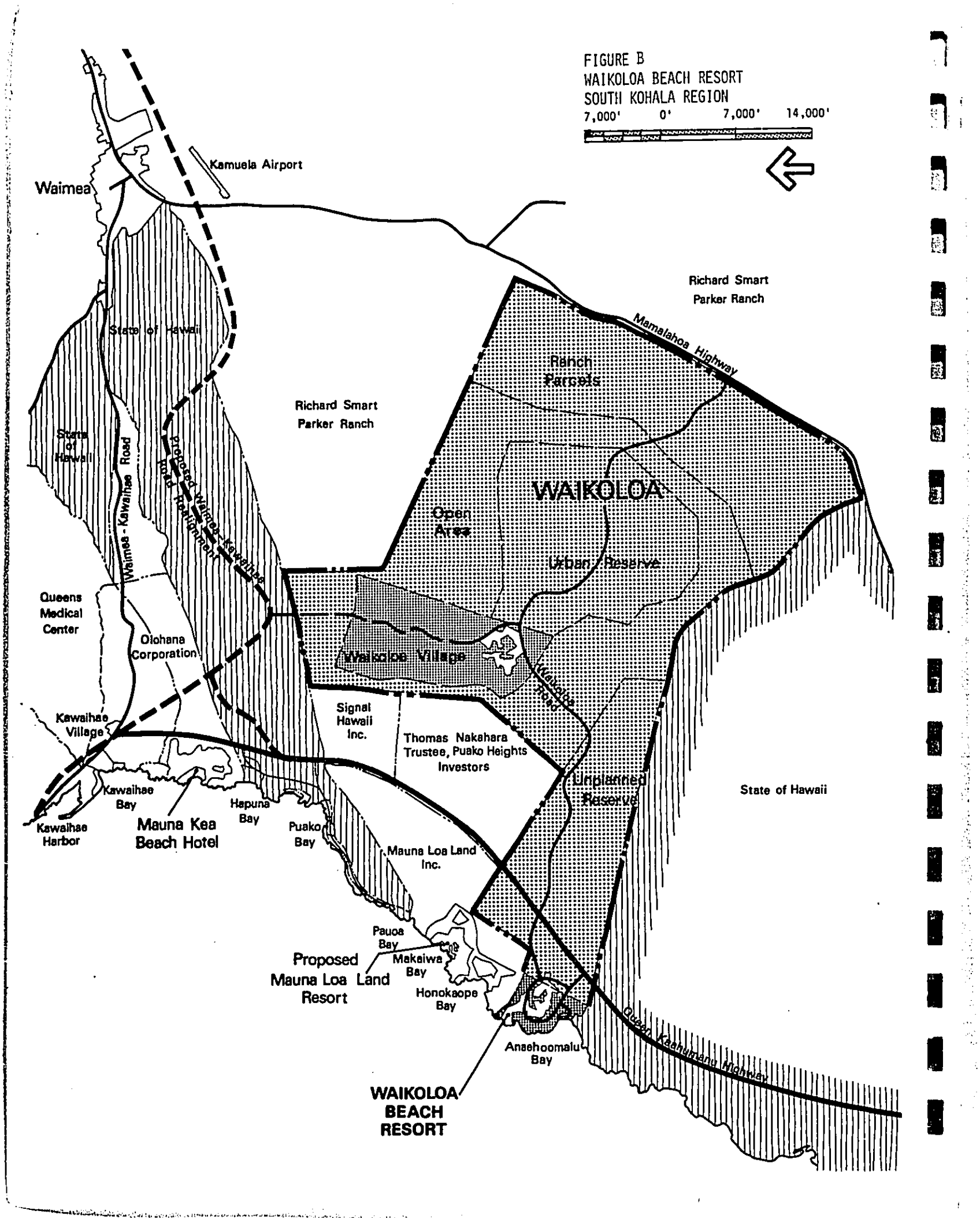


FIGURE B
WAIKOLOA BEACH RESORT
SOUTH KOHALA REGION
7,000' 0' 7,000' 14,000'
Kamuela Airport
Waimea
State of Hawaii
Richard Smart
Parker Ranch
Mamalahoa Highway
Ranch
Parcels
Richard Smart
Parker Ranch
State
of
Hawaii
Waimea - Kawaihae Road
Proposed Waimea - Kawaihae Road Realignment
WAIKOLOA
Open
Area
Urban Reserve
Queens
Medical
Center
Olohana
Corporation
Waikoloa Village
Waikoloa Road
Signal
Hawaii
Inc.
Thomas Nakahara
Trustee, Puako Heights
Investors
Kawaihae
Village
Unplanned
Reserve
State of Hawaii
Kawaihae
Bay
Hapuna
Bay
Kawaihae
Harbor
Mauna Kea
Beach Hotel
Puako
Bay
Mauna Loa Land
Inc.
Pauoa
Bay
Proposed
Mauna Loa Land
Resort
Makaiwa
Bay
Honokaope
Bay
Queen Kaahumanu Highway
Anaehoomalu
Bay
WAIKOLOA
BEACH
RESORT

B. PROJECT HISTORY

The Waikoloa Beach Resort located at 'Anaeho'omalu Bay is part of Waikoloa, a planned community consisting of some 31,000 acres of land lying between the ocean and the Mamalahoa Highway, and transversed by the Queen Ka'ahumanu Highway. The land was formerly owned by Richard Smart, owner of the Parker Ranch, headquartered in Waimea.

The initial land purchase agreement was consummated on December 2, 1969. The project is divided into several major parcels.

Parcels One and Two

Parcels One and Two comprise land in the resort area adjacent to the Pacific Ocean and 'Anaeho'omalu Bay. Parcel One is 40 acres in size and zoned for hotel sites and open spaces. This parcel is immediately adjacent to the beach. Parcel Two consists of 463 acres and has been zoned for hotel, multi-family, commercial and golf course development. This area also fronts on the Pacific Ocean and lies to the north and east of Parcel One.

Parcel Four

Parcel Four consists of approximately 4,725 acres and is presently an unplanned reserve consisting of lava flow lands. This parcel lies immediately mauka of the resort area and is traversed by the Queen Ka'ahumanu Highway and by the Waikoloa Road constructed by Boise, leading from Waikoloa Village to the WBR.

Upper Lands

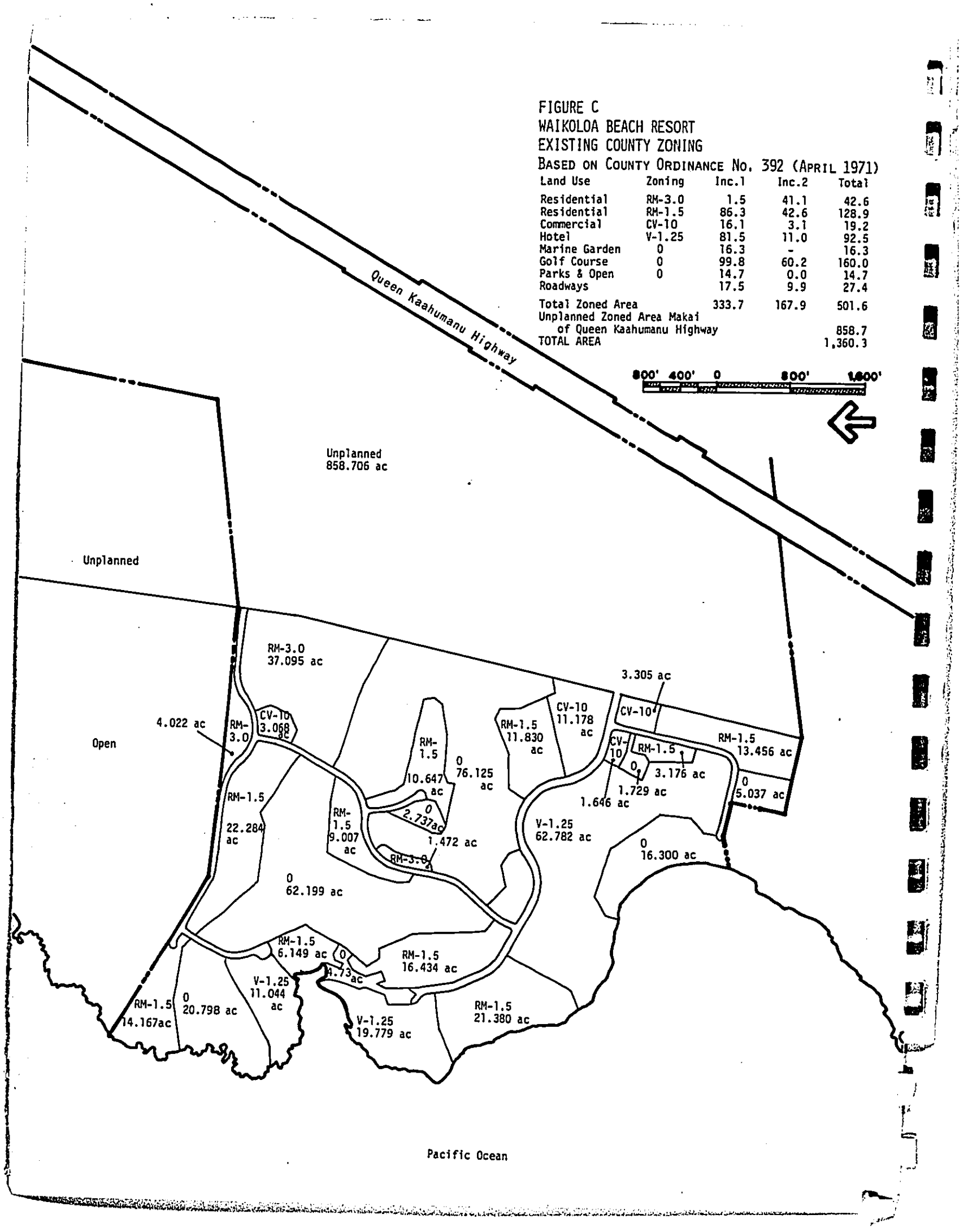
The upper lands comprise approximately 25,764 acres. They consist of 1) a recreational village including a golf course, condominiums, residential housing, clubhouse and related village and commercial facilities (approximately 2,794 acres); 2) an urban reserve (approximately 4,653 acres); 3) recreational open space surrounding the village (approximately 10,000 acres). The ranch parcels are located in the upper portion of the tract adjacent and makai of the Mamalahoa Highway. A major thoroughfare, Waikoloa Road, traverses the ranch parcels and provides access from the Mamalahoa Highway through the Waikoloa Village to the WBR.

The region has long been recognized by the State of Hawai'i and the County of Hawai'i as a major resort area. Substantial State capital improvement program projects, including the Honokahau Harbor, the Queen Ka'ahumanu Highway, the Ke-ahole Airport and the Kawaihae deep sea harbor have been completed in the past 15 years. The County of Hawai'i General Plan, completed in 1971, says in part "South Kohala's coastline, dotted with beaches and coves, is envisioned as a major resort area."

In 1968, the State Land Use Commission designated the lands of 'Anaeho'omalu as urban, in conjunction with Boise's announced intention to

FIGURE C
WAIKOLOA BEACH RESORT
EXISTING COUNTY ZONING
BASED ON COUNTY ORDINANCE No. 392 (APRIL 1971)

Land Use	Zoning	Inc.1	Inc.2	Total
Residential	RM-3.0	1.5	41.1	42.6
Residential	RM-1.5	86.3	42.6	128.9
Commercial	CV-10	16.1	3.1	19.2
Hotel	V-1.25	81.5	11.0	92.5
Marine Garden	0	16.3	-	16.3
Golf Course	0	99.8	60.2	160.0
Parks & Open	0	14.7	0.0	14.7
Roadways		17.5	9.9	27.4
Total Zoned Area		333.7	167.9	501.6
Unplanned Zoned Area Makai of Queen Kaahumanu Highway				858.7
TOTAL AREA				1,360.3



develop the WBR. At the same time, the State Land Use Commission approved the urban designation for the lands of Waikoloa Village.

The County of Hawai'i subsequently adopted amendments to the County General Plan correlating with the decisions of the State Land Use Commission. These amendments were included in the 1971 County of Hawai'i General Plan.

In December 1969, the Waikoloa Village lands were rezoned by the County of Hawai'i to multi-family, single family and commercial uses, and in April 1971, County Ordinance No. 392 provided for the zoning of the WBR in two increments. The first increment was granted zoning at the time of the ordinance passage. When building permits are issued, ground is broken and construction is commenced on permanent structures on 25 per cent of the hotel land and 15 per cent of the multi-family land in the first increment, then the zoning on the second increment shall take effect upon application to the planning department and certification by the Planning Director that the requirements have occurred. The present zoning for the WBR allows for 3,000 hotel units and approximately 4,400 condominiums as well as lands for commercial use (Figure C).

Since the initial land purchase, Boise has master planned the entire project and at the Waikoloa Village constructed an extensive system of roads, water and sewer facilities (including water source and sewage disposal facilities), a championship 18-hole golf course, a clubhouse, swimming pool, tennis courts, and equestrian center, a 38 unit condominium complex (used by both residents and transients), a village store, gas station, post office and fire department. Many of the improvements were designed and engineered to a size and standard to serve the entire Waikoloa project, especially the urban designated lands. Boise's financial investment was predicated on the long range return from the development of the entire property. Over 60 homes have been built or are under construction and Waikoloa Village has a population of over 100. The first unit of Waikoloa Village, totaling 968 single family lots, has been developed and is substantially sold. In addition approximately 5,000 acres of ranch parcels have been sold. Present zoning in the Waikoloa Village allows for an additional 4,800 single family and 1,700 multi-family units.

Waikoloa Beach Resort Phase I, subdivided into Lots One to 28, inclusive, and Lots R-1 to R-7, inclusive, was filed March 28, 1972, in File No. 1256 (Figure D).

Development of the WBR has been held up due to a cloud affecting Parcels One and Two.

The cloud was created by two lawsuits. The first suit is entitled Abraham Kulalaku McAulton vs. Richard Smart, et al., Civil No. 2172 in the Circuit Court of the Third Circuit, State of Hawai'i. McAulton claimed an undivided one-half interest on the property on the basis of his alleged ancestral tie to Queen Kalama, from whose heirs and successors Smart's ancestors acquired the property. The matter was tried before a jury which ruled in favor of Smart on May 15, 1974. McAulton has

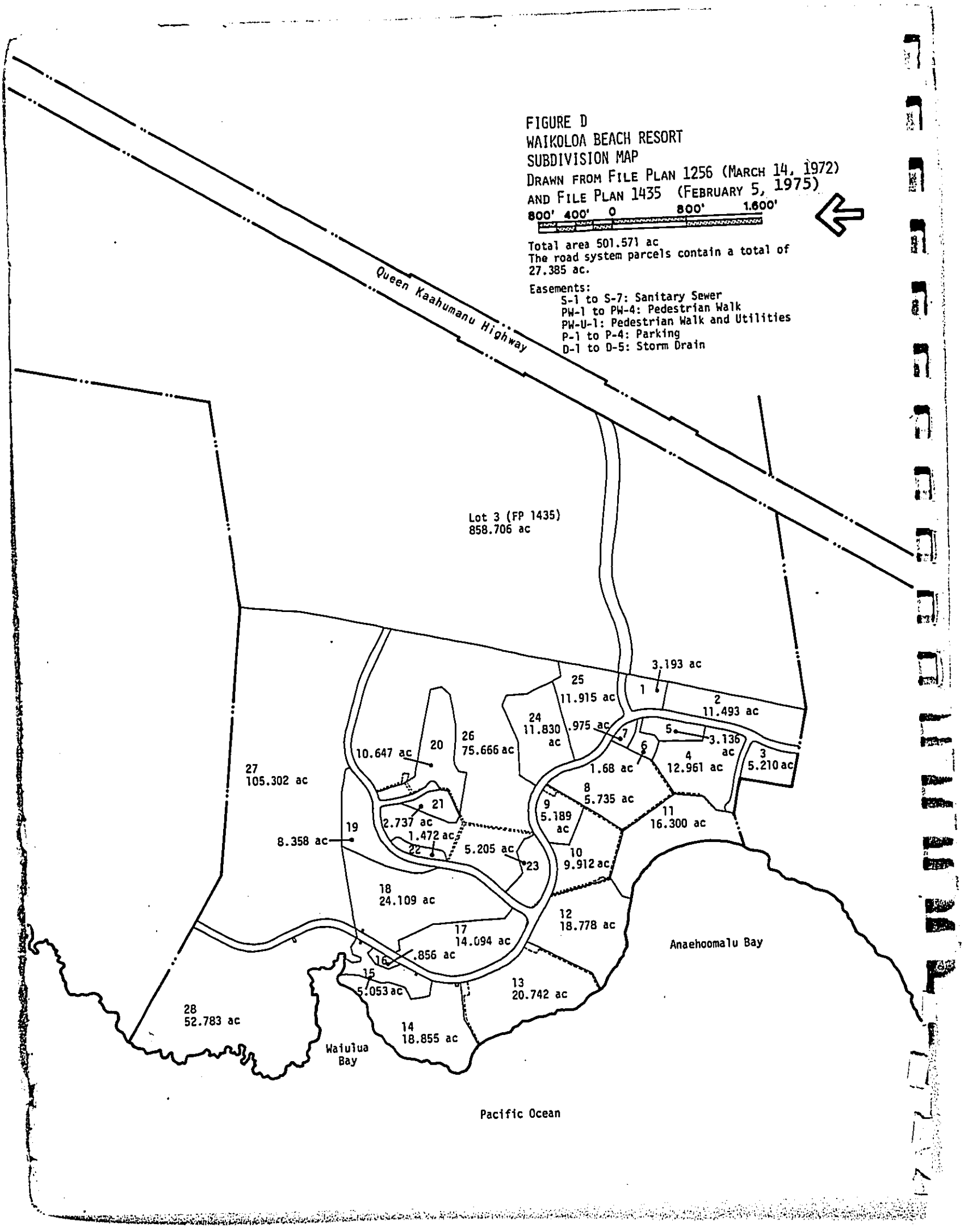


FIGURE D
WAIKOLOA BEACH RESORT
SUBDIVISION MAP
DRAWN FROM FILE PLAN 1256 (MARCH 14, 1972)
AND FILE PLAN 1435 (FEBRUARY 5, 1975)
800' 400' 0 800' 1,600'
Total area 501.571 ac
The road system parcels contain a total of 27.385 ac.
Easements:
S-1 to S-7: Sanitary Sewer
PW-1 to PW-4: Pedestrian Walk
PW-U-1: Pedestrian Walk and Utilities
P-1 to P-4: Parking
D-1 to D-5: Storm Drain
Queen Kaahumanu Highway
Lot 3 (FP 1435)
858.706 ac
1
3.193 ac
2
11.493 ac
3
5.210 ac
4
12.961 ac
5
3.136 ac
6
7
.975 ac
8
5.735 ac
9
5.189 ac
10
9.912 ac
11
16.300 ac
12
18.778 ac
13
20.742 ac
14
18.855 ac
15
5.053 ac
16
.856 ac
17
14.094 ac
18
24.109 ac
19
8.358 ac
20
10.647 ac
21
2.737 ac
22
1.472 ac
23
5.205 ac
24
11.830 ac
25
11.915 ac
26
75.666 ac
27
105.302 ac
28
52.783 ac
1.68 ac
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

appealed to the Supreme Court of Hawai'i, all briefs have been filed in that court and the case is awaiting final oral argument.

The other suit is entitled George A. K. Wilcox, et al. vs. Richard Smart, Civil No. 3400, and affects the same property. The suit was filed on June 18, 1974, in the Third Circuit Court by a group of 14 persons alleging that they have an interest in the property by virtue of their descent from the granduncle of Queen Kalama. On December 3, 1975, summary judgment was entered by the Third Circuit Court against Wilcox et al., dismissing their suit. However, the court allowed Wilcox et al. 20 days to move to amend their complaint. On Dec. 17, the attorneys for Wilcox, et al., moved to amend to claim heirship through other relatives of Queen Kalama. On Jan. 12, 1976, the court allowed the filing of a second amendment making minor modifications in the plaintiffs' allegation of heirship. Trial is expected in 1976.

As a result of the Third Circuit Court decision in the McAulton case and having been able to obtain a satisfactory title insurance policy, Boise completed the land purchase from Richard Smart in September, 1974.

During the litigation, Boise constructed a major water transmission line from the Waikoloa well field to the WBR (approximately ten miles); rough graded roads, began construction of a golf course, and undertook an extensive cleanup and rehabilitation program at 'Anaeho'omalu Beach. Two fishponds have been restored, a dangerous underwater ledge of sandstone has been removed from the beach area, the curving sand beach has been cleaned and restroom and shower facilities for public use have been completed.

A significant aspect of Waikoloa was the discovery of potable water. The original water investigation was made by John D. Fett and Associates in 1967. The first well, drilled at the 600 foot elevation and known as Parker Two, produced 7.7 gallons per minute (gpm) at 380 parts per million (ppm) chloride. The second well, drilled at the 814 foot elevation, known as Parker One, produces 700 gpm with 600 ppm chloride and is considered brackish. Parker One is being used for irrigation water for the Waikoloa Village golf course. The third well, drilled at the 1,200 foot elevation is known as Parker Five. After considerable testing on Parker Five, Parker Four was drilled at the same elevation and approximately 350 feet NW of Parker Five. Extended tests were made on Parker Four and Five in conjunction with the Hawai'i Department of Water Supply, State Division of Water and Land Development, Stephen P. Bowles - Consulting Hydrologist/Geologist, and Harold T. Stearns - Consulting Geologist. Parker Four showed an average of 665 gpm and Parker Five 656 gpm. The water quality is excellent. Both wells show 25 ppm chloride, compared with EPA maximum allowable of 250 ppm. No treatment is required.

C. PROJECT JUSTIFICATION

The Waikoloa Beach Resort, located at 'Anaeho'omalu Bay, is part of Waikoloa, a planned community containing a total of 31,000 acres of land lying between the ocean and Mamalahoa Highway, and transversed by the Queen Ka'ahumanu Highway. There are two urban designated portions of the project: an approximate 2,800 acre village complex and an approximate 500 acre resort complex. Currently available in the village complex are single family homes and lots, apartment condominiums, an 18-hole Robert Trent Jones golf course with clubhouse, swimming pool, tennis courts, equestrian facilities, and a 10,000 acre open recreation reserve set aside for hunting, riding, hiking, camping, and other outdoor recreational activities.

Boise's objective in developing the WBR is to create a viable major destination resort consistent with the objectives of the General Plan of the County of Hawai'i, (1. to provide an orderly development to accommodate the Visitor Industry; 2. to provide a resort that maximizes conveniences to its users, and 3. to ensure that the resort development maintains the social, economic, and physical environments of Hawai'i and its people), and the State Land Use Plan.

Extensive tourism growth in the South Kohala District was identified in the State Tourism Plans as a means of achieving tourism dispersion *from* O'ahu and Waikiki. Based upon recent capital improvement programs (Table I-C.1) to provide public access and services which will

Table I-C.1 PRINCIPAL GOVERNMENT INVESTMENT IN WEST HAWAI'I SINCE 1960*

Project	Government Investment (Million $)
Queen Ka'ahumanu Highway	16.00
Ke-ahole Airport	19.90
Water Resources, North Kohala	3.90
Water Resources, Waimea	4.10
Kawaihae-Hawi Highway	5.70
Waimea Airport Improvements	0.57
Honokohau Small-Boat Harbor	2.40
Kawaihae Deep-Water Harbor	1.50
Kawaihae Marina	0.06
Hapuna State Park	0.96
Spencer Park (County)	0.75
Lapakahi Historical Park (State)	0.50
Kawaihae-Honoka'a Highway Realignment (2.88 spent to date - 21.86 estimate to complete)	24.74
Total	81.08

*Source: Water in South Kohala, 'Olohana Corporation; Mauna Loa Land, Inc., EIS; Phone conversations with Charles Schuster, District Engineer, Dept. of Transportation, State of Hawai'i, and Ronald Okamura, Dept. of Parks and Recreation, County of Hawai'i.

foster resort tourist development within the South Kohala District, there can be no question that the State recognizes this area as a principal visitor destination area.

Development by the WBR has been held up due to a cloud on the title of the property. As a result of favorable jury verdict by the Third Circuit Court and the issuance of title insurance, Boise can now proceed with the WBR. Past delays have resulted in losing one hotel developer. Further delays could result in losing another hotel or possibly no development at all.

During the litigation period, Boise spent over $3 million to construct a water transmission line (approximately ten miles) from their well field to the WBR. As a result water is available now. In addition, Boise has rough graded roads, the first nine holes of an 18-hole golf course, done extensive archaeological work, restored the ancient fishponds (Kahapapa and Ku'uali'i), and done an extensive clean up of the beach including the construction of rest rooms and showers. An area inaccessible before is now enjoyed by residents of the County of Hawai'i every day. To date for land acquisition, improvements, engineering and planning, Boise has spent over $9.5 million on the WBR (over $40 million within the whole Waikoloa project). At the current interest rates, delays become very costly. The only way Boise can recuperate their investment not only in the WBR but in the entire Waikoloa project is through the development of the WBR into a viable major destination resort.

Boise is prepared to make an additional major capital expenditure at the WBR in order to get the project moving. Boise has been successful in negotiations with Princess Hotels International, who will operate the first hotel at the WBR. This hotel will be a 350-room, $30,000,000 luxury facility expanding to 400-438 rooms in the future. In addition, negotiations are underway with other international chains for a second hotel at the WBR.

The WBR is in an area designated in the Hawai'i County General Plan for major resorts. The State Land Use Plan includes the area in an urban district, available for resort development. In April 1971, Boise obtained the necessary zoning to develop the WBR.

In September 1974, Boise retained Hastings, Martin, Hallstrom and Chew, Ltd., consulting land economists, to appraise the parcels within the WBR. This appraisal was updated in August 1975. In the appraisal, they stated the following:

"Highest and Best Use

"The highest and best use is that use which may be reasonably expected to yield the highest net return to the land over a given period of time. The use must be legal and in compliance with regulations and ordinances within the police power of the County and State, including health regulations, zoning ordinances, building code requirements, etc.

"The development parcels appraised are considered to be well planned

for a recreation oriented resort and residential community. The white sand beach and ancient Hawaiian fishponds create a desirable amenity, particularly on the Island of Hawai'i which has few such natural features. The demand for hotel and multi-family zoned sites having white sand beaches make the subject parcels highly attractive and economic. Access from Ke-ahole Airport and Kailua-Kona has been further facilitated with the opening of the new Queen Ka'ahumanu State Highway. .

"In our opinion, the highest, best and most productive use of the subject property would be the ultimate development of the individual parcels in conformance with their County zonings."

An analysis of State tourism indicates a strong demand for additional visitor facilities in the State. As the market expands, the need for specifically accommodating each differentiated market segment increases. The role of the Neighbor Islands is taking on new strength in the State tourism picture as return visitors and the affluent, more and more, state their preferences for the amenities of high-quality, master-planned, and environmentally controlled destination resorts. Our research shows that this market segment is growing, and so far on the Big Island, is adequately satisfied only at the Mauna Kea Beach Hotel.

There is a concurrent need in Kohala to diversify and stabilize the economic base of the district. The tourism industry offers an excellent vehicle for accomplishing a portion of this need. Such diversification and consequent stabilization would prevent rending the community's social fabric due to market cycles and external forces beyond the control of the community itself.

The following sections discuss some characteristics of tourism, State and County tourism patterns, the market for resort facilities such as Waikoloa, and their benefits in terms of new employment opportunities and contributions to State and County revenues.

1. Demand for Tourism*

The State of Hawai'i is a destination area in the minds of a very broad segment of the overseas travel market. Its importance in the travel industry is probably greater than what its economic, cultural, and educational importance justifies. Part of this is due to constant and effective promotion; the travel of a large number of local Hawai'i residents through the mainland United States and other places; the importance of Hawai'i to the military (including Pearl Harbor); and many other factors. Its principal subdestinations are Honolulu and Waikiki, for which a semi-independent image has been developed.

The stature and importance of the State of Hawai'i can be elevated even higher in the world travel market by further development of its existing and potential subdestination areas including the creation of new ones.

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

An area must have unique aspects in order to make it more desirable or attractive than similar competitive areas.

In general, the following items must be considered when assessing the potential appeal of resort destination areas and, concomitantly, the economic viability of its development:

- -- Climate
- -- Physical characteristics
- -- Location and accessibility
- -- Man-made attractions
- -- Activities-variety and quality
- -- Facilities
- -- Market conditions and relationship
- -- Local attitude-visitor appreciation
- -- Price structure and perceived value
- -- Image
- -- Promotion
- -- Government attitude
- -- Investment climate

More particularly, specifications for the selection of tourist destination areas in Hawai'i should include the following: (1)

- -- The best possible climate in terms of sunshine, temperature, rainfall, constant (though gentle) winds, and predictable weather.
- -- An attractive environment with regard to view, indigenous flora, and setting.
- -- A minimum of at least 1,500 rooms in close proximity to each other.
- -- White sandy beaches and calm water suitable for the development of boating, water skiing, yachting, swimming, and other water sports.
- -- Adequate harbor and pier facilities for small boats.
- -- Sports facilities with a championship golf course as the most important facility.
- -- Wherever possible, the existence of established tradition and a program for the preservation, reconstruction, and restoration of historical landmarks.
- -- Shopping facilities within reasonable proximity.
- -- Adequate land available for additional development.

Climate is of particular importance. A survey of Pacific area travelers reported that 85 per cent of visitors traveling to Hawai'i and 69 per cent of those traveling beyond indicated "good climate" as Hawai'i's most favorable feature. Hawai'i's greatest assets then, are its climate, its beauty, and its people; the most undesirable are its commercialism and the high cost of transportation to the islands and the high prices ex-

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(1) "Selected Destination Areas of the World" prepared for the Hawai'i State Planning Office, 1960.

perienced once there. Selected results are shown in Table I-C.2.

Thus, it is apparent that the Kohala Coast Resort Region and WBR in particular amply satisfy the requisites for an outstanding resort destination area.

Table I-C.2 IMPRESSIONS OF HAWAI'I*
By Pacific Area Visitors

Feature	Visitors to Hawai'i Per Cent	Visitors to Hawai'i Rank	Visitors Beyond Hawai'i Per Cent	Visitors Beyond Hawai'i Rank
Favorable Features				
Good climate	85	1	69	1
Beautiful scenery	82	2	68	2
Warm, friendly people	72	3	49	3
Comfortable accommodations	64	4	48	4
Attractive customs	44	5	33	5
Exotic environment	43	6	29	6
Outstanding food	37	7	28	8
Good Shopping	36	8	22	9
Exceptional recreational facilities	33	9	29	7
Unfavorable Features				
Too commercial	28	1	30	1
High prices	25	2	26	2
High transportation costs	15	3	8	3

*Source: Pacific Area Travel Association, Pacific Visitors Survey, October 1967.

2. State of Hawai'i Tourism Industry*

Visitor Count

From 1960 to 1970, the tourist volume to the State of Hawai'i increased at an average rate of 20 per cent per year. During 1967 alone it increased by 35 per cent, including a substantial jump in the military rest and recreation (R & R) program. From 1970 to 1971, visitor arrivals to the islands were slower than normal because of general economic uncertainties, the phasing out of R & R for military personnel and Phase II economic controls. However, after 1971, the number of visitors resumed almost a 20 per cent average per year growth rate. By 1973, total overnight and longer visitors to the state were 2,630,952 up from 2,244,377 in the previous year, a gain of 17.2 per cent.

In the aftermath of the Middle East crisis in late 1973, tourism growth slowed. First fuel supplies were constrained, and now fuel prices are high. These effects are aggravating economic difficulties in many nations which are primary sources of tourism patronage to Hawai'i and during 1974, state tourism growth slowed to a 5.9 per cent gain over 1973. These trends are shown in Table I-C.3.

The average length of stay of westbound destination Hawai'i visitors increased slightly from 10.2 days in 1973 to 10.4 days in 1974, and westbound overnight and longer visitors increased slightly from 9.4 to 9.5 days.

Another important change in visitor characteristics is travel status. Prior to the past several years, about one-fourth of the westbound visitors arrived in organized tour groups, while three-fourths came on an individually arranged basis. By 1974 the percentage of Mainland visitors arriving in organized tour groups was about 47 per cent.

Visitor Expenditures

Visitor expenditures are estimated to be the largest source of income to the state. In 1969, visitors spent $525,000,000. By 1974 this figure had increased to $1,070,000,000, a gain of over 100 per cent during the five year period. Reduced airline fares and packaged tour programs of short durations increased the volume of tourism activity and reduced average visitor expenditures. As indicated in Table I-C.4 the average per tourist expenditure decreased from $442 in 1960 to $384 in 1974. In 1974, the average visitor expenditure was 13 per cent greater than in 1973. Part of this gain, however, was likely due to inflationary effects.

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table I-C.3

VISITOR TRENDS
State of Hawai'i

Year	Overnight and Longer Visitors	Annual Percentage Increase	Westbound Visitors	Eastbound Visitors
1950	46,583	--	N.A.	N.A.
1955	109,798	18.7%	98,105	11,693
1960	296,517	22.0	250,795	45,722
1961	319,807	7.9	248,540	71,267
1962	362,145	13.2	279,625	82,520
1963	429,140	18.5	332,680	96,460
1964	563,925	31.4	460,290	103,635
1965	686,298	21.8	567,218	119,710
1966	835,456	21.6	686,886	148,570
1967	1,124,818	34.6	893,103	231,715
1968	1,314,571	16.8	1,015,844	298,727
1969	1,527,012	16.2	1,181,029	345,983
1970	1,798,591	17.8	1,377,756	420,835
1971	1,818,944	1.1	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

Source: Hawai'i Visitors Bureau.

Table I-C.4 VISITOR EXPENDITURES*
State of Hawai'i

Year	Visitor Expenditures (million)	Expenditure Per Visitor
1960	$ 131.0	$442
1961	137.0	428
1962	154.0	425
1963	186.0	433
1964	205.0	364
1965	225.0	328
1966	280.0	335
1967	380.0	338
1968	440.0	335
1969	525.0	344
1970	570.0	317
1971	645.0	355
1972	755.0	336
1973	890.0	338
1974	1,070.0	384

*Source: Hawai'i Visitors Bureau.

Hotel Room Inventory

In Hawai'i most of the hotel facilities are designed to accommodate tourists visiting the state; for example, in 1974, 93 per cent of westbound visitors in Hawai'i indicated that the purpose of their visit was pleasure, business and pleasure, or to attend a convention, and 91 per cent indicated they intended to stay in hotels.

As seen in Table I-C.5, most of the visitor plant facilities are located in Waikiki, on the Island of O'ahu. A dramatic increase in the number of visitor rooms occurred between 1967 and 1971 when nearly 16,700 new rooms, almost double the 1967 inventory, were added over the four year period. Since then, however, the rate of increase has been very small with most of the new units being added on the Neighbor Islands.

This effective dispersion of rooms from Waikiki is indicated by the decline in the proportion of rooms in Waikiki since 1963. During that year, Waikiki contained 91 per cent of the visitor rooms on the Island of O'ahu and approximately 74 per cent of those in the entire state. By 1974, the proportion of O'ahu rooms in Waikiki had declined to 86 per cent and the proportion in the entire state to 55 per cent.

New hotel units recently completed or scheduled for completion on O'ahu within the next year, include the Hyatt Regency Waikiki, 1,260 rooms, in the Hemmeter Center Phase II with a reported completion date in 1976, the 210 room expansion of the International Inn (now known as the Ramada Inn) completed in late 1975 and Hale Koa, at Fort DeRussy, completed in late 1975, with 416 units, but only available for military personnel. On Kaua'i an additional 172 rooms are under con-

Table I-C.5 VISITOR ROOMS[1] IN HAWAI'I 1963 - 1974[2]

Year	O'ahu Waikiki	O'ahu Off Waikiki	Hawai'i	Kaua'i	Maui	Moloka'i	Lana'i	Total
1963	8,383	820	742	596	821	33	8	11,403
1964	9,013	1,018	865	776	1,190	33	8	12,903
1965	9,531	1,552	1,387	860	1,456	33	8	14,827
1966	10,728	1,870	1,790	1,115	1,625	81	8	17,217
1967	11,390	1,776	2,188	1,260	1,910	123	10	18,657
1968	13,966	2,026	2,480	1,914	2,285	120	10	22,801
1969	16,590	1,859	3,166	2,565	2,643	89	11	26,923
1970	18,452	2,765	3,486	2,609	2,940	60	11	30,323
1971	21,483	3,129	3,980	2,699	3,942	105	11	35,349
1972	21,540	3,568	4,796	2,629	3,976	88	11	36,608
1973	21,843	3,522	5,234	2,868	5,109	88	11	38,675
1974	21,812	3,540	5,348	3,102	5,731	88	11	39,632

[1] Includes apartment-hotels and condominium apartments reported available for rent.
[2] As of following February of year indicated.
Source: Hawai'i Visitors Bureau.

struction at the Kaua'i Surf. In Hilo, the Hilo Hawaiian Hotel with 290 rooms has been completed, and 59 rooms in the Pacific Polynesian Hotel are under construction. The new King Kamehameha Hotel in Kailua-Kona has 460 rooms, replacing the old 114-room hotel. The Maui Intercontinental has opened at Wailea on Maui with an ultimate 600 rooms planned. Additional units for transient use are expected in the form of rental condominiums, but we have not included them in this inventory of proposed new hotel rooms.

Room Rate and Occupancy Trends

In response to expanding tourism to the state, Hawai'i's hotel industry added capacity to meet the increased demand, and between 1967 and 1971, added more than the existing market demand could effectively support. Also, in 1971, the condition of excessive supply was aggravated by a substantial slacking in tourism caused largely by an economic slowdown on the U.S. Mainland and a reduction in R & R activity.

These events weakened the hotel industry's performance from 1967 to 1971. Since then, performance has improved. Table I-C.6 shows the percentage occupancy of hotels by island from 1963 through 1974. In Waikiki, occupancies increased continually from 1963 to a peak in about 1967, but declined drastically to 58.9 per cent by 1971. Since then, the addition of new rooms has slowed, and occupancy levels have recovered.

Neighbor Island hotel occupancy has followed the same general pattern, except for the Big Island of Hawai'i which peaked in 1968 but has de-

clined since then. Although visitor traffic is up on the Big Island, new projects, mainly condominiums, added have outpaced tourism growth, continuing an oversupply situation. Hotel occupancy on Maui dipped in 1974 due mainly to the addition of 1,100 units, again mostly rental condominiums, during the year.

Table I-C.6 PERCENTAGE OCCUPANCY OF HOTEL ROOMS IN HAWAI'I BY ISLAND* 1963 to 1974

Year	O'ahu(1) Large(2)	O'ahu(1) Small(3)	Hawai'i	Kaua'i	Maui
1963	79.2%	75.6%	69.6%	65.4%	62.7%
1964	78.4	77.8	70.1	72.3	65.9
1965	82.6	81.6	71.9	71.0	63.9
1966	86.2	81.6	68.7	71.1	63.5
1967	90.8	89.8	71.3	79.4	71.1
1968	91.0	84.1	78.4	75.8	71.6
1969	81.9(4)	79.3(5)	76.4	62.5	67.1
1970	74.1(6)		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

(1)Waikiki Hotels
(2)100 rooms or more
(3)Less than 100 rooms
(4)125 rooms or more
(5)Less than 125 rooms
(6)Occupancy figure consolidated in 1970
*Source: Hawai'i Visitors Bureau.

Data published by the Hawai'i Visitors Bureau and the Hawai'i Hotel Association show that the hotel room rates generally follow changes in occupancy. Using the composite occupancy rate in Waikiki hotels as an indicator of the statewide rate, Table I-C.7 shows how occupancy increased to a high in 1967, declined to a low in 1971, and began recovering in 1972. The corresponding average daily room rates gained until 1970 before softening. Even after occupancies recovered in 1972, average daily room rates continued downward. However, average room rates rebounded in 1973 and increased dramatically in 1974.

Occupancies in Waikiki hotels are returning to the traditionally high levels achieved before the enormous infusion of rooms began in about 1968. Room rates are also increasing and are returning to prior levels if the inflationary effects on currency values are included. Excluding inflation, rates are below previous peaks.

Table I-C.7 OCCUPANCY RATES IN WAIKIKI HOTELS AND AVERAGE DAILY ROOM RATES OF HAWAI'I HOTELS 1964 - 1974

Year	Occupancy of Waikiki Hotels(1)	Average Daily Room Rate-Hawai'i Hotels
1964	72.8	$17.75
1965	82.6	18.83
1966	86.0	20.15
1967	90.8	21.34
1968	91.0	22.69
1969	81.9	23.98
1970	74.1	25.74
1971	58.9	24.28
1972	70.0	21.11
1973	81.5	21.99
1974	82.0	24.61

(1) Large hotels only until 1970.
Source: Hawai'i Visitors Bureau, Hawai'i Hotel Association

Selected State Tourism Trends

Table I-C.8 shows trends in selected characteristics of state tourists since about 1965 as reported by Hawai'i Visitors Bureau reports. This period encompasses the 1967-1970 period during which military R & R traffic increased substantially for both military personnel traveling eastbound and their dependents traveling westbound.

Analysis indicates that military dependents consisted mainly of females in the 20-29 age group who were making their first visit, stayed less than 12 days and traveled alone. Subjectively backing out military dependents reveals that the characteristics of westbound visitors to the state have changed surprisingly little since 1965.

For example, comparing visitor characteristics in 1965 to those in 1974 shows that size of party has increased slightly from 1.61 to 1.72; age delineations indicate 20-29 year old visitors increased slightly from 14 per cent to 17 per cent and 30-49 year old visitors declined from 38 per cent to 35 per cent, and other age groups remained about the same proportion; the median age declined slightly from 45.2 to 44.1 years; the male-female ratio changed from 45.55 to 44.56 per cent; a greater proportion stayed seven to twelve days and fewer stayed longer so that the average length of stay dropped from 11.8 days to 10.4 days; pleasure travel increased from 75 to 78 per cent, being offset partially by the decline in business travel from 5 to 3 per cent; persons staying in hotels and hotel apartments increased to 91.4 per cent from 90.1 per cent; hardly any change in the occupation of the visitors occurred except that the "business, managers, and officials" category dropped from 29 per cent to 26 per cent while retirees gained from 11 per cent to 12 per cent; and the percentage of first time visitors decreased from 68 to 63 per cent and repeat visitors increased from 32 to 37 per cent.

Table I-C.8
(Page 1)

TRENDS IN SELECTED VISITOR[1] CHARACTERISTICS
State of Hawaii
1965 - 1974

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
TRAVEL STATUS										
Organized Tour Group, %				29.9	27.7	21.9	27.2	41.3	45.4	47.2
Individual Basis, %				69.4	71.4	77.5	72.2	58.1	54.1	52.3
Government-Military, %				0.7	0.9	0.6	0.6	0.6	0.5	0.5
Total, %				100.0	100.0	100.0	100.0	100.0	100.0	100.0
SIZE OF PARTY										
Persons Per Party	1.61	1.58	1.55	1.52	1.53	1.55	1.61	1.71	1.69	1.72
AGE										
Under 20, %	9.2	8.6	10.6	11.3	12.2	11.6	10.8	9.0	10.2	9.9
20 - 29, %	14.0	14.7	19.1	22.0	22.4	22.9	19.7	16.7	17.1	16.8
30 - 49, %	38.2	37.9	34.8	33.2	33.3	34.0	34.7	35.9	34.9	35.4
50 - 59, %	22.7	22.5	20.6	19.3	18.7	18.9	20.9	23.0	22.2	22.5
60 and older, %	15.9	16.3	14.9	14.2	13.4	12.6	13.9	15.4	15.6	15.4
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Median Age	45.2	45.3	38.4	41.7	40.1	40.7	42.6	44.7	44.0	44.1
SEX										
Male, %	44.7	44.4	40.5	38.7	39.0	39.9	42.5	44.5	43.2	44.1
Female, %	55.3	55.6	59.5	61.3	61.0	60.1	57.5	55.5	56.8	55.9
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table I-C.8
(Page 2)

TRENDS IN SELECTED VISITOR(1) CHARACTERISTICS
State of Hawai'i
1965 - 1974

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
LENGTH OF STAY										
1 - 6 Days, %	9.7	10.8	9.0	9.3	11.4	14.3	15.9	10.6	10.6	10.2
7 - 12 Days, %	45.1	46.8	52.4	53.3	53.2	55.7	50.9	58.1	60.4	60.9
13 - 18 Days, %	33.9	30.9	28.5	28.4	26.0	23.8	26.7	25.7	23.4	23.7
19+ Days, %	11.3	11.5	10.1	9.0	9.4	6.2	6.5	5.6	5.6	5.2
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Average Stay, Days	11.8	11.5	11.2	11.1	10.9	10.3	10.5	10.6	10.4	10.4
PURPOSE OF TRIP										
Pleasure, %	75.2	71.6	74.9	76.8	72.9	74.6	76.0	77.4	78.3	78.2
Business, %	5.4	5.5	4.1	3.8	4.6	3.8	3.4	2.8	2.6	2.9
Business & Pleasure, %	11.0	10.2	9.3	8.6	9.5	9.9	9.1	9.5	8.7	10.1
Military & Government, %	1.2	1.0	0.9	0.7	0.9	0.6	0.6	0.5	0.5	0.5
Relatives, %	4.9	5.3	6.0	5.8	6.5	6.3	6.3	4.9	4.7	3.6
Convention, %	1.7	5.7	4.4	3.7	5.1	4.5	4.3	4.8	5.0	4.5
Other, %	0.6	0.7	0.4	0.6	0.5	0.3	0.3	0.1	0.2	0.2
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
ACCOMMODATIONS										
Hotel or Apt.-Hotel, %	90.1	87.1	84.9	84.6	83.2	84.2	84.9	89.0	89.3	91.4
Rented Home or Apt., %	0.3	0.8	0.8	0.7	1.2	0.8	1.0	1.0	0.7	0.6
Friends or Relatives, %	7.6	10.1	11.6	11.8	12.9	12.6	12.2	8.8	8.6	6.7
Other, %	2.0	2.0	2.7	2.9	2.7	2.4	1.9	1.2	1.4	1.3
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table I-C.8
(Page 3)

TRENDS IN SELECTED VISITOR(1) CHARACTERISTICS
State of Hawai'i
1965 - 1974

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
OCCUPATION										
Professional & Technical, %	31.7	31.8	29.4	26.9	26.2	27.9	30.4	33.0	32.1	32.9
Business, Managerial, Official, %	29.2	28.1	22.9	21.4	22.1	21.6	23.8	25.9	24.3	26.4
Clerical, Office, Sales, %	13.1	12.3	12.5	12.3	11.4	12.2	12.2	11.8	12.5	11.7
Military & Dependents, %	1.7	2.6	10.0	14.2	15.1	13.7	6.8	2.3	1.3	1.2
Other Employed, %	6.2	6.1	6.1	6.2	6.4	7.2	7.6	7.9	8.4	8.0
Retired, %	10.7	11.0	9.6	8.9	8.4	7.6	9.7	11.6	12.5	11.7
Students & Non-Employed, %	7.4	8.1	9.5	10.1	10.4	9.8	9.5	7.5	8.9	8.1
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
TRIPS TO HAWAII										
First Trip Visitors, Party Heads	161,000	189,000	286,000	353,000	369,000	483,000	447,000	554,000	661,000	649,000
Repeat Visitors, Party Heads	75,000	89,000	117,000	141,000	163,000	236,000	256,000	299,000	347,000	452,000
First Trip, %	68.3	67.8	71.0	71.5	69.4	67.2	63.6	64.8	65.6	62.7
Second Trip, %	14.1	14.3	13.3	13.1	13.7	14.7	15.9	15.8	15.1	16.2
Third Trip, %	5.7	5.7	5.1	5.0	5.1	5.6	6.5	6.2	6.1	6.7
Fourth+ Trip, %	11.9	12.2	10.6	10.4	11.8	12.5	14.0	13.2	13.2	14.4
Total, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Repeat Visitors, %	31.7	32.1	29.0	28.5	30.6	32.8	36.4	35.1	34.4	37.3

Table I-C.8
(Page 4)

TRENDS IN SELECTED VISITOR[1] CHARACTERISTICS
State of Hawaii
1965 - 1974

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
ORIGIN										
California, %	45.7	39.7	36.5	34.2	33.4	33.4	32.0	27.7	25.5	24.4
Other Pacific Coast, %	8.6	8.7	8.2	7.6	8.3	8.6	9.1	9.2	8.8	8.9
Mountain, %	5.7	5.2	5.1	5.1	5.3	5.7	5.7	5.6	5.1	4.9
Central, %	21.4	24.1	25.8	26.9	27.6	26.7	27.8	28.7	29.3	30.5
Atlantic, %	16.8	19.5	22.8	24.6	23.8	20.0	19.0	20.9	22.9	21.5
Total, U.S.	98.2	97.2	98.4	98.4	98.4	94.4	93.6	92.1	91.6	90.2
Canada, %	1.3	2.3	1.1	1.2	1.1	5.0	5.7	7.1	7.7	8.9
Other Foreign, %	0.5	0.5	0.5	0.4	0.5	0.6	0.7	0.8	0.7	0.9
Total All Visitors, %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table I-C.8
(Page 5)

TRENDS IN SELECTED VISITOR[1] CHARACTERISTICS
State of Hawaii
1965 - 1975

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
INCOME											
Median Family Income											
First Quarter							$15,900	$19,600	$20,300	$22,100	$23,200
Second Quarter						$12,700	$13,700	$17,500	$18,100	$19,400	
Third Quarter						$13,100	$14,000	$16,900	$15,900	$18,100	
Fourth Quarter						$15,100	$15,700	$18,700	$20,200	$20,900	
Percent Over $15,000											
First Quarter							52.7	64.6	66.2	74.0	75.7
Second Quarter						38.0	43.1	58.5	60.4	66.3	
Third Quarter						40.3	44.4	56.8	53.2	60.5	
Fourth Quarter						50.2	52.2	62.8	67.6	70.3	
Percent Over $25,000											
First Quarter							23.9	33.0	35.4	39.9	44.4
Second Quarter						13.4	14.1	25.0	26.8	29.4	
Third Quarter						13.0	16.0	21.0	17.9	26.2	
Fourth Quarter						23.7	20.9	28.0	34.0	35.8	

(1) Westbound visitors destined to Hawaii and staying overnight or longer.

Source: Hawaii Visitors Bureau Research Reports and Visitor Reaction Surveys.

Travel status changed measurably with persons on organized tour groups increasing from 30 per cent to 47 per cent. Visitor origin also showed significant changes with California dropping from 46 per cent of the total to 24 per cent in 1974, being offset by gains from the Central states (21 per cent to 31 per cent), the Atlantic states (17 per cent to 22 per cent), and Canada (1 per cent to 9 per cent).

Yet, despite the relatively consistent characteristics, income has increased substantially. For instance, median family income for visitors traveling in the first quarter gained from $15,900 in 1971 to $23,200 for 1975. This relatively high rate of gain has been observed for visitors in almost all quarters except the third quarter in 1973. Median family income dropped from $16,900 in 1972 to $15,900 in 1973, but then regained to $18,100 in the third quarter of 1974.

Thus, it appears that Hawai'i's visitors, despite the changes in travel status and location of residence, still have about the same characteristics as they had in 1965 - they just have higher family incomes.

Hawai'i Visitor Industry Forecast

It is difficult to forecast trends in economic activities which grow at the startling rates experienced by the Hawai'i visitor industry in recent years. There are, however, several factors which appear significant regarding past growth, and likely to influence future prospects. These are:

- -- economic growth on the Mainland,
- -- high employment levels resulting in high levels of disposable income,
- -- overall population growth,
- -- general increases in vacation and leisure time,
- -- economic expansion in the Far East,
- -- greater interest in long distance travel,
- -- gains in transportation technology.

During the 1960's all of these factors operated in such fashions to favor increased long distance travel. Hawai'i shared in the benefits of these trends. More recently, world monetary conditions have made foreign travel by U.S. residents more expensive so that domestic travel will likely be stimulated. At the same time, travel to the U.S. by foreign residents has become cheaper enhancing the prospects of the Hawai'i visitor industry. Recent world events have caused a great deal of uncertainty about the outlook for Hawai'i tourism, and it still may be too soon to fully assess the impact of the fuel shortages and fuel price increases. Two major sources of state tourism are the U.S. Mainland and Japan, and the effects of the fuel situation on their economies will influence the state's tourism prospects. Additionally, fuel costs and shortages could affect the ability of the transportation industry to transport visitors to the state.

With these concerns in mind, an investigation of the fuel shortage impact on the Hawai'i tourist industry was undertaken. It revealed that Hawai'i may be benefiting from the restricted supply of fuel. There

seems to be continuing and strong favorable attitudes toward travel. As gasoline becomes more expensive, predisposed travelers are shifting their transportation modes to long haul commercial carriers, and traveling to comprehensive destination areas. The concentration of visitor facilities, nearby recreation amenities, and a well organized ground transportation system have made Hawai'i a more desirable destination area. Thus, while overall travel may shrink as a result of economic uncertainties and higher travel costs, Hawai'i seems to be attracting increments diverting from other destination areas such as Europe and from the vacation segment traditionally traveling by automobile. In fact, travel was down to most destination areas in 1975; whereas, in Hawai'i, visitations in 1975 were about the same as in 1974. Were it not for the strike against the major air carrier in December 1975, tourism to Hawai'i in 1975 would have been up slightly.

As a result of our investigations, we see a continuation of Hawai'i's tourism growth but at a decreasing rate.

Based upon our assessment that economic conditions on the U.S. Mainland and in Japan has stabilized, and the U.S. economy began rebounding about mid 1975, we expect the visitor count in 1976 to be up from five to eight per cent.

From 1975 to 1990, the growth rate is expected to be six, five, and three per cent per year respectively for each five year period as seen in Table I-C.9. This average growth in tourism of 4.6 per cent per year to 1990 conforms closely with the State's proposed policy of achieving a five per cent per year growth rate.

Table I-C.9 FORECAST OF OVERNIGHT VISITORS* TO STATE OF HAWAI'I 1975 - 1990

Year	Westbound	Eastbound	Total
1975	2,180,000	620,000	2,800,000
1980	2,800,000	1,000,000	3,800,000
1985	3,400,000	1,400,000	4,800,000
1990	3,800,000	1,700,000	5,500,000

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Occupancy levels usually reflect the balance of demand to supply forces. In light of a forecast of increased visitations and a slackening of supply, the balance is getting healthier.

Pressures resulting from intensified demands are measured in terms of price levels. That is, as market pressures increase, average room rates correspondingly will gain. This phenomenon is already apparent from Table I-C.7 which showed that as market pressures subsided (demand factors decreasing relative to supply causing a reduction in occupancy levels) room rates dropped. And, now that occupancies are recovering, room rates are rebounding too.

Thus, the combined forces of continually increasing demand and lack of corresponding new supply will create additional pressures in the Hawai'i hotel market resulting both in increased occupancies and higher average daily room rates.

Since few hotel rooms are being constructed to meet rising demand, resort condominiums have been utilized increasingly as transient accommodations.

3. County of Hawai'i Tourism Industry*

Visitor Count

Tourism to the Neighbor Islands in general has increased faster than tourism to the state as a whole. This stems from extensive promotion of inter-island tour packages, more repeat visitors who prefer Neighbor Island amenities, additional recreational facilities to attract visitors and more facilities available to accommodate them.

Table I-C.10, shows the proportion of westbound visitors to Hawai'i staying overnight or longer who indicated an intention of visiting the Neighbor Islands. The proportions shown represent all westbound visitors staying overnight and longer, including those destined to Hawai'i and those traveling beyond Hawai'i. As seen, the proportion intending to visit the Big Island of Hawai'i increased from 35.8 per cent in 1965 to a high of 40.9 per cent in 1969. The proportion declined to 36.7 per cent in 1973, and then rose slightly in 1974 to 36.8 per cent. In contrast, the proportion intending to visit Maui increased from 37.2 per cent in 1965 to 42.2 per cent in 1974. This increased penetration into the total State visitor market is attributed to the enhanced quality and quantity of visitor plant facilities on Maui, stimulated by development of the Ka'anapali Beach Resort in the early 1960's. Visitations to Kaua'i on the other hand fluctuated between about 34 and 36 per cent until 1972, and then dropped to 29.8 per cent in 1974.

In early 1973, the Hawai'i Visitors Bureau completed a survey among Japanese visitors to the state. It was determined at that time that approximately 43 per cent had visited the Big Island of Hawai'i. Assuming that a smaller proportion of all eastbound visitors did, we estimate that approximately 40 per cent of total eastbound visitors visited the Big Island in 1973 as well as in 1974.

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 I-C.11. As seen, estimated westbound visitors increased from 203,000 in 1965 to 804,000 by 1974, or a fourfold increase. The table also shows our forecasted capture of the state market to 1990. Although the share of westbound visitors has declined slightly over the last few years, we anticipate that the proportion of westbound visitors to Hawai'i County will increase during the period to 1990. This assessment reflects anticipated efforts to divert tourism from Waikiki and O'ahu to the Neighbor Islands, preference for Neighbor Island amenities by the increasing number of repeat visitors to the state and the expected addition of new visitor facilities on the island. As seen from the table, we expect the number of westbound Big Island visitors to double from an estimated level of 807,000 in 1975 to 1,634,000 by 1990.

An increasing proportion of eastbound visitors is also expected to visit Hawai'i County for the same reasons indicated for westbound visitors.

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Figure E

TOURISM ESTIMATES AND FORECASTS
County of Hawaii
1965 - 1990

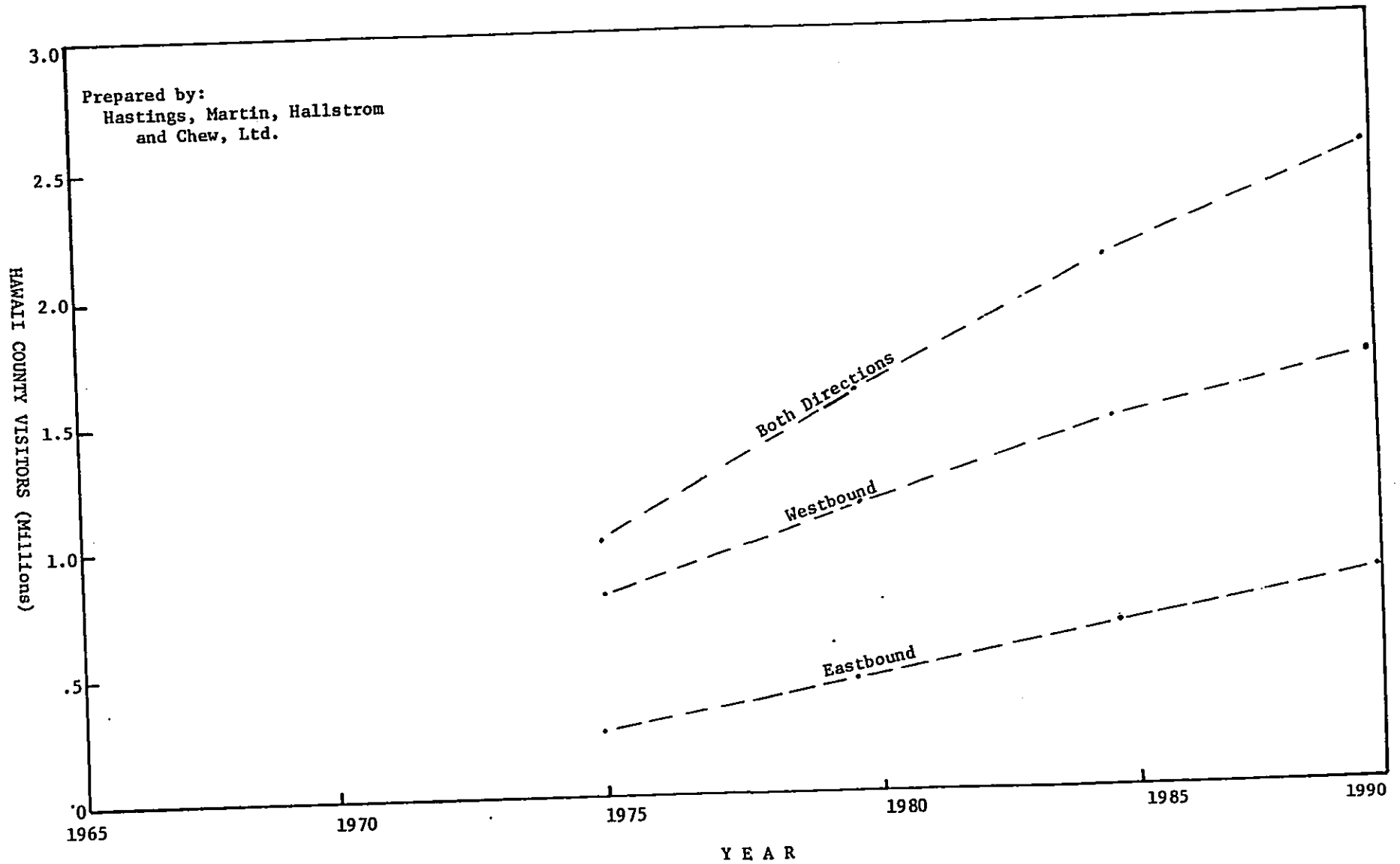

Table I-C.10 ESTIMATED NEIGHBOR ISLAND TOURISM(1)
Westbound Visitors Indication Intention to Visit Neighbor Islands
1965 - 1974

Year	Estimated Percentages		
	To Hawai'i	To Maui	To Kaua'i
1965	35.8%	37.2%	36.4%
1966	34.5	35.6	34.2
1967	36.3	38.6	34.9
1968	40.6	40.0	36.0
1969	40.9	39.4	36.2
1970	37.1	37.3	34.3
1971	39.8	42.3	36.0
1972	39.2	43.7	34.8
1973	36.7	40.6	31.2
1974	36.8	42.2	29.8

(1)Westbound visitors staying overnight and longer, including visitors destined to Hawai'i and those traveling beyond Hawai'i.
Source: Hawai'i Visitors Bureau, Annual Research Reports. Hastings, Martin, Hallstrom and Chew, Ltd.

In addition, we anticipate an increasing tendency to provide Neighbor Island facilities catering to the Japanese visitor. Whereas in Waikiki many of the transient accommodations cater to the Japanese mode of travel, on the Neighbor Islands where space is more plentiful, we anticipate the recreation facilities will be provided to accommodate the Japanese manner of participation in recreation on a large group basis. The number of golf courses and other amenities planned or likely in the South Kohala District supports this assessment. As a result, eastbound traffic should increase faster, and we forecast an increase in eastbound visitors to the island of 3.3 times, from a level of 241,000 in 1974 to 799,000 by 1990. Combined eastbound and westbound travel to the island is projected to increase from 1,059,000 in 1975 to 2,443,000 by 1990. Figure E shows graphically the trends to the number of visitors to the Big Island and our forecast to 1990.

An indication of relative tourism growth is shown in Table I-C.12. Forecasts are converted to indices using 1975 as the base year, and show the ratio of projected tourism in a particular year to the level recorded in 1975. For example, westbound visitors to the state will increase 1.74 times, eastbound 2.74 times, and both directions 1.96 times. By comparison, westbound visitors to Hawai'i County will increase by 2.02 times, eastbound by 3.17 times, and both directions by 2.31 times. Thus Hawai'i County tourism is expected to gain faster than the state as a whole.

Characteristics of Hawai'i County Tourism

The Big Island of Hawai'i 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, the only active volcanoes in the nation, massive lava fields, the only producing coffee in-

Table I-C.11 TOURISM ESTIMATES AND FORECASTS
County of Hawai'i
1965 - 1990

Year	Westbound Per Cent of State	Westbound Estimated Visitors	Eastbound[1] Per Cent of State	Eastbound[1] Estimated Visitors	Both Directions[2] Estimated Visitors
1965	35.8	203,000	--	--	--
1966	34.5	237,000	--	--	--
1967	36.3	369,000	--	--	--
1968	40.6	412,000	--	--	--
1969	40.9	483,000	--	--	--
1970	37.1	511,000	--	--	--
1971	39.8	569,000	--	--	--
1972	39.2	699,000	--	--	--
1973	36.7	759,000	40	225,000	986,000
1974	36.8	804,000	40	241,000	1,045,000
1975[3]	37.0	807,000	41	252,000	1,059,000
Forecast:					
1980	40	1,120,000	43	430,000	1,550,000
1985	42	1,428,000	45	630,000	2,058,000
1990	43	1,634,000	47	799,000	2,443,000

(1) 1973 and 1974 estimate based upon survey of Japanese visitors. Not estimated prior to 1973.
(2) Westbound only until 1973.
(3) Estimated.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

dustry in the United States, the largest orchid industry in the country, the largest privately owned working ranch in the nation, black sand beaches, white sand beaches, lava rock coastlines, one national park and two national historical parks, rain forests, waterfalls, deserts and a number of historical areas. Typical tours to the Big Island consist of a number of sightseeing trips. For example, one day is usually spent visiting the volcanoes and perhaps the black sand beaches in Puna and Ka'u. Another trip might include the historical sites and areas and coffee processing facilities in South Kona. Other trips would include sightseeing in and about Kailua-Kona and the City of Hilo.

Table I-C.12 INDEX(1) OF THE TOURISM GROWTH
State of Hawai'i and County of Hawai'i
1975 - 1990

	State of Hawai'i			County of Hawai'i		
Year	Westbound	Eastbound	Both Directions	Westbound	Eastbound	Both Directions
1975	1.00	1.00	1.00	1.00	1.00	1.00
1980	1.28	1.61	1.36	1.39	1.71	1.46
1985	1.56	2.26	1.71	1.77	2.50	1.94
1990	1.47	2.74	1.96	2.02	3.17	2.31

(1) Ratio of tourism to base year of 1975.
Source: Hastings, Martin, Hallstom and Chew, Ltd.

The popularity of the Big Island for sightseeing is reflected by the attendance figures presented in Table I-C.13 of selected state attractions. As seen, the Hawai'i Volcanoes National Park registered the largest attendance of any attraction in the state in 1973 except for the Honolulu Zoo on O'ahu where attendance figures include a large number of local residents. Excluding the Honolulu Zoo, the Hawai'i Volcanoes National Park registered over 20 per cent more visitors than the next most attended attraction, the U.S.S. Arizona Memorial in Pearl Harbor on O'ahu. Furthermore, the Big Island contained three of the state's four national park system facilities: the Hawai'i Volcanoes National Park, City of Refuge National Historical Park and the Pu'ukohola Heiau National Historic Site. The only other national park in the state is Haleakala National Park which registered fewer visitors than the City of Refuge in 1973. The level of visitations to the Hawai'i Volcanoes 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 and visits by residents of other islands.

Inquiries among visitor industry representatives include that many of the trips to the Big Island consist of an average stay of about 2.5 days consisting of either: (1) entry at Hilo with quick visits to the volcanoes, the black sand beaches in Puna and Ka'u, historic areas of South Kona and then departure from Kona, or vice versa; or (2) very quick sightseeing trips to Hilo to see the volcanoes and returning on the same day.

Only a limited number of destination resort areas with self-contained

recreation, amusement and entertainment facilities have been developed on the Big Island. These include mainly Keauhou-Kona south of Kailua-Kona, the Mauna Kea Beach Resort and the Kona Village at Ka'upulehu. Other areas under development are Waikoloa in South Kohala, and Sea Mountain at Ninole being developed by C. Brewer.

Although there are only limited active recreation facilities in either Hilo or Kailua-Kona, these two areas contain most of the visitor plant facilities on the island. Table I-C.14, shows the distribution of visitor accommodations and occupied units calculated from average occupancy figures provided by the Hawai'i Visitors Bureau.

Table I-C.13 ATTENDANCE(1) AT SELECTED STATE ATTRACTIONS By Island - 1974

Island and Attraction	Attendance
O'ahu	
Honolulu Zoo	1,089,657
U.S.S. Arizona Memorial	1,049,454
'Iolani Palace State Monument(2)	745,000
Polynesian Cultural Center	700,000
Sea Life Park	530,000
Mormon Temple Grounds, La'ie	361,347
Waikiki Aquarium	299,300
Paradise Park	247,389
Maui	
Haleakala National Park	441,251
Hawai'i	
Hawai'i Volcanoes National Park	1,613,050
City of Refuge National Historical Park	241,880

(1) Those with attendance over 200,000.
(2) Visits in 1973. Visits in 1974 were down due to restoration work.
Source: State of Hawai'i, Department of Planning and Economic Development, 1975 Data Book.

From 1965 to 1974, the total number of hotel units in the county increased from 1,387 almost four-fold to a level of 5,348 by 1974. Occupied rooms, however, increased slower, by a factor of 3.24 times during the same period. Meanwhile tourism to the state in both directions increased by a factor of 4.06 indicating that the County of Hawai'i did not achieve its proportional share of growth as measured by occupied rooms. This is despite the fact that visitors to the island probably increased at a more rapid pace than to the state as a whole.

Table I-C.14 also shows the distribution of hotel units around the island and points out that in 1965 Kona accounted for 62.9 per cent of the total units. After completion of the Mauna Kea Beach Hotel in 1966 and expansion in 1968, the proportion of rooms in Kona declined to 45.8 per cent of the county total. Since then, new additions in Kona have raised that proportion to 57.1 per cent, or still not as high as its proportion in 1965. Meanwhile the proportion of rooms in Hilo increased from 30.8

Table I-C.14

DISTRIBUTION OF VISITOR PLANT INVENTORY
County of Hawai'i
1965 - 1974(1)

Location	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
TOTAL UNITS										
Hilo	427	656	850	939	1,328	1,345	1,547	1,817	1,782	1,850
% of County	30.8	36.6	38.8	37.9	41.9	38.6	36.5	37.9	34.0	34.6
Kona	873	888	1,074	1,170	1,449	1,752	2,306	2,582	3,009	3,055
% of County	62.9	49.6	49.1	47.2	45.8	50.3	54.4	53.8	57.5	57.1
Other	87	246	264	371	389	389	388	397	443	443
% of County	6.3	13.8	12.1	14.9	12.3	11.1	9.1	8.3	8.5	8.3
Total County	1,387	1,790	2,188	2,480	3,166	3,486	4,241	4,796	5,234	5,348
% of County	100.0	100.0	100.0	100.0	200.0	100.0	100.0	100.0	100.0	100.0
OCCUPIED UNITS										
Hilo - Average Occupancy	68.6	60.5	60.1	76.9	76.2	69.0	63.6	65.1	63.2	60.6
- Occupied Units	293	397	511	722	1,012	928	984	1,183	1,126	1,121
- % of County	29.0	33.4	32.8	37.1	41.8	39.0	36.9	39.8	34.5	34.2
Kona - Average Occupancy	77.1	75.9	80.8	79.2	75.8	67.5	60.8	57.8	60.3	59.2
- Occupied Units	673	674	868	927	1,098	1,183	1,402	1,492	1,814	1,809
- % of County	66.6	56.7	55.6	47.7	45.4	49.7	52.5	50.3	55.6	55.3
Other - Average Occupancy	50.8	48.1	68.6	79.5	79.4	69.4	72.7	74.1	72.5	77.5
- Occupied Units	44	118	181	295	309	270	282	294	321	343
- % of County	4.4	9.9	11.6	15.2	12.8	11.3	10.6	9.9	9.9	10.5
County - Average Occupancy	72.8	66.4	71.3	78.4	76.4	68.3	62.9	61.9	62.3	61.2
- Occupied Units	1,010	1,189	1,560	1,944	2,419	2,381	2,668	2,969	3,261	3,273
- % of County	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(1) Approximately end of year figures.
Source: Hawai'i Visitors Bureau, Annual Research Reports.
Hastings, Martin, Hallstrom and Chew, Ltd.

per cent in 1965 to a peak of 41.9 per cent in 1969 upon the completion of projects along Banyan Drive, but subsequently declined to 34.6 per cent in 1974. Approximately the same distributions applied on an occupied room basis.

More visitors to Hawai'i County than to the state travel as members of organized groups. This results from most Neighbor Island visitors traveling for pleasure; whereas, a larger share of visitors to the state are traveling for other purposes, such as business, military, visiting relatives, and so forth. Thus, while the distribution of travelers to the state in 1974 was about 47 per cent group travelers and 53 per cent independent, we estimate that visitors to Hawai'i County were the reverse of this, or 53 per cent group travelers and 47 per cent independent.

The choice of accommodations by travelers depends upon travel status and the characteristics of the accommodations. Investigations have shown that occupancy in Kona, for example, ranged from 100 per cent independent travelers in older and smaller apartment-hotels, to a low of about 20 per cent in larger, newer facilities designed and programmed for large volumes of group visitors. In general, the occupancy of newer Kona hotels comprised about 60 per cent group travelers; while older hotels, with their traditions, attract return visitors and achieve a patronage consisting of about 60 to 80 per cent independent travelers.

A high volume of group travelers is a relative new phenomenon for Hawai'i. Given the current trends in mode travel, however, the proportion of group travelers is projected to continue increasing.

Nevertheless, there is still a large component of independent travelers. Given the rising affluence of the visitor, the increasing number of return visitors, and increasing preference for the Neighbor Island environment, there will likely be a growing need for high quality resort accommodations and facilities on the Big Island as well as facilities to serve group travelers.

The seasonality of tourism to the Island can be observed from the monthly occupancy rates shown in Table I-C.15. Occupancies in Kailua-Kona generally exceed those in Hilo in winter and are less in summer. Hotels outside Kona and Hilo consistently have higher occupancy rates than those in the two major visitor centers.

Almost all visitors to the Island arrive by air. Hilo is the State's only other gateway outside of Honolulu and is served by five overseas airlines. Three have daily service and two have either weekly or twice a week service. In addition, charters are permitted to land in Hilo. In view of current expansions at General Lyman Field, it is likely to remain the primary facility on the Island; and it is unlikely that Ke-ahole Airport will expand in the near future to handle overseas flights or chartered flights. General Lyman Field in Hilo is capable of accommodating Boeing 747 and stretch DC-8 aircraft. Besides Hilo, the Big Island is served by two other airports, capable of handling inter-island carriers utilizing DC-9 and Boeing 737 aircraft. The other two are Ke-ahole Airport serving Kona and South Kohala, and Waimea-Kohala Airport. Even including O'ahu, the Island of Hawai'i is the only island having

Table I-C.15 OCCUPANCY IN HOTELS BY MONTH*
Island of Hawai'i - 1974

	Kailua-Kona	Hilo	Other	Island Average
January	51.4	48.4	79.1	52.9
February	75.1	66.5	82.3	72.8
March	69.2	66.3	85.0	69.5
April	53.8	58.7	81.8	57.8
May	56.6	61.7	77.7	60.2
June	55.9	65.9	67.0	60.3
July	66.5	69.7	73.0	68.1
August	69.9	71.9	88.0	72.1
September	47.9	55.1	71.8	52.4
October	61.5	64.4	77.5	63.9
November	53.2	53.3	77.7	55.4
December	47.5	45.2	69.3	48.5
Year	59.0	60.6	77.5	61.2

*Source: Hawai'i Visitors Bureau, Annual Research Report.

more than one airport handling scheduled airlines.

Excluding chartered buses, the primary sources of ground transportation from the airports to hotels are rental automobiles and limousine service.

4. Demand for Transient Accommodations*

The market for transient accommodations in Hawai'i has expanded dramatically due to the explosive growth of State tourism. Furthermore, even though the general characteristics of visitors have not changed drastically over the last ten years, each delineated market segment has grown sufficiently to support a wide variety of accommodations, and recreation and amusement facilities.

As mentioned already, 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 recent temporary setbacks), expanding population and increasing predispositions to travel. Furthermore, improvements in transportation technology have reduced travel time requirements so that areas considered remote in the past are now readily accessible. Transportation technology has also reduced costs, permitting large numbers of persons previously constrained by financial requirements to participate in travel. By expanding both the geographic dimensions of the market and reducing travel costs, transportation improvements per se have substantially broadened the market area from which patronage can be drawn. Larger market area dimensions has also multiplied the number of tourist areas competing for the traveler and his expenditures. Thus, competition for visitors and patronage has intensified.

Long distance travel has not been limited to vacationers or tourists. Advances made in the travel industry have contributed to making all persons more mobile so that other activities such as geographically diversified business operations are now more easily accommodated.

The transient accommodations market is part of the travel industry since the basic source of demand for transient accommodations derive from the propensity to travel. In general, travel may be delineated into two general categories as follows:

Terminal

- Vacationers wishing to spend several days or more in the locality.
- Business travelers visiting facilities or person in the vicinity.
- Group meetings or conventions.
- Friends and relatives visiting residents in the surrounding community.
- Guests attracted by local events or special activities in the areas.

Transient

- Business travelers passing through.
- Touring vacationers passing through.

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

- Persons on private errands passing through.

Each of these broad categories can be delineated further. For example, vacationers staying in the area may be independent travelers, travelers on a packaged program, or members of a large organized group with a series of planned activities. Further, they may be intending to participate mainly in activities which are integral with lodging facilities, or they may be intending to participate mainly in activities away from their lodging. Segmenting the categories shows that each classification of vacationers will have different requirements for type of accommodations and associated amenities. The characteristics of the vicinity may even dictate the segment most likely attracted. Each of the other general categories can be delineated similarly.

Thus, the transient accommodations market is highly segmented with each specific category having different requirements. In a sense this allows operators to either focus attention on capturing a narrow segment of the market, or attempt to cater to all segments, but with a potential loss of efficiency.

Market segmentation also allows facilities catering to different classifications of patrons to co-exist in an area so long as each segment is of an economic size. Aggregations of facilities in a single area adds to its cumulative attraction. This increases the likely draw to the area and makes more viable each of the operating entities within the market system. Variety, quality and quantity of both amenities and facilities are all very important when trying to merchandise transient accommodations to broad market segments.

An example of market segmentation would be the marketing program planned by the Waikoloa Princess Hotel. Management of the Princess plans to draw to the area, not from the area, by catering to high quality conventions such as the AMA, insurance executives and corporate conferences. They also plan to attract the individual traveler through travel agents and through the other Princess Hotels in Mexico, Bermuda, the Bahamas, Portugal and San Francisco. (Appendix 1).

Methodology

Market analysis is accomplished by comparing factors of demand with factors of supply. This is done first by evaluating the determinants of historical patterns of demand and then projecting Statewide demand. State demand is delineated by analyzing the relative attractions of each Island, and their 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 or within a particular island, a current and anticipated inventory of facilities in competitive regions 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 meas-

uring imbalances between anticipated supply conditions and delineated forecasts of demand.

Supply Factors

From a preceding discussion of Big Island tourism, it was shown that there are only two large concentrations of hotel rooms on the Island, Hilo and Kona. Only a modest number of units are located outside these two areas, and most of these are in the South Kohala District, near Kawaihae and Puako.

Hilo Hotel Supply

The role that Hilo has played in Big Island tourism has been mainly one of accommodating overnight visitors who are beginning or concluding their visit to the island. Tourism also received a boost when General Lyman Field was expanded to handle direct flights from the Mainland, making Hilo the State's second gateway or departure point. Major stimulation occurred also in 1968 and 1969 when "hotel row" along Banyan Drive began developing, and all major hotels have been built since then.

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 visitor attractions are within a radius of 30 miles. These sights include the Hawai'i Volcanoes National Park, Kalapana Black Sand Beach, orchid nurseries, macadamia nut plants, Rainbow and 'Akaka Falls, Boiling Pots and the Lyman House Memorial Museum.

The major cause of this visitor pattern is probably the lack of the "Sun, Surf and Sand" requisite of Hawai'i resort regions. The high incident of rainfall, 137 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 region.

A breakdown of Hilo's hotel inventory by price range is shown in Table I-C.16. As seen, the largest proportion of rooms are priced under $20 per night. Further, only two hotels are priced in the first class range between $30 and $39 per night, and none are priced above $40 per night.

Kona Hotel Supply

Kona's role in the Island's tourism infrastructure 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 limited. Few of the transient accommodations contained a full range of resort amenities.

Table I-C. 16

DELINEATION OF TRANSIENT ACCOMMODATIONS BY PRICE RANGE(1)
Hilo, Hawaii - 1975

Hotel	Units	Less Than $20.00	$20.00-$24.00	$25.00-$29.00	$30.00-$34.00	$35.00-$39.00	$40.00 +	Amenities
Cresent Manor	30	30	-	-	-	-	-	TV, R, CL, SP
Dolphin Bay Hotel	17	17	-	-	-	-	-	-
Hilo Bay Hotel	120	120	-	-	-	-	-	AC, TV, R, CL, SP, SH, MR, O
Hilo Hotel	57	57	-	-	-	-	-	AC (part), TV, R, CL, SP, MR
Hilo Hukilau	139	139	-	-	-	-	-	R, CL, SP, SH
Hilo Lagoon	421	-	421	-	-	-	-	AC, R, CL, SP, SH, MR
Hotel Palm Terrace	37	37	-	-	-	-	-	R, CL
Iolani Hotel	19	19	-	-	-	-	-	-
Kaleimoni	4	4	-	-	-	-	-	-
Lehua Apartment/Hotel	20	20	-	-	-	-	-	-
Naniloa Surf	388	-	-	-	-	388	-	AC, TV, R, CL, SP, SH, MR, O
Orchid Island Hotel	117	-	-	117	-	-	-	AC, TV, R, CL, SP, SH, MR, O
Polynesian Pacific Hotel	12	12	-	-	-	-	-	TV, SP, O
Rainbow Hotel	20	20	-	-	-	-	-	AC (part)
Travelodge at Hilo	149	-	-	149	-	-	-	AC, TV, R, CL, SP, MR, O
Waiakea Village	298	-	-	-	298	-	-	AC, TV, R, CL, SP, SH, MR
Total Rooms	1,848	475	421	266	298	388	-	
Percent of Total	100.0	25.7	22.8	14.4	16.1	21.0	-	

(1) Published rates for double occupancy superior room.

Amenities:
- AC = Air Conditioning
- SP = Swimming Pool
- TV = Television
- R = Restaurant
- CL = Cocktail Lounge
- MR = Meeting Rooms
- SH = Shops On-Site
- O = Oceanfront Location

Source: Hawaii Hotel Guide; Hawaii Visitors Bureau "Visitor Plant Inventory"; Hastings, Martin, Hallstrom and Chew, Ltd.

Table I-C. 17

DELINEATION OF TRANSIENT ACCOMMODATIONS BY PRICE RANGE(1)
Kona, Hawaii - 1975

	Units	Used As Transient Accommodations	Less Than $20.00	$20.00-$24.00	$25.00-$29.00	$30.00-$34.00	$35.00-$39.00	$40.00 +	Amenities
Hotel									
Hotel King Kamehameha	-	460	-	-	-	-	460	-	AC, R, CL, SP, SH, MR, O, PS, E
Islander Inn	-	185	-	185	-	-	-	-	AC (part), R, CL, SP, SH, PS
Keauhou Beach Hotel	-	314	-	-	-	-	314	-	AC, TV, R, CL, SP, GC, SH, MR, O, E
Kona Hilton	-	452	-	-	452	-	-	-	AC, R, CL, SP, SH, MR, O, PS, E
Kona Hotel	-	11	11	-	-	-	-	-	R
Kona Hukilau Hotel	-	104	104	-	-	-	-	-	AC (part), R, CL, SP, SH, MR, PS
Kona Inn	-	222	-	-	222	-	-	-	AC, R, CL, SP, SH, MR, O, PS, E
Kona Lagoon	-	436	-	-	436	-	-	-	AC, R, CL, SP, TC, MR, O, E
Kona Plantation Hotel	-	20	-	-	-	-	20	-	CL, SP, PS
Kona Seaside	-	126	-	126	-	-	-	-	AC, TV, SP, PS
Kona Sunset Hotel	-	25	25	-	-	-	-	-	R, CL, SP, PS
Kona Surf	-	550	-	-	-	-	-	550	AC, TV, R, CL, SP, GC, TC, SH, MR, O, E
Kona Tiki Hotel	-	15	15	-	-	-	-	-	SP, O
Kona Village Resort	-	70	-	-	-	(Full American Plan)		70	R, CL, SP, SH, MR, O
Manago Hotel	-	49	49	-	-	-	-	-	R, CL, MR
Teshima's Inn	-	10	10	-	-	-	-	-	R, CL, MR
Total Hotel	-	3,049	214	311	1,110	-	794	620	
Percent Distribution		100.0	7.0	10.2	36.5	-	26.0	20.3	
Apartment/Townhouse									
Casa De Emdeko	106	57	-	-	-	-	57	-	AC, SP, O
Hale Kona Kai	120	15	-	-	-	15	-	-	AC, SP, O
Kailua Village Apartments	64	28	28	-	-	-	-	-	SP
Kalanikai Apartment/Hotel	24	24	24	-	-	-	-	-	AC (part), SP, PS
Keauhou Resort Condominium	48	33	-	-	-	-	33	-	TV (part), SP, GC
Kona Alii Condominium	70	70	-	-	-	-	-	70	AC, TV, R, CL, SP, TC, SH, MR, PS
Kona Riviera Villa	13	13	-	-	13	-	-	-	AC (part), SP, O
Kona Shores Condominium	79	70	-	70	-	-	-	-	AC (part), TV (part), SP, O
Kona White Sands Hotel	10	8	8	-	-	-	-	-	-
Malia Kai	20	18	-	18	-	-	-	-	SP
Total Apartment/Townhouse	554	336	60	88	13	15	90	70	
Percent Distribution		100.0	17.8	26.2	3.9	4.5	26.8	20.8	
TOTAL ALL UNITS		3,385	274	399	1,123	15	884	690	
Percent Distribution		100.0	8.1	11.8	33.2	0.4	26.1	20.4	

(1) Published rates for double occupancy superior room for hotels, and one bedroom units for apartment/townhouses per night.

Amenities:
- AC = Air Conditioning
- SP = Swimming Pool
- TV = Television
- R = Restaurant
- CL = Cocktail Lounge
- MR = Meeting Rooms
- SH = Shops On-Site
- TC = Tennis Courts
- GC = Golf Course
- O = Oceanfront Location
- PS = Proximity to Shopping, Restaurants, etc.
- E = Entertainment

Source: Hawaii Hotel Guide; Hawaii Visitors Bureau "Visitor Plant Inventory"; Hastings, Martin, Hallstrom and Chew, Ltd.

Later as tourism expanded, the character of the visitor to Kona, and Kona itself, changed. The area became one not so much for visitors intending to remain in the area for the duration of their vacation, but rather one of a convenient stopping place for visitors on their around the Island sightseeing trips. Recently, additions have included destination resort projects such as Keauhou-Kona Resort Community and Kona Village Resort away from Kailua-Kona. Many of these newer facilities contain a full range of amenities directed toward the visitor with preferences for more active recreation and for more extensive entertainment.

In Table I-C.17, the transient accommodations available in Kona are delineated by current price ranges and their associated amenities. The comparison also shows apartment and townhouses available in the pool of transient accommodation.

As seen from the table, there is a broad spread of accommodations by price range from those under $20 per night for double occupancy to the Kona Village Resort with prices of $80 to $125 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 higher priced. There are a few exceptions, however. For example, the Kona Lagoon has a fairly complete range of amenities and yet is in a middle price range. The highest priced facilities are in resort destination areas, and include the Keauhou Beach Hotel, the Kona Surf in the Keauhou-Kona Resort Community and Kona Village Resort. The table indicates that over one-third of the hotel accommodations are in the highest price category of over $30 per night for double occupancy. Almost half of the rooms are in the middle upper price ranges, and only a small number are in the lowest price ranges.

Apartment hotels show a slightly different pattern with a larger proportion in the lowest price range, and a large proportion in the highest price range with only a limited number in between. Of the apartment townhouse projects in the highest price range, one is located in Keauhou-Kona Resort Community. Another is located on the waterfront, and another is located in the town of Kailua. We understand that the occupancy of these projects in the highest price range has been relatively low except for the one located in the planned resort area.

Larger hotels are located in the planned resort area. Of the six having over 200 rooms, three are located in Keauhou-Kona Resort Community. Approximately 43 per cent of the hotel rooms in Kona are located in the planned resort area.

An agreement was reached recently between Bishop Estate and Troy V. Post that could result in construction of another 1,100 hotel rooms, golf course, executive retreat and other amenities in Keauhou-Kona over the next 10 to 15 years. The agreement is conditional upon occupancy reaching 75 per cent in the existing three hotels in Keauhou-Kona. A tennis center is currently under construction.

Table I-C. 18

DELINEATION OF TRANSIENT ACCOMMODATIONS BY PRICE RANGE(1)
South Kohala District, Island of Hawaii, Hawaii - 1975

	Units	Used As Transient Accommodations	Less Than $20.00	$20.00-$24.00	$25.00-$29.00	$30.00-$34.00	$35.00-$39.00	$40.00 +	Amenities
Hotel									
Kamuela Inn	-	19	19	-	-	-	-	-	-
Mauna Kea Beach Hotel	-	310	-	-	-	(Modified American Plan)		310	AC, R, CL, SP, GC, TC, SH, MR, O
Waimea Village Inn	-	40	-	-	40	-	-	-	R, C, SH
Total Hotel	-	369	19		40	-	-	310	
Percent Distribution		100.0	5.1	10.8	-	-	-	84.1	
Apartment/Townhouse									
Puako Beach Resort Apts.(2)	-	27	-	-	-	27	-	-	-
Waikoloa Village(3)	-	21	-	21	-	-	-	-	R, CL, SP, GC, TC, Stable
Total Apartment/Townhouse	-	48	-	21	-	27	-	-	
Percent Distribution		100.0	-	43.8	-	56.2	-	-	
TOTAL ALL UNITS		417	19	21	40	27	-	310	
Percent Distribution		100.0	4.6	5.0	9.6	6.5	-	74.3	

(1) Published rates for double occupancy superior room for hotels.
(2) Mostly three bedroom units; rental rates estimated.
(3) Rate shown for studio units; one bedroom units rent for $30.00 per night.

Amenities:
AC = Air Conditioning
SP = Swimming Pool
R = Restaurant
CL = Cocktail Lounge
MR = Meeting Rooms
SH = Shops On-Site
TC = Tennis Courts
GC = Golf Course
O = Oceanfront Location

Source: Hawaii Hotel Guide; Hawaii Visitors Bureau "Visitor Plant Inventory"; Hastings, Martin, Hallstrom and Chew, Ltd.

South Kohala District Hotel Supply

Even though it contains the world renowned Mauna Kea Beach Hotel, the South Kohala District on the Big Island is not noted as a resort region. The Mauna Kea Beach Hotel has a reputation independently as a premier resort facility.

Selected portions of the district have the requisites of "Sun, Surf and Sand"; yet only a limited number of transient accommodations have been developed in the region. The district has the lowest recorded rainfall in the State and therefore, the highest proportion of sunny days; white sand beaches with calm swimming water; and attractive views of the ocean, the four major land masses on the island including both Mauna Kea and Mauna Loa, and Haleakala on the Island of Maui. Lack of accessibility and lack of water appear to be major reasons for the relatively low level of development. However, these barriers are now being removed.

Transient accommodations which have been developed are shown in Table I-C.18. The Mauna Kea Beach Hotel is a free-standing destination resort which began operating in 1966. The other facilities are of modest scale, and except for Waikoloa Village, appear to accommodate primarily in-transit visitors.

All are modestly priced, except for the Mauna Kea Beach Hotel. We have estimated that rates for the Puako Beach Resort Apartments are between $30 and $34 since they are mainly three bedroom units. Other than this project, the Mauna Kea Beach Hotel is the only facility in the region achieving published rates over $30 per night.

Summary of Accommodations

Table I-C.19 summarizes the primary transient accommodations on the Big Island by price range. Inventory numbers do not correspond exactly with other tabulations due to minor discrepancies between data in the Hawai'i Hotel Guide, the "Visitor Plant Inventory", and the omission of minor facilities. These differences, however, do not have a noticeable effect on our analyses.

Major projects contain a total of about 5,650 transient accommodation units, the largest number of which are located in Kona. The next largest concentration is in Hilo, and only a small proportion is currently in South Kohala.

With the exception of slight distortions in the middle range of room rates, the number of units are relatively evenly distributed among the various ranges. The largest number of units are in the $25 to $29 per night range; although the next largest grouping was in the $35 to $39 per night range. A large number are also in the $40 and over range.

Demand Factors

Previous discussion on the tourism industry for the State and Hawai'i

Table I-C.19

SUMMARY OF PRIMARY TRANSIENT ACCOMMODATIONS BY PRICE RANGE[1]
Island of Hawaii - 1975

District or Region	Units	Less Than $20.00	$20.00-$24.00	$25.00-$29.00	$30.00-$34.00	$35.00-$39.00	$40.00 +
Hilo	1,848	475	421	266	298	388	-
Kona	3,385	274	399	1,123	15	884	690
South Kohala	417	19	21	40	27	-	310
Total	5,650	768	841	1,429	340	1,272	1,000
Percent Distribution	100.0	13.6	14.9	25.3	6.0	22.5	17.7

(1) Published rates for double occupancy superior room.

Source: Hawaii Hotel Guide; Hawaii Visitors Bureau "Visitor Plant Inventory"; Hastings, Martin, Hallstrom and Chew, Ltd.

County, visitor forecasts were made for the State and delineated into projections for the County. As shown earlier, we expect State tourism to grow at an average rate of 4.6 per cent per year from 1975 to 1990, and County tourism to grow slightly faster at 5.7 per cent per year during the same period.

Underlying these projections, particularly the higher county growth rate, is the assumption the Kohala Coast Resort Region will experience substantial resort development within the next five to ten years. Addition of such facilities will enhance the competitive posture of the Island relative to others, and of the region relative to other parts of the Island. The region itself, in many respects, will be competing directly with other State resort regions, just as the Mauna Kea Beach Hotel has been doing for a number of years.

Thus, in order to delineate our previously stated demand forecasts, the potential attraction of the Kohala Coast Resort Region must be compared with other regions in the State.

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 to the Kona resort region on the Big Island. Excluded from the comparison is Princeville at Hanalei on Kaua'i since, despite its unusually beautiful scenery, it lacks the climatic conditions and high quality swimming beaches necessary to create the type of resort region which will compete effectively with the envisioned facilities in the Kohala Coast Resort Region. Hilo was excluded also because it too lacks the appropriate climatic conditions and swimming beaches. Kona was included although it lacks swimming beaches since it is the most potentially competitive area on the Island.

From Table I-C.20, it can be seen that the major Neighbor Island resort regions competing with the Kohala Coast Resort Region are Kailua to Keauhou-Kona, West Hawai'i, and Ka'anapali, Maui. The figures for hotel rooms and residential units for the Maui resort regions are understated since hotels and condominium apartments nearby, but not within the resort communities' boundaries, are not included in the estimates.

Were all the units, say within ten miles of Ka'anapali from Lahaina to Kahana included, this region would most likely contain the largest inventory of resort facilities outside of Waikiki. The resort community of Ka'anapali, itself, currently contains about 2,153 hotel units and 312 condominium apartments. It also contains two golf courses (one championship and one executive), about 20 tennis courts, a commercial town center and excellent beaches.

Following Ka'anapali, the next largest destination resort region in the state in terms of facilities is the entire area from Kailua-Kona to Keauhou-Kona in West Hawai'i. Here, the total number of hotel rooms amounts to about 2,661 rooms, and the condominium apartments number about 1,000. These include all condominium apartment units, and not just

Table I-C. 20

SUMMARY OF EXISTING AND PLANNED FACILITIES
MAJOR COMPETITIVE NEIGHBOR ISLAND RESORT REGIONS

	Hotel Rooms	Residential Units	Golf Courses	Tennis Courts	Marina	Commercial Town Center	Miles To Major Interisland Airport	Miles To Inter-Island Ferry	Historical, Cultural and Other Activities
Kohala Coast Resort Region									
Existing	369	48	2	11	1 (Kawaihae)	1	10 - 20 (Kamuela) 15 - 25 (Keahole)	2 - 10 (Kawaihae)	Puukohola Heiau National Historic Site, Petroglyph King's Trail, Burial Caves, Riding Stable, Spencer Beach Park, Hapuna Beach State Recreation Area, excellent beaches, hunting, fishing.
Impending (1)	1,700-2,000	800-1,500	3	15-30	1 (Anaehoomalu)	2			
Total (2)	2,100-2,400	800-1,500	5	25-40	2	3			
Kailua and Keauhou-Kona									
Existing	3,000	1,000	1	11	3 (Keauhou, Kailua, Honokohau)	1 (Kailua)	8 - 12 (Keahole)	35 - 40 (Kawaihae)	Historic sites in Kailua, Heihau, Billfish Tournament, City of Refuge National Historical Park.
Impending		1,500		19-24		1			
Total	3,000	2,500	1	30-35	3	2			
Kaanapali (Maui)									
Existing	2,153	312	2	20	1 (Lahaina)	1	30 (Kahului)	20 (Maalaea)	Historic sites in Lahaina, excellent beaches
Impending	500	800-1,400		10-20					
Total	2,600	1,100-1,700	2	30-40					
Wailea (Maui)									
Existing	-	-	1	11			16 (Kahului)	12 (Maalaea)	Historic ruins, excellent beaches
Impending	900-1,500	500-1,500		10-20		1			
Total	900-1,500	500-1,500	1	20-30		1			
Kapalua (Maui)									
Existing	-	-					35 - 40 (Kahului)	25 - 30 (Maalaea)	Excellent beaches
Impending	300- 750	500-1,000	1	15-20					
Total	300- 750	500-1,000	1	15-20					

(1) Next 10 years.

(2) Total Units Rounded

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

those utilized for transient accommodations.

At present, there are only about 369 hotel rooms and 48 condominium apartment units used as transient accommodations in the Kohala Coast Resort Region. And, at present, there are no completed hotel or residential units in either Wailea or Kapalua resort communities, although both types of units are currently under construction in Wailea.

Although a comparison of Neighbor Island resort regions at this time clearly shows the relative strengths of Ka'anapali and Kona in terms of facilities, an indication of potential strength is provided by the inventory of facilities anticipated by the end of the next ten years. This also is shown in Table I-C.20.

The comparison shows a highly competitive posture for the Kohala Coast Resort Region relative to the other regions. For example, during the next ten years, enough hotel rooms are likely to be added to provide the region with as many as Ka'anapali currently has, and about 80 per cent as many as does Kona. The region will still have fewer rooms than either Ka'anapali or Kona since those areas will continue adding rooms themselves. On the other hand, the region should have more units than either Wailea or Kapalua. There will be additional condominium apartments constructed in the Kohala Coast Resort Region, but not enough to exceed the anticipated inventories of the other resort regions at the end of ten years.

However, the major competitive strength of the region in the future will be the sizable amount and variety of recreational facilities and activities which will be available. In particular, after completion of the golf course in the WBR, there will be three high quality Robert Trent Jones golf courses available within just a few miles of each other at WBR, Waikoloa Village and at the Mauna Kea Beach Hotel. Completion of a golf course thereafter by Mauna Loa Land, Inc. will provide a fourth high quality course. No other resort region in the entire state would have this intensity of quality golf courses.

Combining this popular sport with a large number of tennis courts, excellent swimming beaches, good boating and diving facilities, and nearby marinas will make the region a strong recreation oriented destination area. Other recreation will include trail riding and equestrian activities, hunting and even skiing on Mauna Kea. Passive recreational and educational activities will include inspecting petroglyphs at Waikoloa and Puako, traversing the King's Trail, visiting Pu'ukohola Heiau National Historic Site, or other historic sites along the coast and in Waimea. Sightseeing in other parts of the Island is facilitated by the high-speed belt highway from Kailua round to the volcanoes.

Further, the classic resort requirements of "Sun, Surf and Sand" are amply present in the region.

Barriers of accessibility and water are being removed. Extensive State investment has been made in developing Kawaihae Harbor, building Ke-ahole Airport, and completing just recently the Queen

Ka'ahumanu Highway which abuts WBR, and links Kawaihae's deep water harbor to the airport at Ke-ahole and the town of Kailua. Now, accessibility to this resort region is as good as accessibility to any other Neighbor Island resort region.

Water is currently available to portions of the region; Waikoloa has sufficient water from the Waikoloa aquifer on site. Water is already available to the Mauna Kea Beach Hotel and associated facilities. Commitments for water have been made by the County to Mauna Loa Land, Inc. for their development, but delivery of water will require their participation in constructing off-site lines and facilities.

Thus, the prospects are very good that the available "Sun, Surf and Sand" and complementary accommodations and recreational facilities, and the now excellent accessibility will combine to make the Kohala Coast Resort Region one of the strongest in the State.

Forecast of Island Demand

Tourism forecasts were converted to projections of transient accommodations demand by estimating the average stay, multiplying by the number of visitors to get visitor days, dividing by the average party size to obtain average occupied room days, and then dividing by the number of days in the year, 365, to obtain the average daily number of occupied rooms. Total rooms were calculated by assuming an average annual occupancy of 70 per cent would be achieved, although an average of only 61.2 per cent occupancy was achieved in 1974.

After converting tourism projections to forecasts of transient accommodations for the Island, separate subarea projections were made for Hilo, Kona and all other areas on the Island. Our methodology then consisted of estimating what share of the market apportioned to the areas outside of Hilo and Kona could be attracted to the Kohala Coast Resort Region and to the subject project.

Interviews and investigations indicated that each locale (that is, Hilo, Kona and other areas) had different market characteristics. Furthermore, eastbound, westbound and local traffic had different use patterns and average stays. Information readily available included the number of visitors by directon of travel, their average party size, and the number of occupied rooms by location delineated by hotel and condominium apartment units. Average stays of each category of visitor were estimated by accounting for all of the occupied rooms in each of the locations.

Utilizing estimates of average stays, forecasts of eastbound and westbound visitors to the County along with an increment for local travel were converted to forecasts of occupied room demand and total room demand at 70 per cent occupancy. These results are shown in Table I-C.21. As seen, total room demand in 1974 was about 4,600 and about the same was expected for 1975. Demand will then increase to 7,500 by 1980, 10,300 by 1985 and 13,200 by 1990. Net new demand will be 8,600 new units from 1974 to 1990, or an average of about 540 new units per year over the 16 year period.

Table I-C.21

FORECAST OF TRANSIENT ACCOMMODATION DEMAND
County of Hawaii
1974 - 1990

	1974	1975	1980	1985	1990
Westbound					
Visitors	804,000	807,000	1,120,000	1,428,000	1,634,000
Average Stay, Days	2.2	2.2	2.5	2.8	3.0
Visitor Days	1,769,000	1,775,000	2,800,000	3,998,000	4,902,000
Average Party Size	1.8	1.8	1.8	1.8	1.8
Occupied Rooms	2,693	2,900	4,300	5,900	7,500
Rooms @ 70% Occupancy	3,846	3,900	6,100	8,400	10,700
Eastbound					
Visitors	241,000	252,000	430,000	630,000	799,000
Average Stay, Days	0.7	0.7	0.8	0.9	1.0
Visitor Days	169,000	176,000	344,000	567,000	799,000
Average Party Size	1.7	1.7	1.7	1.7	1.7
Occupied Rooms	272	300	600	900	1,300
Rooms @ 70% Occupancy	388	400	900	1,300	1,800
Local					
Visitors	100,000	109,000	139,000	178,000	227,000
Average Stay, Days	1.5	1.5	1.5	1.6	1.6
Visitor Days	150,000	164,000	208,000	285,000	363,000
Average Party Size	1.6	1.6	1.7	1.8	1.9
Occupied Rooms	256	300	300	400	500
Rooms @ 70% occupancy	366	400	500	600	700
Total					
Visitors	1,144,000	1,168,000	1,689,000	2,236,000	2,660,000
Average Stay, Days	1.8	1.8	2.0	2.2	2.3
Visitor Days	2,088,000	2,115,000	3,352,000	4,850,000	6,064,000
Average Party Size	1.8	1.8	1.8	1.8	1.8
Occupied Rooms	3,221	3,300	5,200	7,200	9,300
Rooms @ 70% Occupancy	4,600	4,700	7,500	10,300	13,200
Interperiod Change		100	+2,800	2,800	2,900

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

However, as seen in Table I-C.22, the current inventory exceeds the estimated 1975 demand at 70 per cent occupancy already. By 1990, an additional 7,852 units, or an average of about 490 new units per year, will be required.

Delineation of Island Demand by Subarea

An analysis was made of the current hotel industry infrastructure on the Big Island, and an assessment made of the roles that each plays to delineate the room demand into districts. The relative growth trends in terms of occupied units in the County, Hilo and Kona were tabulated and shown previously in Table I-C.14. In general, increases in occupied accommodations for the whole County approximated State tourism trends until about 1971 at which point State tourism began increasing faster.

Table I-C.22 NET NEW TRANSIENT ACCOMMODATIONS DEMAND* County of Hawai'i 1947 - 1990

Year	Projected Demand, Units	Existing Units	Net New Demand Over 1974, Units
1974	4,600	5,348	- 748
1975	4,800		- 648
1980	7,500		+2,152
1985	10,300		+4,952
1990	13,200		+7,852

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Occupied accommodations in Hilo increased more rapidly than State tourism until about 1969 and then slowed so that by 1973 their overall growth rates were about equal. Kona occupied accommodations, however, have grown slower than State tourism.

Even though Hilo still contains fewer rooms, both total and occupied, its rate of growth has been faster than Kona's rate. Thus, the relative roles of Hilo and Kona in the County hotel industry have changed since 1965. Hilo's role is one of accommodating visitors as they either begin or end their trip around the Big Island, or to accommodate them when visiting Hawai'i Volcanoes National Park. On the other hand, Kona's traditional role of accommodating visitors for long stays for rest and relaxation has changed to one of also accommodating persons as they either end or begin their trip around the Island, which has caused the average stay to decline. Additional effective capacity has been achieved by the reduction in average stay. Therefore, fewer hotel rooms are needed to accommodate current visitors.

Trends and forecasts of the distribution of occupied transient accommodations among the various resort areas on the Island, presented in

Table I-C.23 show that from 1965 to 1974, Kona had the largest number of occupied units. In 1965, Kona accounted for 66.6 per cent of occupied units in the county, but by 1974, this proportion had declined to 55.3 per cent. Hilo, on the other hand, accounted for only 29 per cent of the occupied rooms in 1965 and 34.2 per cent by 1973. In 1965, Kona contained 2.6 times the number of occupied rooms as Hilo, but by 1973, this ratio had declined to 1.6 times.

Room demand is growing in other parts of the Island, too. Table I-C.23 shows that the proportion of occupied rooms in other parts of the island increased from 4.4 per cent in 1965 to 10.5 per cent in 1974.

Our overall county forecasts assumed that new destination resort hotel facilities would be developed to accommodate persons for multiple day vacations. However, destination resort areas of the type envisioned will likely occur in areas outside of Hilo and Kona. Areas having the necessary characteristics are the coastal areas of the South Kohala District (Kohala Coast Resort Region), parts of the Ka'u District and possibly parts of the Puna District.

Hilo does not have the necessary climate for active outdoor recreation amenities currently in demand. Kona's recreational amenities have in general been passive in nature. Although additional recreation facilities have been provided in the Keauhou-Kona Resort Community, they do not amount to very much for the whole Kona area.

On the other hand, portions of the Kohala Coast Resort Region offer ample opportunities for development of comprehensive and integrated destination resort developments, since it possesses the requisite environmental amenities of a high percentage of sunny days, white sand beaches, safe swimming beaches, dry climate, excellent views of the water and mountains, and ample open land to permit flexible planning. The potential exists in this region to develop visitor complexes similar to the ones on Maui which have been instrumental in both increasing that Island's attraction to visitors and extending their average stays.

The proposed Sea Mountain project in Ka'u has some similar advantages although it does not appear to have the same potential for developing extensive facilities as the Kohala Coast Resort Region.

These factors were taken into account in projecting the likely geographic distribution of occupied transient accommodations on the Island. In general, a declining role in the overall visitor industry complex for both Hilo and Kona is seen. This does not mean that the visitor facilities in these ares will not continue to expand correspondingly with overall tourism; just that their rates of growth will be less. Hilo will continue to function in its role of gateway and departure points to and from the State and Island. Kona may revert to its historic role of attracting some longer-stay visitors; and it will continue to accommodate visitors as a convenient stopping place for their around the Island trips. Both areas also have limited land available for extensive expansion of resort and recreational facilities.

South Kohala is expected to develop extensive destination resort facili-

Table I-C.23

DISTRIBUTION OF OCCUPIED TRANSIENT ACCOMMODATIONS[1]
County of Hawai'i
1965 - 1990

Year	Hilo		Kona		Other		Total County	
	Units	Per Cent of County	Units	Per Cent of County	Units	Per Cent of County	Units	Per Cent
1965	293	29.0%	673	66.6%	44	4.4%	1,010	100.0%
1966	397	33.4	674	56.7	118	9.9	1,189	100.0
1967	511	32.8	868	55.6	181	11.6	1,560	100.0
1968	722	37.1	927	47.7	295	15.2	1,944	100.0
1969	1,012	41.8	1,098	45.4	309	12.8	2,419	100.0
1970	928	39.0	1,183	49.7	270	11.3	2,381	100.0
1971	984	36.9	1,402	52.5	282	10.6	2,668	100.0
1972	1,183	39.8	1,492	50.3	294	9.9	2,969	100.0
1973	1,126	34.5	1,814	55.6	321	9.9	3,261	100.0
1974	1,121	34.2	1,809	55.3	343	10.5	3,273	100.0
Forecast:								
1975	1,120	34	1,780	54	400	12	3,300	100.0
1980	1,560	30	2,340	45	1,300	25	5,200	100.0
1985	1,870	26	2,880	40	2,450	34	7,200	100.0
1990	2,050	22	3,250	35	4,000	43	9,300	100.0

[1] Includes hotel rooms and apartments.
Source: Hawai'i Visitors Bureau, Annual Research Reports.
Forecasts by Hastings, Martin, Hallstrom and Chew, Ltd.

ties beginning at Kawaihae, southward to 'Anaeho'omalu Bay. This area contains three major projects: The 'Olohana development which includes the Mauna Kea Beach Resort; the adjacent Mauna Loa Land, Inc.'s proposed development; and Boise's WBR at 'Anaeho'omalu Bay. These three projects currently have a single planning firm (Belt, Collins and Associates, Ltd.) coordinating overall land use planning. In just these three projects, ultimate plans call for some 5,000 to 5,500 hotel rooms, eight golf courses, various tennis and racquet clubs, in addition to resort condominium developments. Land is amply available to permit a development of this magnitude. With the completion of the Queen Ka'ahumanu Highway from Kailua to Kawaihae, access to this area is excellent from the new Ke-ahole Airport and from Kailua-Kona. Thus, the resort complexes would be in remote and peaceful environments, yet in close proximity to urbanized areas such as Waikoloa Village, Waimea and Kailua-Kona, and the amenities they offer. Additionally, the coordinated master planning of each resort community and the entire resort region will guarantee preserving the aesthetics of the area. This ability to control the resort environment results from the scale of developments planned, in contrast to the congested development in Kailua-Kona, Waikiki, and some areas on Maui where small parcel ownerships prevail.

Table I-C.23 shows an anticipated decline in the proportion of occupied hotel rooms in the Hilo area from 34.2 per cent in 1974 to 22 per cent by 1990. The proportion of facilities in Kona is expected to decline also from 55.3 per cent in 1974 to about 35 per cent by 1990. On the other hand, rather sizable increases are expected in other parts of the County, from 10.5 per cent in 1974 to 43 per cent by 1990, mainly as a result of anticipated expansion in the Kohala Coast Resort Region.

The results show an anticipated increase in the Kona demand for occupied accommodations of 1,809 in 1974 to 3,250 by 1990, a gain of about 1,440 occupied rooms. Achieving the 1990 level projected for Kona and Hilo means almost doubling the current hotel inventory in each area. It also means almost doubling the recreation, amusement and entertainment facilities, too. A relative decline in Hilo's role may occur if Ke-ahole Airport becomes a major point of entry and departure for visitors patronizing the Kohala Coast Resort Region.

Delineated Demand for the Region

While the largest proportion of transient accommodations on the Big Island have historically been located in Hilo and Kona, we forecast that from now until 1990, the greatest share will be developed outside these two centers. There are a number of potential development areas on the Island, but none have the necessary combination of climatic conditions, excellent swimming beaches, and available land to develop the potential cumulative attraction as does the Kohala Coast Resort Region. Furthermore, three high quality resort communities with controlled environments have already began development or are being planned for the region. These will make available the largest concentration of recreation amenities and activities on any of the Neighbor Islands.

Numerous discussions were held with various resort hotel and tour operators, resort developers, and other visitor industry representatives to assist us in delineating the expected island demand for the Kohala Coast Resort Regions. Most of the hotel and tour operators realized that it will be necessary to provide a large number of amenities and activities in the area in order to overcome the region's current lack of identity, and to attract destination resort visitors.

Tour operators have experienced difficulties in retaining visitors for more than one night in Hilo and more than two to three nights in Kona. Yet, all agreed that Maui visitors, for periods of four days and more, were content with minimum amounts of sightseeing so long as clear skies, white sand beaches, and calm swimming water were readily available.

These combined attributes of "Sun, Surf and Sand" are not present in either Hilo or Kona, and this lack has contributed to the slower tourism growth on the Big Island relative to Maui, where this combination of attributes is present. Some respondents indicated that in both Hilo and Kona, the overcast skies, dark rocky (blue rock) and unsafe shoreline, and deep blue water get depressing after a short period of time, and certainly are not the conditions sought by visitors to Hawai'i. These factors, in conjunction with recent overbuilding in Hilo and Kona have contributed to the lower occupancy levels experienced in the two areas. After learning of the white sand beaches, warm sunny weather and the extent of resort facilities and recreational amenities planned, the tour operators recognized the favorable prospects for developing a high quality resort region in South Kohala.

Hotel operators also recognized the desirability of building destination resorts or resort communities in the region. They too pointed out the need for providing a number of facilities, including nearby high quality golf courses, in order to enhance the "cumulative attraction" of the region. Some operators added that those with national and world wide sales organizations could easily direct visitor traffic to specific Neighbor Island resorts. In fact, operators with extremely desirable Waikiki locations could even use reservations in their Waikiki hotels as leverage, and influence visitors to stay at specified Neighbor Island resorts.

Land planning for the three primary projects in the Kohala Coast Resort Region is being coordinated by a single planning firm, and all three are planning for aesthetically attractive resort environments. It now appears that promotional efforts are being coordinated also to facilitate creating an awareness of the area as a high quality resort region.

With these prospects and attributes in mind, we have estimated that most of the Big Island demand for transient accommodations projected for areas outside of Hilo and Kona can be attracted to the Kohala Coast Resort Region. In fact, we estimate that the proportion is likely to be from 70 to 90 per cent of the demand outside of Hilo and Kona. These capture rates are based upon our own subjective assessments of the envisaged character of the region and planned facilities versus the character and facilities likely to be developed in other parts of the

Island.

Applying these factors results in the estimated demand shown in Table I-C.24.

Thus, in the next five years, we anticipate a demand for 630 to 810 new transient accommodations. Estimated demand for 1980 to 1985 is for another 810 to 1,040 units, and for 1985 to 1990, another 1,080 to 1,400 units. Over the next 15 years, we forecast a total demand for 2,520 to 3,250 more units.

Table I-C.24
ESTIMATED DEMAND FOR TRANSIENT ACCOMMODATIONS[1]
Kohala Coast Resort Region
Island of Hawai'i, Hawai'i
1975 - 1990

Period	Projected Demand In Areas Outside Hilo And Kona	% Attracted To Kohala Coast Resort Region	Estimated Demand, Kohala Coast Resort Region
1975-1980	900	70 - 90%	630 - 810
1980-1985	1,150	70 - 90%	810 - 1,040
1985-1990	1,550	70 - 90%	1,080 - 1,400
Total	3,600		2,520 - 3,250

[1]Number of occupied units.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

This range of demand approximates the forecasts currently being prepared for the North and South Kohala Community Development Plan. Conversations with consultants for that plan indicate on a preliminary basis, that they are projecting a demand for 3,200 hotel units by 1990. Adding the existing 400 units to our forecasts yields a total demand for 2,920 to 3,650 units, or close to their projections.

These estimates are based upon occupied rooms, and show that the demand is sufficient to accommodate a healthy growth of hotel rooms in the region. Over the entire 15 year period, demand is projected to increase between about 170 and 220 occupied units per year.

Estimated Marketability

Potential Demand at the Subject Project

The regional forecast shows that the demand for transient accommodations from 1975 to 1980 will be sufficient to support development of from three to four hotel projects of viable economic sizes.

At present, the major potential competitors for the market demands will be the projects planned at WBR, those planned on the adjacent property by Mauna Loa Land, Inc., and possibly some planned by Laurance Rockefeller's 'Olohana Corporation near the Mauna Kea Beach Hotel in the area from Hapuna Beach to Kawaihae.

Table I-C. 25

SUMMARY OF CHARACTERISTICS
Proposed Competitive Projects
Kohala Coast Resort Region
Island of Hawaii

	Hotel Rooms	Residential Units/Lots	Golf Courses	Tennis Courts	Marinas	Shoreline Condition	Fishponds/ Lagoons	Town Center	Historical Activities	Others
Waikoloa Beach Resort (Including Waikoloa Village)										
Existing	—	1,000	1 - 18 hole	2	Yes (Kawaihae)	Crescent white sand beaches and rocky lava.	Yes	Yes (Waikoloa Village)	Petroglyphs, burial caves, King's Trail and Fishpond Village.	Riding stable, rodeos, canoe races, hunting, sailing, snorkeling and polo.
Impending(1)	1,200	1,000-1,500	1 - 18 hole	5-10	Yes	—	—	Yes (Anaehoomalu Resort)		
Total(2)	1,200	2,000-2,500	2 - 18 hole	7-12	Yes	—	—	2		
Olehana Corporation (Mauna Kea Beach Hotel)										
Existing	310	100	1 - 18 hole	9	Yes (Kawaihae)	Crescent white sand beaches and rocky lava.	—	—	Petroglyphs and Puukohola Heiau National Historic Site.	Sailing, snorkeling and scuba diving.
Impending	300	100- 300	1 - 18 hole (par 60)	5-10	Yes	—	—	Yes (Resort)		
Total	600	200- 400	2 - 18 hole	14-19	Yes	—	—	1		
Mauna Loa Land, Inc.										
Existing	—	—	—	—	Yes (Kawaihae)	Rocky lava.	Yes	—	King's Trail, archaeological sites, burial caves and petroglyphs.	Snorkeling.
Impending	700- 800	400- 600	1 - 27 hole	5-10	Yes	—	—	Yes		
Total	700- 800	400- 600	1 - 27 hole	5-10	Yes	—	—	1		

(1) Next ten years.
(2) Rounded.

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

In order to evaluate the relative attraction of each resort project, the summary of characteristics shown in Table I-C.25 was developed. Although each project has ultimate plans for more extensive facilities, the lack of water may slow development at both 'Olohana Corporation's project and Mauna Loa Land, Inc.'s resort community. Boise's WBR has an advantage in this case since adequate water is available. Mauna Loa Land, Inc. has a commitment from the County for water, although the bulk of the off-site costs may be born by the developer in order to get the water expeditiously. At present, 'Olohana Corporation may be stymied by lack of water for new improvements.

In addition to having both water and properly zoned land available, WBR, with its white sand, safe swimming beach, will have the clear advantage over Mauna Loa Land, Inc.'s project which has no white sand swimming beaches. Mauna Loa Land does have a network of fishponds and lagoons which will be the central water theme for their proposed high quality (perhaps luxury class) hotel project. 'Olohana Corporation still has a few smaller white sand beaches which could be developed when water becomes available.

As seen in Table I-C.25, each of the three resort projects are likely to have between 600 and 1,200 hotel units at the end of the next ten years. Excluding almost 1,000 subdivision lots which have been sold in Waikoloa Village, at the end of the next ten year period, there could be from 200 to 1,500 residential units in each project. Each will have one or two golf courses, numerous tennis courts, an in-project small boat harbor or marina in addition to easy access to the boat harbor at Kawaihae, a commercial center, and on-site or nearby historical sites. Additionally, Waikoloa Village has a riding stable and sponsors horse races, rodeos and polo matches. Canoe races are also sponsored at 'Anaeho'omalu Bay. The protected waters of 'Anaeho'omalu Bay will permit a number of other aquatic activities such as sailing and snorkeling.

Thus, the competitive position of the WBR relative to other planned resort projects in the Kohala Coast Resort Region is expected to be very strong. Therefore, of the three to four hotels projected for 1975 to 1980, at least two could be attracted to WBR. A similar pattern of demand is expected during subsequent five year periods to 1990.

Average Room Rates

Previous sections have indicated that about 18.8 per cent of the units on the Island were in hotels offering a double occupancy superior room in the price range of $40 or more per night. Further, our field research has indicated that the three hotel projects in this first class and luxury price category (Mauna Kea Beach Hotel, Kona Village Resort Hotel and Kona Surf) have higher than average occupancies. In fact, we estimate that this category actually comprises 22 per cent of occupied rooms. Contributing to the higher occupancy levels at the Mauna Kea Beach Hotel and Kona Village Resort Hotel are the longer periods of stay by their guests. Reportedly, the average stay at the Kona Village Resort is about 4.5 days on an annual basis. The Mauna

Kea Beach Hotel achieves this level during the "off" season, and achieves a higher level during their "in" season. Other hotels on the island show only about a two day average stay.

Analysis of tourism trends show that an increasing portion of state visitors are return visitors, that return visitors have a greater propensity to visit Neighbor Islands, and that the family income of visitors has increased substantially. These trends suggest the need for more Neighbor Island destination resorts of increasing quality.

An indication of the relative increase of selected resort hotel published room rates to family incomes of visitors is shown in Table I-C.26. As seen, rates for selected resort hotels between 1971 and 1975 have increased from 15 per cent for the Royal Hawaiian Hotel to 43 per cent for Kona Village Resort Hotel. Mauna Kea Beach Hotel has achieved an increase of 29 per cent. During about the same period, family incomes of visitors have increased, for any particular quarter, from 38 per cent to as high as 53 per cent. Thus, it appears that visitor purchasing power and the ability to pay higher rates have increased faster than room rates themselves.

Table I-C.26
COMPARISON OF ROOM RATES AND VISITOR INCOMES*
Selected Resort Hotels
1971 - 1975

	1971	1975	Per Cent Change
Room Rates(1)			
Mauna Kea Beach Hotel(2)	$85.00	$110.00	29%
Kona Village Resort Hotel(3)	70.00	100.00	43
Kahala Hilton Hotel	43.00	60.00	40
Royal Hawaiian Hotel	33.00	38.00	15
Family Income			
First Quarter	$15,900	$23,200	46%
Second Quarter(4)	12,700	19,400	53
Third Quarter(4)	13,100	18,100	38
Fourth Quarter(4)	15,100	20,900	38

(1)Published rates for double occupancy for superior room.
(2)Modified American Plan.
(3)Full American Plan.
(4)Since only the first quarter visitor family income is available, comparisons for other quarters are between 1970 and 1974.
*Source: Hawai'i Hotel Guide, 1971 and 1975; Hawai'i Visitors Bureau Visitor Reaction Survey; Hastings, Martin, Hallstrom and Chew, Ltd.

It also appears likely that this pattern of increasing visitor affluence, and more return visitors preferring Neighbor Island resorts, will continue. Therefore, the prospects are good that room rates will continue upward, and that the proportion of rooms in the higher price categories will increase.

In Table I-C.27 we show our forecast that on an occupied room basis, the proportion of rooms in the price category of $40 or more a night (the first class and luxury market) will increase from 22 per cent in 1974 to 23 per cent in 1975, to 25 per cent by 1980, 27.5 per cent by 1985, and 30 per cent by 1990.

While the forecasts are made for the entire island, our prior discussions indicate that the Kohala Coast Resort Region is destined to attract most of this demand for high quality resort facilities. The table shows that we expect the percentage capture in Kohala to be as high as 80 to 100 per cent of the first class and luxury demand. These capture rates are assessed this high since the amenities in the region are the ones which are sought by this particular market segment. An increment of the market is expected to be attracted to Kona Village when it expands, but that increment is expected to be nominal.

Applying the capture rates results in regional demand estimates amounting to 480 to 600 occupied units in the period from 1975 to 1980. This demand is sufficient to support two to three economically sized high quality hotels in the region, and the demand will increase in subsequent five year periods to 1990.

Therefore, on the basis of our analysis, we conclude that the demand for high quality resort facilities in the Kohala Coast Resort Region will support the facilities currently planned through 1980, and will most likely continue supporting facilities planned from 1980 to 1990.

For the same reasons presented in a preceding paragraph which discussed the relative attraction of WBR to other existing and proposed resorts in the region, we estimate that at least two high quality hotels could be supported at the subject resort from 1975 to 1980. Subsequent five year periods will likely support about the same number.

Table I-C.27

FORECAST OF FIRST CLASS AND LUXURY MARKET DEMAND
Island of Hawaii
1974 - 1990

	Forecasted Occupied Units	Percent First Class And Luxury	Estimated Occupied First Class And Luxury Units	Change Between Periods	Percent Capture By Kohala Coast Resort Region	Estimated Demand Kohala Coast Resort Region
1974	3,273	22 %	720	--	--	--
1975	3,300	23	760	40	80 - 100%	30 - 40
1980	5,200	25	1,300	540	80 - 100%	430 - 540
1985	7,200	27.5	1,980	680	80 - 100%	540 - 680
1990	9,300	30	2,790	810	80 - 100%	650 - 810
			Total	2,070		1,650 - 2,070

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

5. Demand for Resort Condominium Apartments*

We analyzed the two most competitive neighbor island destination resort regions, West Maui and Kona, Hawai'i, to assist in determining the demand for condominium homes in the emerging Kohala Coast resort developments. Although both regions witnessed a five-fold increase in hotel rooms, the demand for vacation homes did not increase correspondingly.

As shown in Table I-C.28, hotel rooms in Ka'anapali increased from 477 units in 1964 to 2,480 in 1975. During the same period, the condominium inventory in the West Maui area increased from 22 units to 3,689 units, a 167-fold increase. An average of 94 units were sold annually during the initial five year development of Ka'anapali. Between 1969 and 1973, annual average sales increased to 247, and at the height of condominium investment fervor in 1974, 1,118 units were sold.

The sales rate of condominiums on the Kona coast was not readily available. However, the number of units completed and successfully marketed indicated that condominium growth in Kona was not as spectacular as in West Maui. Although hotel rooms increased from 509 units to 2,856 units between 1964 and 1975, condominium units increased only 26 times from the 1966 count of 37 units to 995 units in 1975.

Although WBR is only a 30 minute drive from Kailua-Kona along the new Queen Ka'ahumanu Highway, the condominium growth of West Maui is more reflective of the demand to be experienced at WBR due to the area's physical and recreational features. For example, the Ka'anapali Resort area contains white sandy beaches, whereas Kona lacks any such comparable beach property.

The facilities at Ka'anapali were built around two golf courses, and the traditional Hawaiian holiday concept of "Sun, Surf, and Sand". In comparison, Kona promoted passive recreation and accommodated sightseeing vacationers and those desiring rest and relaxation. The first golf course in Keauhou-Kona was not completed until the late 1960's and the first Keauhou-Kona hotel was not completed until September 1970.

Therefore, in projecting demand for condominiums on the Kohala Coast, much more consideration was given to the growth patterns of condominiums and hotels in West Maui than to Kona. Additions were analyzed over the ten year period between 1965 and 1974, and unusual fluctuations were smoothed using a three year moving average. The ratio of condominium units sold to available hotel units was calculated since the rate of hotel patronage directly influences the potential for condominium sales. As shown in Table I-C.29, from 1965 to 1975 the moving average sales ratio measured between .105 and .272 units sold per hotel unit available. The rate peaked in 1973 to .272. During the first five years of development at Ka'anapali the average ratio of condominium units sold to available hotel units was .140 and increased to .180

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table I-C.28

HOTEL AND CONDOMINIUM GROWTH
West Maui and Kona Coast
1964-1975

	West Maui			Kona Coast		
Year	Hotels and Apartment-Hotels	Cumulative Condominium Inventory	Condominiums[1] Sold	Hotels and Apartment-Hotels	Cumulative[3] Condominium Inventory	Condominiums Sold
1964	477	22	66	509	-0-	Not Available
1965	637	100	118	565	-0-	"
1966	743	314	105	727	37	"
1967	943	372	101	901	47	"
1968	966	688	78	1,177	47	"
1969	1,202	888	233	1,177	47	"
1970	1,279	1,373	269	1,428	111	"
1971	2,021	1,421	124	2,271	111	"
1972	2,028	1,725	276	2,392	429	"
1973	2,028	2,085	331	2,382	635	"
1974	2,288	2,640	1,118	2,846	721	"
1975	2,480	3,689	224[2]	2,856	995	"

(1) Includes pre-sold units.
(2) As of October 1975.
(3) Does not include projects that had unsuccessful sales programs.
Source: Hawai'i Visitors Bureau, Bureau of Conveyances, Maui Real Estate Brokers and Developers and Hastings, Martin, Hallstrom and Chew, Ltd. Field Survey

Table I-C.29

INDICATED CONDOMINIUM DEMAND
Kohala Coast Resort Region
County of Hawai'i

	West Maui Experience		
	3 Yr. Average		Capture Ratio
Year	Hotels & Apt.-Hotels	Condos Sold	Condominium Unit Sold/ Hotel Units
1965	619	96	.155
1966	774	108	.140
1967	894	94	.105
1968	1,047	137	.131
1969	1,159	193	.167
1970	1,501	208	.139
1971	1,776	223	.126
1972	2,026	243	.120
1973	2,116	575	.272
1974	2,265	558	.246

Indicated Kohala Coast Demand	Capture Ratio Condominium Unit Sold/Hotel Units	Occupied Hotel Units	Total Rooms at 70% Occupancy	Estimated Annual Condominium Sales	Estimated Total Condominium Sales for Period
1978-1980	.140	630- 810	900-1,160	130-160	390- 480
1980-1985	.180	810-1,040	1,160-1,490	210-270	1,050-1,350
1985-1990	.200	1,080-1,400	1,540-2,000	310-400	1,550-2,000
				TOTAL	2,990-3,830

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

during the next five years. At a minimum, due to similarities in climate and amenities, the condominium sales pattern for the Kohala Coast will probably parallel the West Maui experience. Therefore when the first hotel and golf course at WBR are completed in 1978, the annual capture rate should approximate .140 condominium units per hotel room. By 1980 this rate will increase to .180, and from 1985 to 1990, it should reach .200.

Applying these factors to the estimated demand for transient accommodations indicated a demand for 390 to 480 vacation homes during the period 1978 to 1980 and a demand which would increase to 1,550 to 2,000 units between 1985 and 1990.

Demand at the Subject Property

As indicated earlier in our analysis of hotel room demand at WBR, lack of water is expected to slow development at both 'Olohana Corporation's project and Mauna Loa Land, Inc.'s resort community. Therefore, during the first three years of development, WBR should capture 80 to 100 per cent of the Kohala Coast condominium market. Although WBR would retain a tentative advantage over Mauna Loa Land, Inc.'s project because the latter lacks white sand swimming beaches, the capture rate at WBR is expected to decline to about 60 to 75 per cent during the later years of development. Table I-C.30, summarizes the anticipated demand for condominium units at the subject property. A total demand

Table I-C.30

CONDOMINIUM MARKETABILITY FORECASTS*
Waikoloa Beach Resort 1978-1990
County of Hawai'i

Year	Kohala Coast Condo Demand	Waikoloa Per Cent of Market	Waikoloa Condo Demand
1978	130 - 160	80 - 100	100 - 160
1979	130 - 160	80 - 100	100 - 160
1980	130 - 160	80 - 100	100 - 160
1981	210 - 270	60 - 75	130 - 200
1982	210 - 270	60 - 75	130 - 200
1983	210 - 270	60 - 75	130 - 200
1984	210 - 270	60 - 75	130 - 200
1985	210 - 270	60 - 75	130 - 200
1986	310 - 400	60 - 75	190 - 300
1987	310 - 400	60 - 75	190 - 300
1988	310 - 400	60 - 75	190 - 300
1989	310 - 400	60 - 75	190 - 300
1990	310 - 400	60 - 75	190 - 300
Totals	2,990 - 3,830	-	1,900 - 2,980

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

of 1,900 to 2,980 units is projected for WBR during the first 13 year development period. Annual condominium demand is expected to range between 100 and 160 units during the first three years of development. By 1986, annual demand between 190 and 300 is anticipated.

6. Demand for Commercial Facilities*

Commercial facilities will be a necessary part of the WBR to provide additional activities for visitors, to satisfy their requirements for goods and services, to add to and diversify economic sub-activities, and to increase employment. Traditionally, one of the primary activities of visitors is shopping; not only for basic day-to-day needs, but also for appropriate apparel for the local climate and customs, souvenirs and gifts for friends, and arts and crafts representative of the locale.

The magnitude of Neighbor Island visitor expenditures averaged $45.16 according to the Visitor Expenditure Survey conducted by the Hawai'i Visitors Bureau in 1974. Of this amount, $5.21 was spent for clothing, gifts, and souvenirs, or about $9.90 per average hotel room assuming 1.9 persons per room. Assuming a 70 per cent occupancy, each hotel room generated $2,529 in sales per year. Resorts in remote locations should have generated about $110 per square foot of space in 1974; so that each room should support 23 square feet of commercial space, or, say 25 square feet, excluding eating and drinking facilities. Thus, each 300 room hotel increment should support 7,500 square feet of commercial space.

Visitors staying in resort condominium apartments usually have longer average stays. Further, they usually are return visitors, some of whom are periodic visitors who actually own their units. As such, their day-to-day level of expenditures for daily needs, clothing, gifts, and souvenirs is much less than those of hotel guests who have yet to accumulate a large number of these items. Also, the proportion of resort condominium apartments generally occupied as transient accommodations is much less than the proportion of hotel rooms. Based upon research of condominium use in other resort areas, this proportion is estimated to be 25 per cent. This usually results from 50 per cent of the units being available as transient accommodations, and those averaging about 50 per cent occupancy. Expenditures of condominium apartment users is not generally available; rather, we have assumed that the the amount of space required per occupied unit would be about half that required for each hotel unit, or 12.5 square feet per occupied condominium apartment unit.

7. Demand for Recreational Facilities*

Recreational facilities are traditional and requisite components of successful destination resort areas. Variety and quality of recreational amenities enhance the "cumulative attraction" of an area. Frequently, recreation facilities are so unique and so distinguished that they con-

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

tribute more to the identity of an area than its other facilities.

Recreational pursuits create activities with which to fill the leisure time of visitors. Thus, recreation facilities not only draw visitors to an area, they also serve to retain visitors in an area for longer periods of time. Therefore, they are a very necessary aspect of resort development, as well as an important contributor to an area's economy.

Part of the "cumulative recreational attraction" of WBR will be the beach facilities, golf, historical parks, walking trails, boating and fishing, other aquatic activities, and others.

Some can be supported by minimum visitor activity since their costs are nominal. Others will require large levels of visitor activity due to their high initial costs.

Golf, even with its high initial costs, will be a necessary part of the resort, and the first golf course will be playable when the first hotel opens for operations. At Ka'anapali, two golf courses have been in use since about 1,200 hotel rooms were available. Presently with 2,200 rooms, the second course is being expanded from an "executive" course to a "championship" course. At Keauhou-Kona, there are presently about 1,300 hotel rooms supporting one golf course. Application was made for redistricting adjacent lands for development of a second course. Thus, it appears that at a level of about 1,800 rooms, the second golf course at WBR could be supported.

Most of the passive recreation facilities and active beach facilities can be supported and justified by the initial level of visitors anticipated.

Justification for the small boat harbor will materialize after the market size increases. This likely will occur after the second hotel is completed, along with the associated complement of permanent residents, condominium apartment users, and so forth.

8. Benefits to the Community*

Development of the WBR not only would accommodate market demands effectively, such a development in the region would enhance the local economy and thereby strengthen the community fabric. New jobs will be created not only during the initial construction phases, but also a wide range of jobs will be generated to operate the resort facilities. Expanding tourism to diversify the region's economic base mitigates the effects of secular swings in the economy by providing more overall stability to the community. For example, had the regional economy been more diversified and better balanced when the Kohala Sugar Company's operations terminated, the affected workers might have been able to find alternative employment in an expanding sector within the region with minimal social and community disruption.

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

It is emphasized that the tourism industry should not be relied upon solely for the economic salvation of the region. To do so would result in the same dependence upon a single industry, as was the case with the Kohala Sugar Company.

Subsequent sections deal in detail with impacts on employment, income, housing, population, and revenues to the State and local governments. Only a short synopsis of each will be presented at this juncture.

Direct jobs will be created as a result of construction requirements as well as the need to operate and maintain the resort and recreation facilities. During the initial construction phase, approximately 300 jobs contributing $4,393,000 in annual salaries and wages in terms of 1975 dollars will be filled. Upon completion of the first hotel, and after the first full year of its operations in 1978, annual direct income from the resort and construction jobs will amount to $6,664,000, again in terms of 1975 dollars for 710 direct jobs. By the time the project is estimated to be completed in the year 2005, there will be 3,870 new direct jobs generating $31,874,000 in annual salaries and wages.

Including an increment for secondary employment, the WBR when completed should generate a total of 4,680 new jobs in the region. Of this 2,880 are expected to be filled by current residents in Kohala, or by their future family members. Only 1,800, or only about 38 per cent are expected to be filled by in-migrants. Even so, almost half of the in-migrants would be management or special skilled workers normally brought in for construction or operations of such remote resort facilities.

Net new housing demand in the region is estimated to be 2,210 units by the time of completion. However, available housing in Waikoloa in the form of dormitory units, proposed resort condominium apartments, and likely Waikoloa Village single family housing should satisfy the WBR employee housing needs to about 1985. Even after that, there would still be ample land in Waikoloa Village upon which to develop housing as dictated by market demand.

9. Demand For Island-Born Executives in the Visitor Industry

There has been criticism of the visitor industry in recent years within island circles because it provides jobs that are described as "demeaning" and because most of the management in the industry is purportedly imported from outside of Hawai'i.

A random sampling of upper management on the Island of Hawai'i would indicate that this frequently-voiced criticism simply isn't true.

A majority of the managers of the Big Island's hotels are island natives, and many, many upper staff and supervisory personnel come from the islands. Hotel managers such as Bill Davis of the Naniloa Surf, Basil Antida of the Hilo Hukilau, Harold Rapoza of the King Kamehameha, Fred Honda of the Keauhou Beach, Nathan Cockett of the Waiakea Village, Wayne Watanabe of the Kona Lagoon, Alex Dizol of the Kona Inn, Bill Kimi of the Hilo Bay, Al Pelayo of the Volcano House and Mitzi Johnson of the Polynesian Pacific are all island products.

In upper management levels, Islanders employed in the Big Island hotels include Lorraine Jitchaku, sales manager for the Hilo Lagoon and Hilo Hawaiian; Fred Pasco, executive assistant manager of the Keauhou Beach; Pat Englehard, administrative assistant to the manager of the Naniloa Surf; Rupert Hunt, assistant manager of the King Kamehameha; Jon Fukuda and Will Silva, assistant managers of the Mauna Kea Beach; Masa Tabata, controller of the Kona Hilton; Bill Salvador, executive chef of the Hilo Lagoon, and Randy Ahlo, food and beverage director of the Waiakea Resort Village.

In other tourism related industries, people of Hawai'i have moved into top management positions throughout the Island of Hawai'i. Such respected airline figures as Al Imoto and Dan Wela, managers of Aloha and Hawaiian Airlines, respectively, and ground transportation executives such as Ken Johnston and Charles Kamaka of Slim Holt Tours, Bill Vanatta of Gray Lines and Lloyd Akiona of Hawaiian Discovery Tours all are island natives.

Their positions as leaders of the tourism industry quickly show that the visitor industry in Hawai'i does attract qualified local products into top management positions.

10. Fiscal Benefits

In order to use a conservative approach to estimating benefits of the project to the State and County, only revenues generated by general excise and personal state income taxes and real property taxes were calculated. Excluding external grants-in-aid, these sources comprised 75 per cent of the State and County revenues, respectively. Other revenues not included and likely to be generated by WBR include fees, permits, licenses, corporate taxes, fines and special excise taxes.

Our analysis shows that costs to the State will amount to about $1,821,000 per year when WBR is completed; however, revenues from general excise taxes and personal state income taxes will total $3,889,000, for a benefit to cost ratio of 2.1.

Costs to the County would be $3,564,000 and property tax revenues $6,015,000, for a benefit to cost ratio of 1.7. (Details of these projections are available in Section IV-H.8, Impact on Revenues to Government.)

D. DEVELOPMENT INCREMENTS*

Development of the WBR area portion of the Waikoloa project will be in three major increments. The first increment of development is the area south of the escarpment bounded by the edge of the Kaniku lava flow, the King's Trail, and 'Anaeho'omalu Bay. This area corresponds to the existing first increment of County zoning. The second increment of resort development will extend along the shoreline to the north property boundary; it will be on the Kaniku lava flow and makai of the King's Trail. This second area has incremental zoning to be released after certain building requirements are completed in Increment One. The third increment will extend mauka from the King's Trail to Queen Ka'ahumanu Highway. This land is currently zoned in the holding designation "unplanned."

The time frame for the development of these stages depends on market demand and other factors. However, it is anticipated that with a favorable economic climate the initial hotel of Increment One will be completed in 1978 and the remainder of Increment One may be completed as early as 1988. Increments Two and Three will be completed some time further in the future. It should be noted that these increments will not run completely sequentially but in all probability there will be times when all three increments are under development. The second increment may commence as soon as certain construction requirements for incremental zoning have been met in Increment One. Increment Three will start when there is a demand for a second 18-hole golf course at WBR, and is therefore dependent upon:

1. The type of hotel guest at WBR.

2. Availability of other golf courses in the area, etc.

Elements of the three increments of resort development are described below and in Table I-D.1.

Increment One: The Initial Resort Community Adjacent to 'Anaeho'omalu Bay:

Hotels: Five sites on 81.3 acres and planned for approximately 2,580 rooms.

Residential: Six sites on 74.6 acres and planned for approximately 1,665 units. (See special note under Increment Two.)

Commercial: 16.1 acres with approximately 96,000 sq. ft. for the first increment (the area will also accommodate a portion of the Increment Two commercial requirement and the temporary clubhouse.)

Recreation facilities, roads and developed open space: 284.8

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*Source: Belt, Collins and Associates, Ltd.

acres consisting of an 18-hole golf course, developed historic sites, a developed beach area, a proposed small boat harbor and an access road from the Queen Ka'ahumanu Highway. Temporary facilities will include a project nursery and a temporary construction yard.

Step 1A, the first step of Increment One, is hopefully to be completed by 1978 and will consist of an initial 350-room hotel and a substantial portion of the major infrastructure--roads, water, sewer, power lines, serving the remaining hotel and multi-family lots in Increment One, etc. A substantial portion of the recreational support facilities will also be constructed at this time -- the 18-hole golf course, a temporary clubhouse, Increment One coastal landscaping, and specific historic sites. The remaining steps of Increment One will be carried out as economics and individual site developers dictate.

Increment Two: The Remaining Coastal Hotel Sites and Additional Residential Areas on the Kaniku Lava Flow Adjacent to the First Golf Course:

Hotel: One site on 11.0 acres consisting of approximately 382 rooms.

Residential: Eight sites on 95.8 acres planned for approximately 1,765 units.

Additional infrastructure and permanent hotel employee parking.

Special Note: Multi-family Parcel 23, zoned RM 1.5, is erroneously shown in this EIS as being developed in Increment Two. This parcel will, in fact, be developed as part of Increment One. The acreage is 8.5 acres with a maximum density of 307 units. Development of this parcel within Increment One will have no significant impact on the WBR.

Increment Three: The Remaining Land Between the Resort Area and Queen Ka'ahumanu Highway:

This increment of development requires additional governmental approvals. It must first receive State Urban Land Use designation and then County zoning. It probably will contain the additional 18-hole golf course and permanent clubhouse constructed during Increment Two. The size and density of the residential areas will depend on the economics and zoning prevailing at the time of development.

In Table I-D.1, the proposed zoning categories and total areas are the same as the current zoning for the area. The proposed zoning does, however, change the location of various parcels. It should be noted that the total build out density of the WBR is lower than the maximum zoning will allow. For the hotel parcels, the total development will be held to 3,000 rooms as is prescribed by the County General Plan (1971) versus 3,216 rooms allowed by the zoning. The multi-family areas could be built to an average maximum density of 29 units per acre with RM-1.5 zoning. However, considering the height limit

Table I-D.1

Proposed Staging and Unit Count (January 20, 1976)

Land Use	Lot No.	Area Acres	Zoning	Maximum Density Allowed On Each Parcel #units	Design Density #units	INCREMENT I Step 1A Incr. I	INCREMENT I Remainder Incre. I	INCREMENT II
Hotel				(34.8)u/ac				
	4	12.8	V-1.25	452			*	
	8	15.7	V-1.25	546			*	
	9 & 10+	15.1	V-1.25	525			*	
	12	18.8	V-1.25	654		350	50	*
	14	18.9	V-1.25	657			*	
	28X	11.0	V-1.25	382				*
		92.3		3,216	3,000	350	2,230	420
Multi-family				29 u/ac	22.0 u/ac			
	13	20.7	RM-1.5	600			*	
	17	17.5	RM-1.5	507			*	
	20	11.0	RM-1.5	319			*	
	24	8.7	RM-1.5	252			*	
	2	13.5	RM-1.5	411			*	
	5	3.2	RM-1.5	104				
							1,665	
	19	11.4	RM-1.5	330				*
	23	8.5	RM-1.5	307				*
	28W	7.0	RM-1.5	203				*
	27DD	13.0	RM-1.5	377				*
	28Z	13.3	RM-1.5	388				*
		127.8			2,835			1,170
				14.5 u/ac	14 u/ac			
	22	16.4	RM-3.0	236				*
	27CC	16.6	RM-3.0	210				*
	27AA	9.6	RM-3.0	139				*
		42.6			595			595
				25.5 u/ac	20 u/ac			1,765
		170.4		4,351	3,430	0		
Commercial	25	10.7	CV-10		129,000sf		90,000sf	33,000sf
	1	3.3	CV-10				6,000sf	
	7	2.1						
	27BB	3.1	CV-10					
		19.2						
Other Uses								
Fishpond Area	11	16.3	0			*		
Public Parking	3	5.0	0			*		
Camel Archaeological Area	6	3.4	0			*		
Small Boat Harbor	15 & 16	5.9	0				*	
Burial Caves Archaeological Area	21	5.5	0			*		
Golf Course and Roads	18, 26, 28, 27	158.1	0			*		
Roads		25.5				13.6	9.9	2.0
Total Other		219.7						
Total Zoned Area		501.6						
Additional Uses in the Unplanned Area Above the King's Trail								
Holes 7 & 8 of Golf Course		17.4	U.P.			*		
Project Nursery		5.0	U.P.			*		
Temporary Construction Yard		7.1	U.P.					
(permanent employee parking)		9.9	U.P.			7.1		9.9
Access Road		7.9	U.P.			7.9		
Petroglyph Field Archaeological Area		5.0	U.P.			*		
*Additional 18-hole Golf Course		160.0	U.P.					*
King's Trail Buffer Strip		20.0	U.P.			*		
		232.3						
Total		733.9			6,430	350	3,895	2,185

*will be developed as required by demand.
+will probably be one hotel; could be two.

and large parking requirement, this density would require approximately 60 per cent land coverage of buildings and pavement. This density is considered out of character with the quality of resort development desired. Therefore, a density of 22 units per acre has been established by Boise as the average number of units in the RM-1.5 areas. The plan calls for 14 units per acre in the RM-3.0 areas. This gives an overall multi-family density of 20 units per acre. With this lower density it is possible to cut the site coverage of buildings and pavement to 30 per cent; units can be placed over the parking areas and still conform to height limits. Limitations on density may be achieved by deed, lease, contract, or protective covenant restrictions imposed by the developer.

The amount of commercially zoned land needed was calculated by first determining the project's commercial floor area requirements and then translating that into land area. Based on the analysis described in Section I-C-6, Demand for Commercial Facilities, it was estimated that WBR would support approximately 129,000 square feet of commercial space. Assuming the use of two-story buildings and the provision of two square feet of parking space for each square foot of commercial floor area, the total ground coverage of buildings and parking facilities will be 322,500 square feet. In order to limit ground coverage to 50 per cent of the total site area, some 14-plus acres of commercially zoned area will be needed.

As stated earlier, Boise's development strategy is to develop an integrated community in the Waikoloa-'Anaeho'omalu area. Support facilities such as housing, schools, etc. are already planned for the Waikoloa Village area. The employment center for this total community will be the WBR area under consideration in this EIS.

The remainder of this section contains a detailed description of the first step of Increment One, a general description of the concept of development for the remainder of Increment One and Increment Two and a brief description of considerations for a future Increment Three.

1. Step 1A, of Increment One, the Initial Hotel Development*

The first resort facilities developed at WBR, Figure F, will consist of a luxury hotel, an 18-hole golf course and substantial offsite improvements for the majority of hotel and multi-family lots in Increment One. A detailed description of the hotel and required support facilities is as follows:

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*The incremental development of the support facilities which include domestic water systems, sewerage disposal system, electrical and communications system, cooking and heating gas, a road network and parking and internal circulation system is included in Section I-E-1 through I-E-7, Support System.

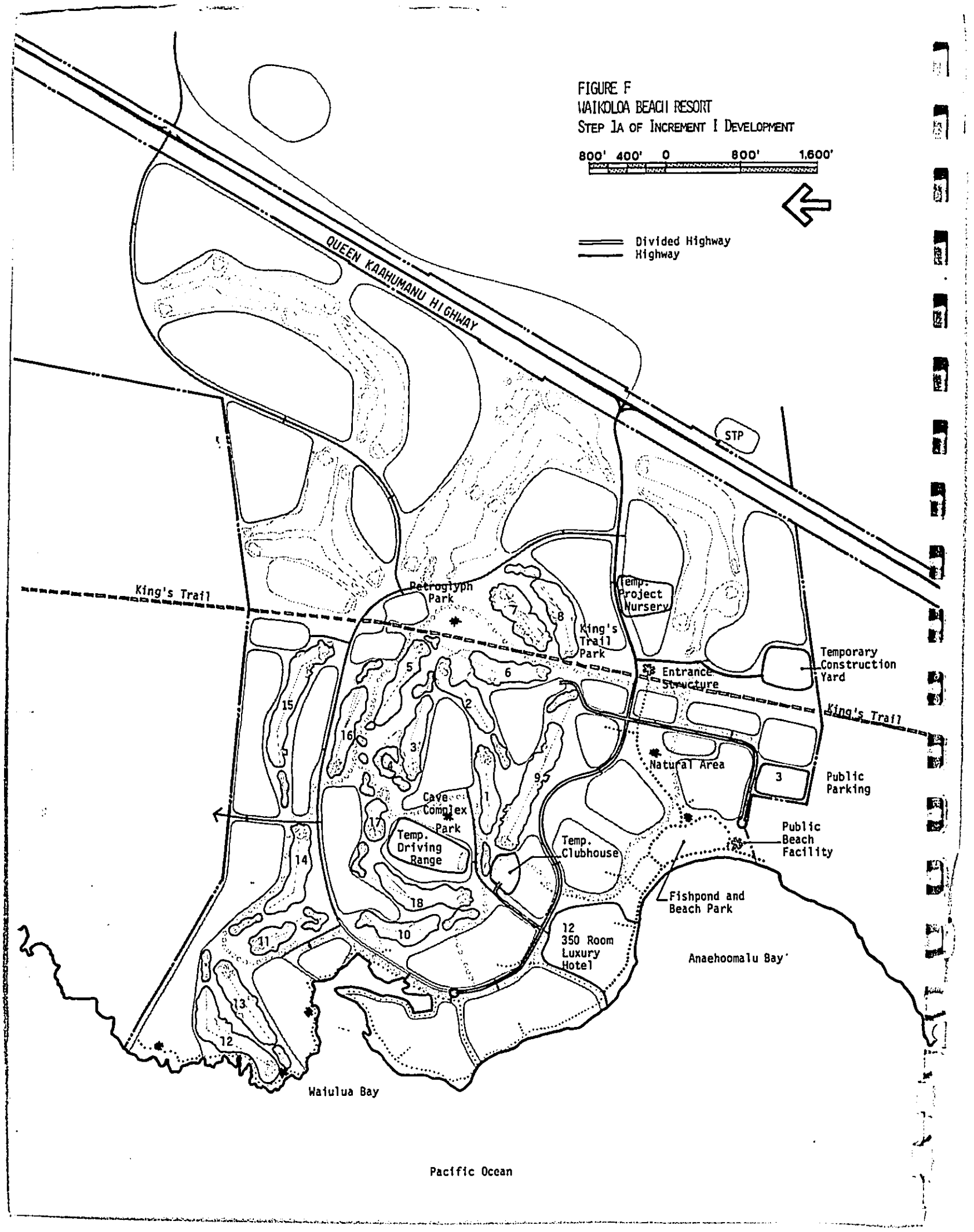
FIGURE F
WAIKOLOA BEACH RESORT
STEP 1A OF INCREMENT I DEVELOPMENT
800' 400' 0 800' 1,600'
Divided Highway
Highway
QUEEN KAAHUMANU HIGHWAY
STP
King's Trail
Petroglyph Park
Temp. Project Nursery
King's Trail Park
Temporary Construction Yard
Entrance Structure
King's Trail
Natural Area
Public Parking
Cave Complex Park
Temp. Driving Range
Temp. Clubhouse
Public Beach Facility
Fishpond and Beach Park
12 350 Room Luxury Hotel
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

Luxury Hotel Complex

Princess Hotels International has recently committed itself to the operation of the first hotel at WBR, an elegant 18-acre complex aimed at the carriage trade. As initially constructed, the hotel will contain 350 rooms. However, it is designed such that it can be expanded to over 400 rooms at some future date.

This luxury hotel will be built behind a cobble and sand beach on Hotel Parcel 12. The hotel will be developed as a Planned Unit Development as provided for in the Hawai'i County Zoning Ordinance. "Rule Seven" guidelines are being used in order to maintain a compact design that permits the maximum amount of open space. Situated just northwest of Kahapapa fishpond, the Waikoloa Princess will provide fine views of the coastline, 'Anaeho'omalu Bay and the many coastal ponds located on the WBR. Present plans call for a five-story high "Y" shaped building oriented along a northeast axis. A sixth floor may be added in the future. The arms of the "Y" open towards the main access road; between them are many of the hotel's public spaces and facilities. The main roof of the five-story structure is 45 feet above grade (57 feet above mean sea level). The tops of the two elevator shafts, the building's highest points, reach 58 feet above grade (70 feet above mean sea level). The main roof of the sixth floor extension will be 54 feet above grade (66 feet above mean sea level). The top of the two elevator service towers will be 67 feet above grade (79 feet above mean sea level). As presently envisioned, the complex will include a variety of fine restaurants and entertainment facilities, a freshwater swimming pool, tennis courts, a luau area and a banquet room. (See Appendix I.)

The grounds will be extensively landscaped with both native and exotic vegetation. The plantings will be chosen so as to blend in with the existing fishpond flora and to soften the lines of the man-made structure.

On-site parking will be provided for approximately 126 automobiles, approximately 50 per cent of the total number required. The remainder will be located on Parcel Two, as described later in this section.

An 18-hole championship golf course designed by Robert Trent Jones will be developed concurrently with the construction of the first hotel. The course has been carefully designed to capitalize on the site's natural features. As additional hotels are constructed and the demand for golf facilities increases, the course will probably be expanded to a full 36 holes by utilizing land mauka of the King's Trail, and the clubhouse will be shifted to its permanent location on the edge of Kaniku lava flow adjacent to the King's Trail. At that time, the area previously occupied by the clubhouse will be converted to multi-family or restaurant use.

The golf course's temporary clubhouse and first tee are located directly across the access road from the first hotel. The first nine holes run out from the clubhouse to the ridge of 'a'a lava formed by the prehistoric Kaniku lava flow, along the ridge to the vicinity of

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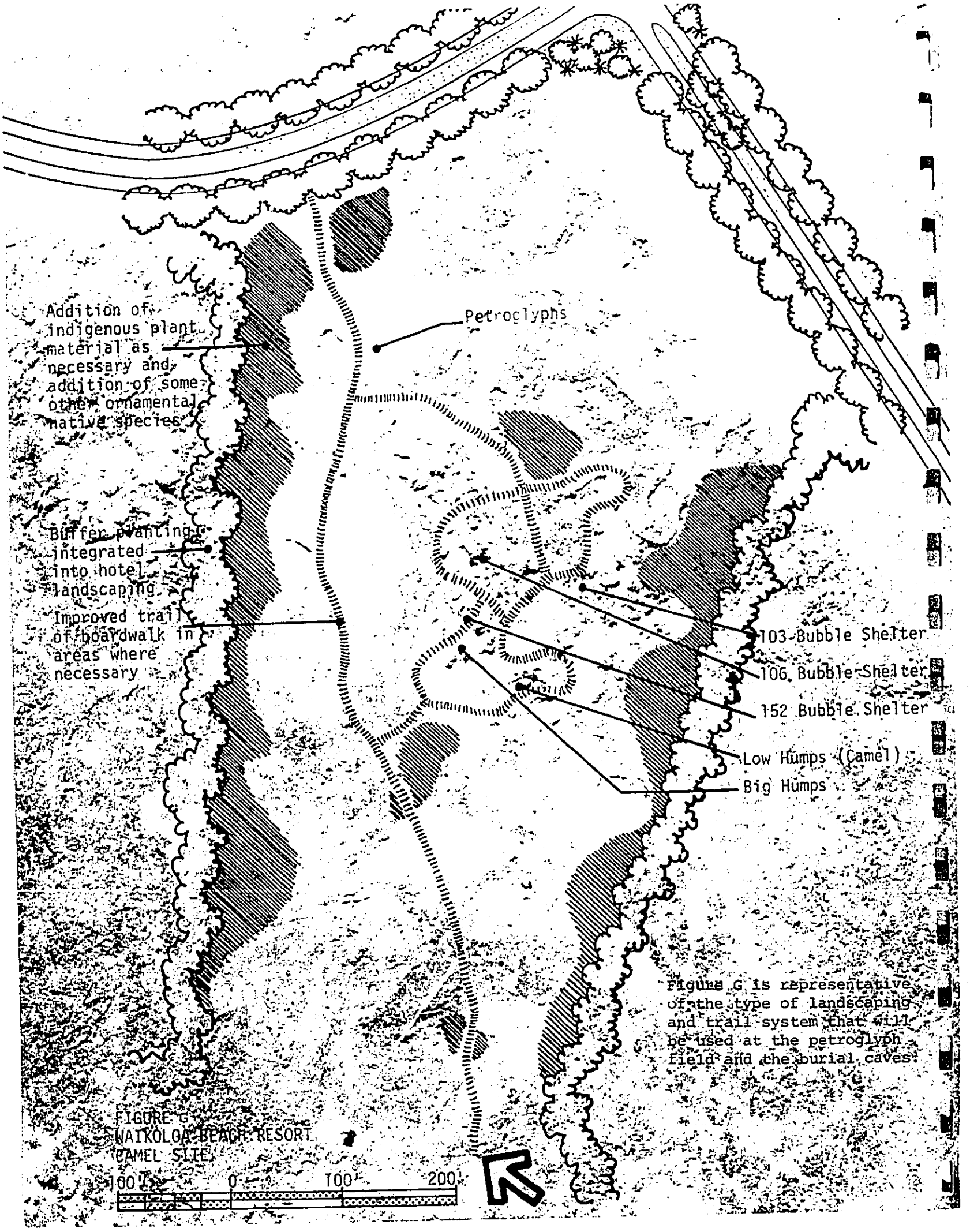

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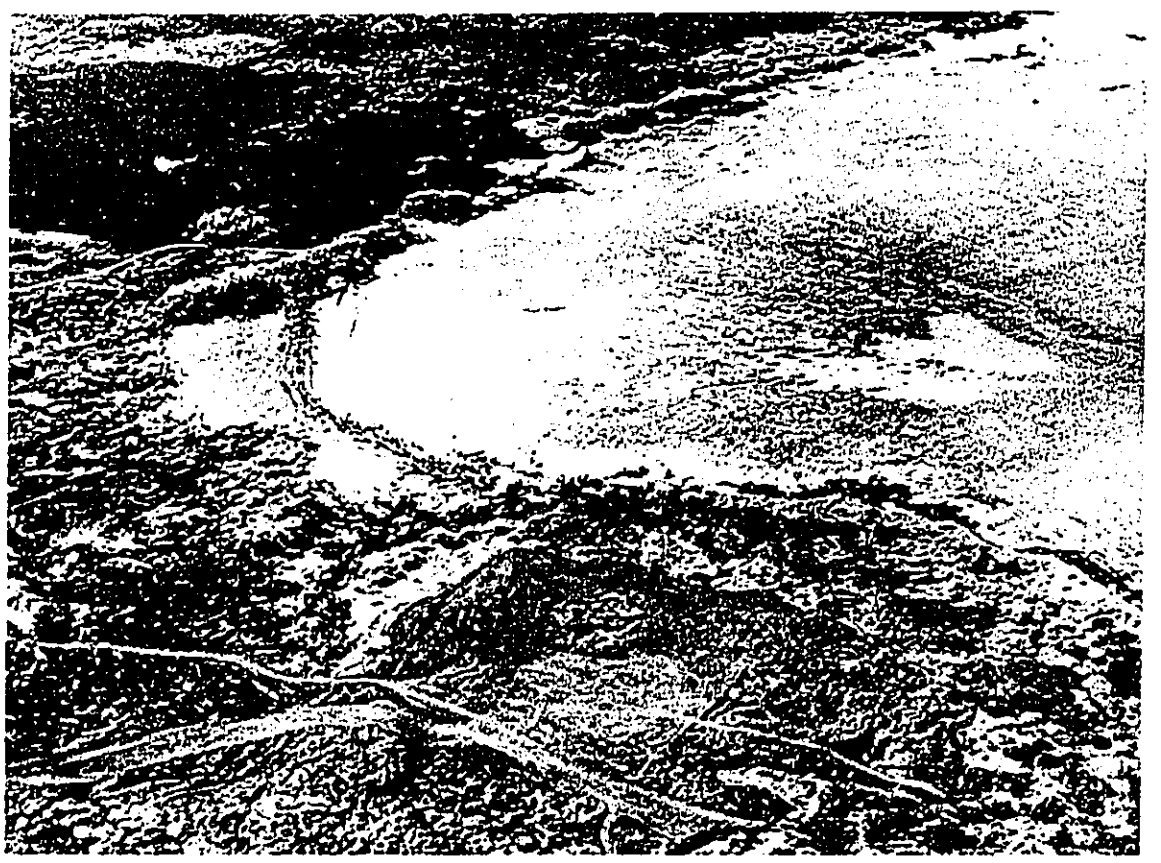
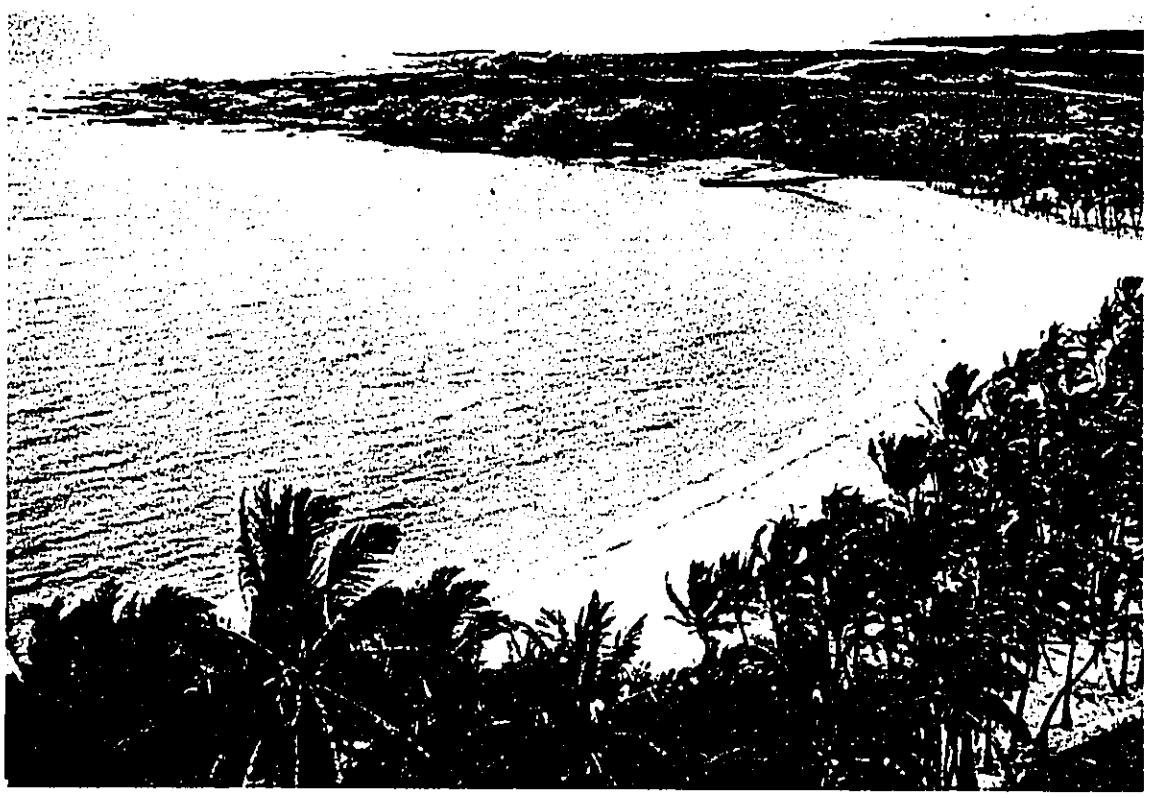


Aerial view of 'Anaeho'omalu Beach looking south. The cleared parcel of land is the approximate site of the Waikoloa Princess Hotel.



Aerial view of 'Anaeho'omalu Beach looking north.

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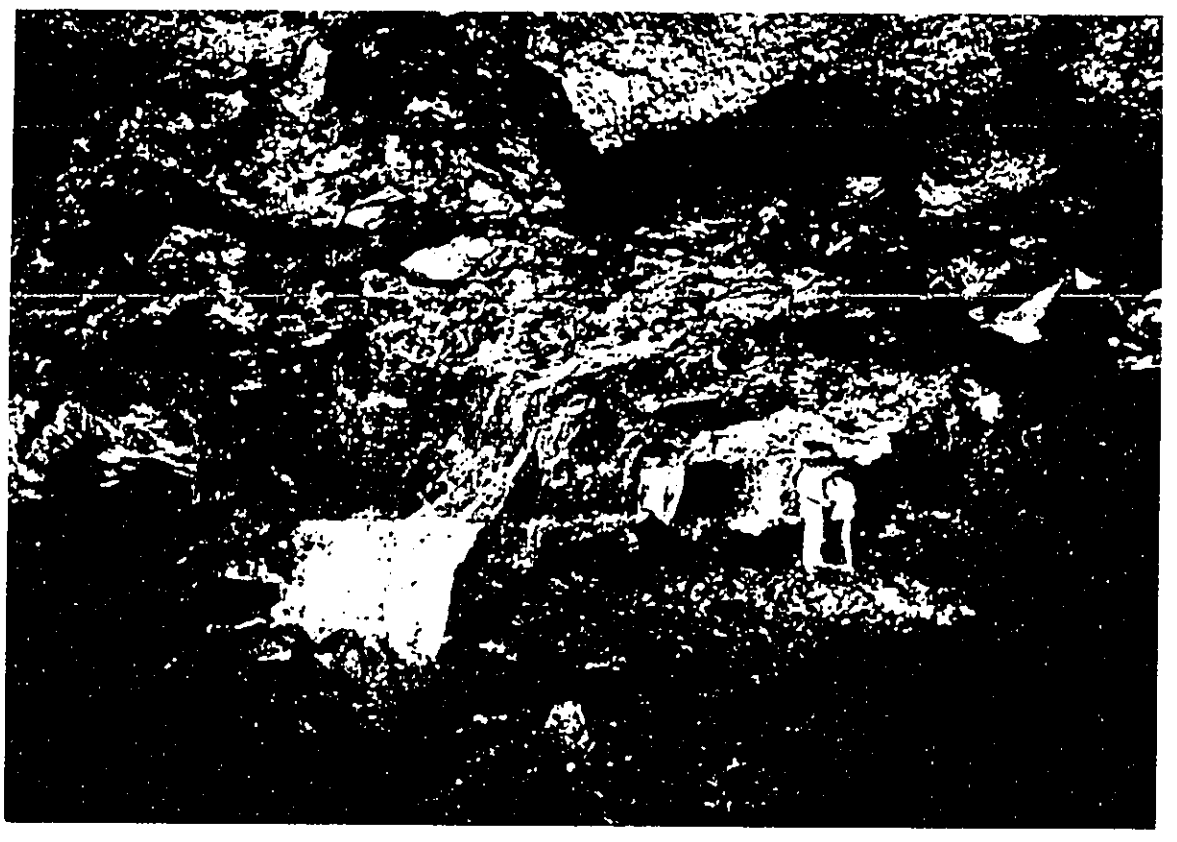
A field of petroglyphs, ancient Hawaiian rock carvings, at 'Anaeho'omalu.



The interior of a burial cave at 'Anaeho'omalu.

the King's Trail, and back to the clubhouse. The back nine follows the higher ground mauka of the future hotel area to the Kaniku ridge. From there it turns towards the ocean and the end of the recently deposited 'a'a before returning to the clubhouse. Par for the 6,985 yard-long course will be 72. (Table I-D.2).

Table I-D.2 Scorecard For First Golf Course

Hole Number	Yards	Par	Hole Number	Yards	Par
1	480	5	10	400	4
2	220	3	11	185	3
3	405	4	12	410	4
4	565	5	13	380	4
5	405	4	14	220	3
6	415	4	15	520	5
7	355	4	16	395	4
8	150	3	17	450	4
9	450	4	18	580	5
Total	3,445	36		3,540	36
			GRAND TOTAL	6,985	72

Archaeological Sites

Five clusters of archaeological sites will be improved, protected and opened on a controlled basis to the public: the Camel, the Mua and Hale Noa, the Burial Cave Complex, the Petroglyph Field and the King's Trail.

The "Camel" (Parcel 6). This feature will be integrated into a landscape feature between two hotels. Casual pathways constructed of natural material will provide access to the various individual sites. Interpretive plaques explaining the formation and past use of the area will be placed at appropriate locations along the paths. (See Figure G.)

Mua and Hale Noa (Parcel 11). These unusually well preserved features will be reconstructed using authentic materials and construction techniques. This reconstruction will be an on-going display for enjoyment and education of visitors on Hawaiian building processes and techniques. When restored to their original condition, these structures will provide an interesting focal point in the public beach and fishpond area.

Burial Cave Complex (Parcel 21). Walkways and exhibits will be established in the cave to display artifacts of pre-contact Hawai'i.

Petroglyph Field (unplanned area). Marked pathways or boardwalks will be provided that allow visitors to view this important grouping of petroglyphs without causing further breakdown of the pahoehoe surface. Interpretive plaques will be installed at appropriate locations.

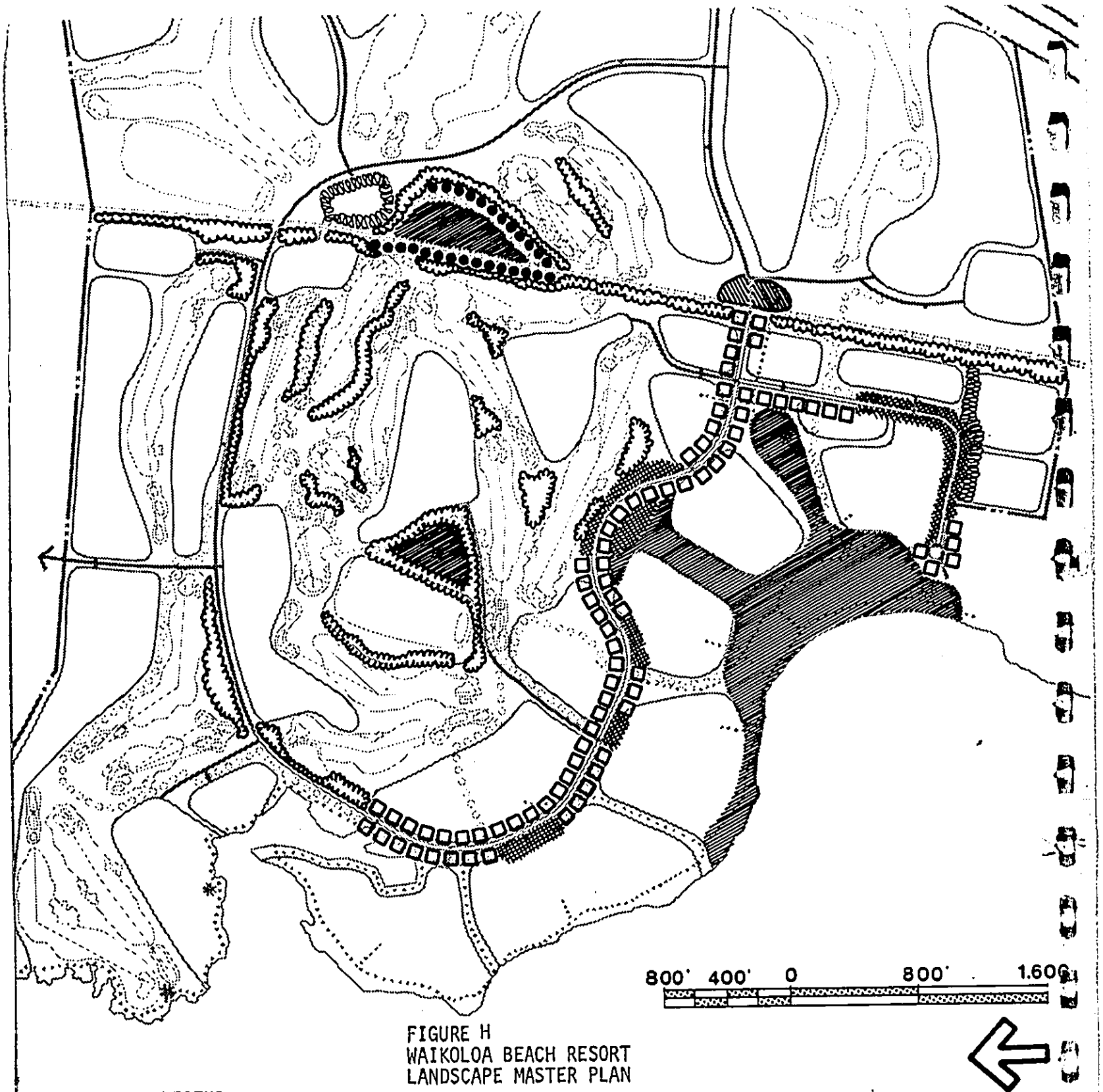


FIGURE H
WAIKOLOA BEACH RESORT
LANDSCAPE MASTER PLAN

LEGEND

- Canopy Trees
- Buffer Planting (Separation function)
- Shrubs and groundcovers
- Low visual screen
- Reinforcement of indigenous landscape as necessary and addition of some other ornamental native species
- Specialized ornamental planting
- Physical screen

King's Trail (unplanned area). Both this and the older Hawaiian trail that crosses the same area will be preserved and maintained. In places where roads cross the trail, the road pavement will be treated with a textured material so that the continuity of the trail will be maintained.

Landscaping

A landscaped shoreline walkway will be developed along the makai side of Parcels 11 and 12. The existing beach strand vegetation will be supplemented with additional plantings of such species as coconut palms, beach heliotrope, naupaka and beach morning glory.

A landscape belt will be established connecting the access road intersection, the archaeological complex located around the "Camel", and Ku'uali'i Fishpond. Footpaths will be provided through the area. Where they cross natural lava field, they will be softened and defined by indigenous vegetation such as beach heliotrope, pua-pilo shrub and groundcover varieties and naupaka.

The Ku'uali'i and Kahapapa fishpond sites (Parcel 11) will be improved by the addition of indigenous plantings of coconut palms, beach heliotrope, koa trees, hau, naupaka and beach morning glory. This landscaping will be developed around view corridors to the ocean that are being preserved for future development on Parcels, 4, 8, and 9-10. Plantings of indigenous species will also serve to enhance the restoration of archaeological sites 126 and 127, the Mua and Hale Noa, that are situated on Parcel 11.

Other archaeological sites to be developed will be provided with landscape buffers to isolate these features from the surrounding development. The large burial cave will be visually screened from the golf course and multi-family parcel with such plantings as bestill, oleander and bougainvillea. The petroglyph field will be surrounded with heavy screen planting of bougainvillea to protect the fragile pahoehoe lava from damage by the golfers' spiked shoes. The King's Trail will also be buffered from the surrounding land uses with such plantings as bougainvillea and ironwood trees.

The graded lava lying between the access roads and plantings and golf course will also be landscaped as will the ground between fairways in the areas that have already been graded. On portions of the golf course that have not been graded, the natural lava surface will act as a buffer. (Figure H shows the General Landscape Plan).

Shoreline Path

A path to provide access to the shoreline is planned to be installed incrementally as the resort development progresses (Figure I). The first portion of the path will be constructed across Parcels 11 and 12 and will include lighting, walking surface and landscaping. The initial installation will also include defining the path alignment across Sites 13 and 14 and making it safe and passable. This will allow access from Waiulua Bay to the south boundary of the resort development.

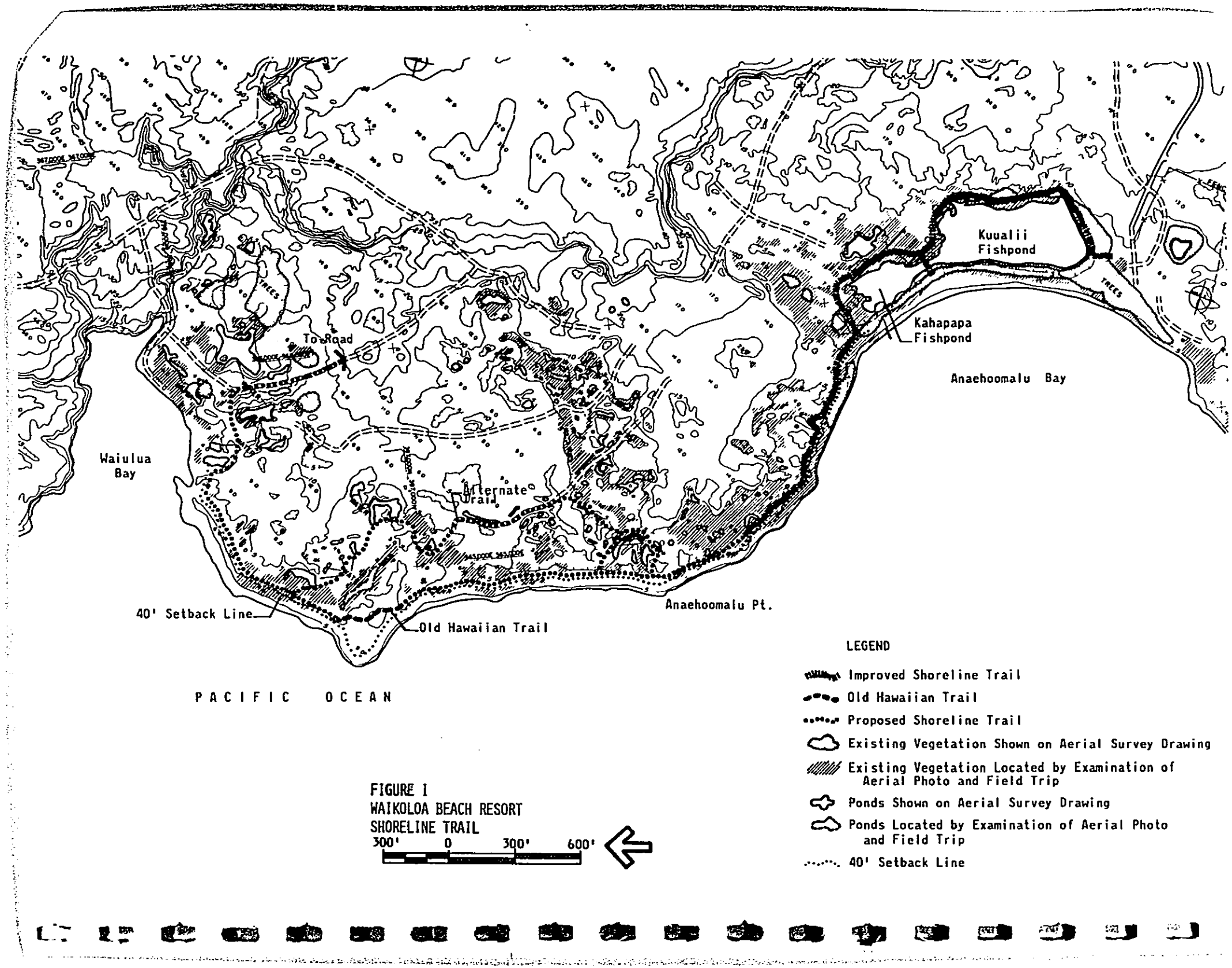


FIGURE I
WAIKOLOA BEACH RESORT
SHORELINE TRAIL

The section of coastline from the end of the Kaniku lava flow to the north boundary of the resort development is already serviced by an existing Hawaiian trail just back from the shoreline. This trail will be preserved as a shoreline walkway.

Temporary Construction Yard

During the initial construction period, a temporary construction yard will be established on the southwestern corner of the unplanned area (just mauka of the King's Trail). This area will be used until the construction effort is finished and the permanent maintenance facility is established on the second 18-hole golf course. At that time, a portion of the area will be used for a transportation center that includes permanent hotel employee parking (assuming a successful rezoning of the area in the future).

Project Nursery

Also during the initial development period, a project nursery of five acres will be established in the unplanned area mauka of the King's Trail. This area will be used as a nursery only during the development period of the project. When the need for the nursery has ended, this area will be put to other uses.

already cleared and in use

2. The Remainder of Increment One Resort Development

The remaining Increment One resort development consists of four additional hotel sites, several multi-family areas, a commercial area, and a proposed small boat harbor. Figure J shows the full development of Increment One.

The Additional Hotel Development

The luxury hotel established during the first step of construction on Parcel 12 will probably be expanded to 400-438 rooms, by adding a sixth floor. The four remaining hotel sites are planned to be developed as first class hotels, and to maintain the level of quality established by the initial hotel. Three of these hotels will be located just inland from Ku'uali'i and Kahapapa Fishponds on Parcels 4, 8, and 9-10. The fourth will be constructed on Parcel 14 at Kahapapa Point. The infrastructure of roads, water distribution lines, sewage collection lines, and underground electrical lines to these sites is included in the initial development stage.

The Parcel 9-10 hotel site is situated on the relatively flat lowland area just mauka of Kahapapa Fishpond. It is only a short walk away from 'Anaeho'omalu Beach and the golf course clubhouse. Because of the absence of any topographic barriers between this and the luxury hotel site, it is particularly important that development on this parcel be of very high quality. A landscape buffer zone will be used to provide the necessary visual separation. A maximum of 525 hotel rooms can be developed here.

Parcel 8 of the Ku'uali'i group is situated in a pocket between a small

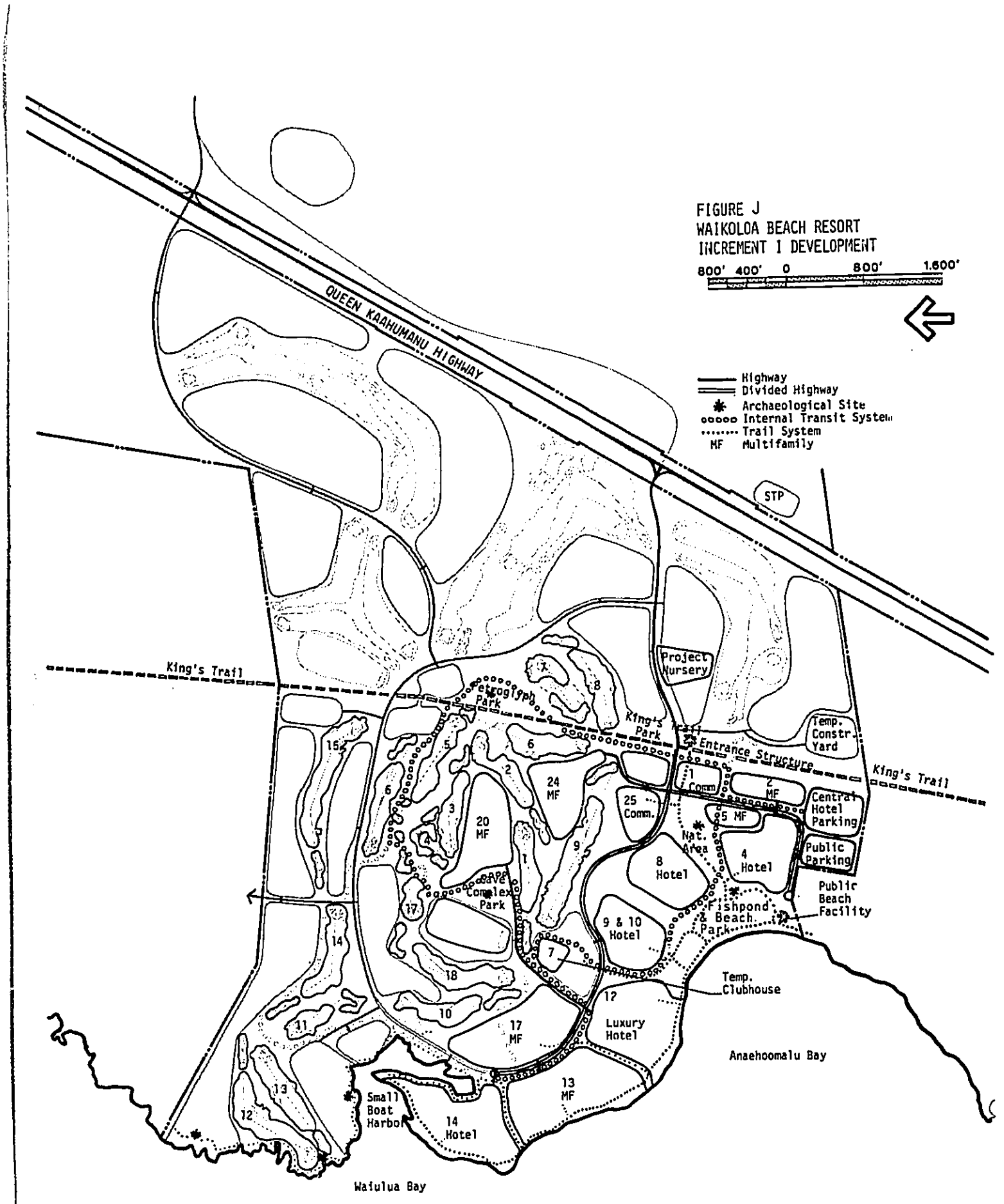


FIGURE J
WAIKOLOA BEACH RESORT
INCREMENT I DEVELOPMENT
800' 400' 0 800' 1,600'
Highway
Divided Highway
Archaeological Site
Internal Transit System
Trail System
MF Multifamily
QUEEN KAAHUMANU HIGHWAY
STP
Project Nursery
King's Trail
Petroglyph Park
King's Park
Entrance Structure
Temp. Constr. Yard
1 Comm
2 MF
Central Hotel Parking
Public Parking
5 MF
Nat. Area
4 Hotel
Public Beach Facility
Fishpond & Beach Park
Temp. Clubhouse
Cave Complex Park
8 Hotel
9 & 10 Hotel
Luxury Hotel
24 MF
25 Comm.
20 MF
17 MF
13 MF
14 Hotel
Small Boat Harbor
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

lava escarpment and Ku'uali'i Fishpond. This hotel will be separated from the Parcel 9 and 10 hotel site by a view plane corridor that will straddle the common boundary of the parcels. The view corridor will also allow an unobstructed view of the fishponds and beach area from the main access road. In its ultimate configuration, this hotel may contain up to 546 rooms. The site amenities are easy physical and visual access to the fishponds and beach, and a physical definition of the limits of the hotel site.

Parcel 4 of the Ku'uali'i group is separated from Parcel 8 by a geologic and archaeological feature known as the "Camel" because of its distinctive, humped shape. The separation will be enhanced by the development of a landscape belt from the Camel to the back of Ku'uali'i Fishpond. This will allow the development of a first class hotel of independent character with a feeling of isolation from the rest of the resort development. The maximum size of this hotel will be up to 452 rooms. The amenities of this site are its relative isolation and its good visual and physical access to the fishponds and beach.

Parcel 14, the last hotel site in Increment One, is in an isolated location on Kaauau Point. This will be an openly designed hotel of a maximum of 657 rooms using the contrasting lava and coral shoreline and the numerous brackish tide pools as a design motif. The site amenities include its isolation from the rest of the hotel development, the extensive shoreline, and direct access to Waiulua Bay. The view of the bay is set against a cliff-like backdrop formed by dark 'a'a of the Kaniku lava flow.

Planned Unit Development

The developer of the Waikoloa Princess Hotel, to be built on Lot 12 of the WBR, has designed the 350-room hotel, expandable to 400 to 438 rooms, to be built in accordance with Rule No. 7 of the County of Hawai'i Zoning Ordinance guidelines. This design concept was reviewed on a preliminary basis with the County of Hawai'i Planning Department in February, 1976. With the necessary approvals, developers of other sites may also wish to follow Rule No. 7 guidelines. This approach allows for the optimum adaptation of development to the land by providing more open space and unobstructed view corridors from the frontage road and from properties across the road, while still providing every guest room an ocean view. In addition, by moving half of the required parking offsite, more space is provided for gardens, preservation of natural areas and other amenities.

Resort Residential Areas

Six resort residential areas have been designated as a part of the first increment of development. These sites are in proximity to the first 18-hole golf course and other open spaces. Parcel 13 is beautifully situated on 'Anaeho'omalu Point, adjacent to the ocean and surrounded by tide pools formed in depressions in the lava. This resort residential area will use the tide pools and the rocky shoreline to complement the architecture and the landscaping. The remaining residential areas

may also contain multi-family dwellings clustered to maximize open space and maintain scenic view corridors of the golf course, ocean and distant mountains.

The infrastructure of roads, water distribution lines, sewage collection lines, and underground electrical to each of the residential parcels are included in the initial development stage.

The Resort Commercial Center

A 10.1-acre resort-commercial development site (Parcel 25) will be located adjacent to the intersection of the resort loop road and the main access road. It is envisioned that this commercial area will be principally for entertainment and shopping within the resort community. Commercial development will occur as demand warrants. The character of the center will be low rise -- an outdoor shopping atmosphere.

In addition to the main commercial area, a visitor orientation/information center will probably be situated at the main entrance to the resort community. It will provide day visitors and overnight guests with pertinent information on activities and facilities within the resort. The center will also house the resort management offices and real estate functions.

The Small Boat Harbor

A five-acre small boat harbor for pleasure and fishing craft is proposed at the head of Waiulua Bay as a part of Increment One. The purpose of the boat harbor will be to bring to WBR resort water related activities such as sport fishing, glass bottom boats, cocktail cruise boats, rental sailboats, etc. While it will have some berthing facilities, these would be for transient boats needing shelter -- not for permanent berthing facilities. The proposed harbor would be constructed with an entrance channel through the Waiulua Bay inlet to an inner boat landing in the adjoining tidal basin. The entrance channel will be at least 16 feet deep, and the bottom width will be at least 120 feet. The interior channels, turning basin and berthing areas for the inner boat landing will be excavated to a depth of at least 12 feet. The planned boat landing area is roughly 160 feet wide, and it extends 1,000 feet southwest from the east end of Waiulua Bay. The construction of the small boat harbor is included in this EIS as a concept only.

It should be noted that construction of a small boat harbor in Waiulua Bay is dependent upon the State Health Department reclassifying the waters of Waiulua Bay from AA to B. A similar request was denied in December of 1971. However, Boise believes that a small boat harbor falls within the range of activities consistent with the County General Plan to enhance the visitors' stay at a major resort area and plans to undertake a more detailed study of the environmental and economic impact of the small boat harbor.

The Central Hotel Parking Facility and the Internal Transit System

A central parking facility and an internal transit system will be de-

veloped as a part of the Increment One group of resort hotels as a means of minimizing the use of private autos within the resort area. A jitney system will provide service to the hotels from a temporary central parking area on Parcel 2 via a meandering scenic path. Initially, when only one or two hotels are in service, the jitneys will follow the entrance road system. When more areas are developed, a special pathway for the jitneys will be established as shown in Figure L. The service will serve as both of an alternative means of moving guests and employees around the site, and, due to the nature of its path through historic and natural features, as a recreational facility. In time the jitney service might be extended mauka to the Waikoloa Village area.

The central hotel parking facility will contain approximately one half of the required parking for all of the hotels, and will be used primarily to accommodate hotel employees. Visitors will be encouraged to use group transporation between the resort area and offsite attractions and regional airports. The central parking facility will also include parking for tour buses and day visitors and a taxi staging point. Initially, the central parking facility will be located on multi-family zoned Parcel 2.

In the future, when the area between the King's Trail and Queen Ka'ahumanu Highway is developed, the transportation center will be permanently placed in the area of the temporary construction yard. A detailed discussion of the parking and circulation requirements appears in Section I-E-7.

The Shoreline Path

The segment of the shoreline path crossing Parcels 13 and 14 will be improved with a walking surface, landscaping and lighting to match the path improvements made on Parcels 11 and 12 during Step 1A.

3. Increment Two of the Resort Development

The second increment of the resort development (Figure K) consists of one additional hotel site and eight resort residential parcels, all clustered around a portion of the original 18-hole golf course. At some time, the golf course may be expanded by the addition of 18 holes in the unplanned area mauka of the King's Trail.

The Hotel Development

Parcel 28X, situated on the Kaniku lava flow and overlooking Waiulua Bay, is the only hotel site in Increment Two. It is on a rough 'a'a lava promontory overlooking a rugged shoreline and is in marked contrast to the low-lying shoreline hotel sites of Increment One. The higher elevation of the site will provide excellent views back into 'Anaeho'omalu Bay. The site will lend itself to a design that capitalizes on contrast with the stark, rugged surroundings. The hotel design will be approximately 380 rooms.

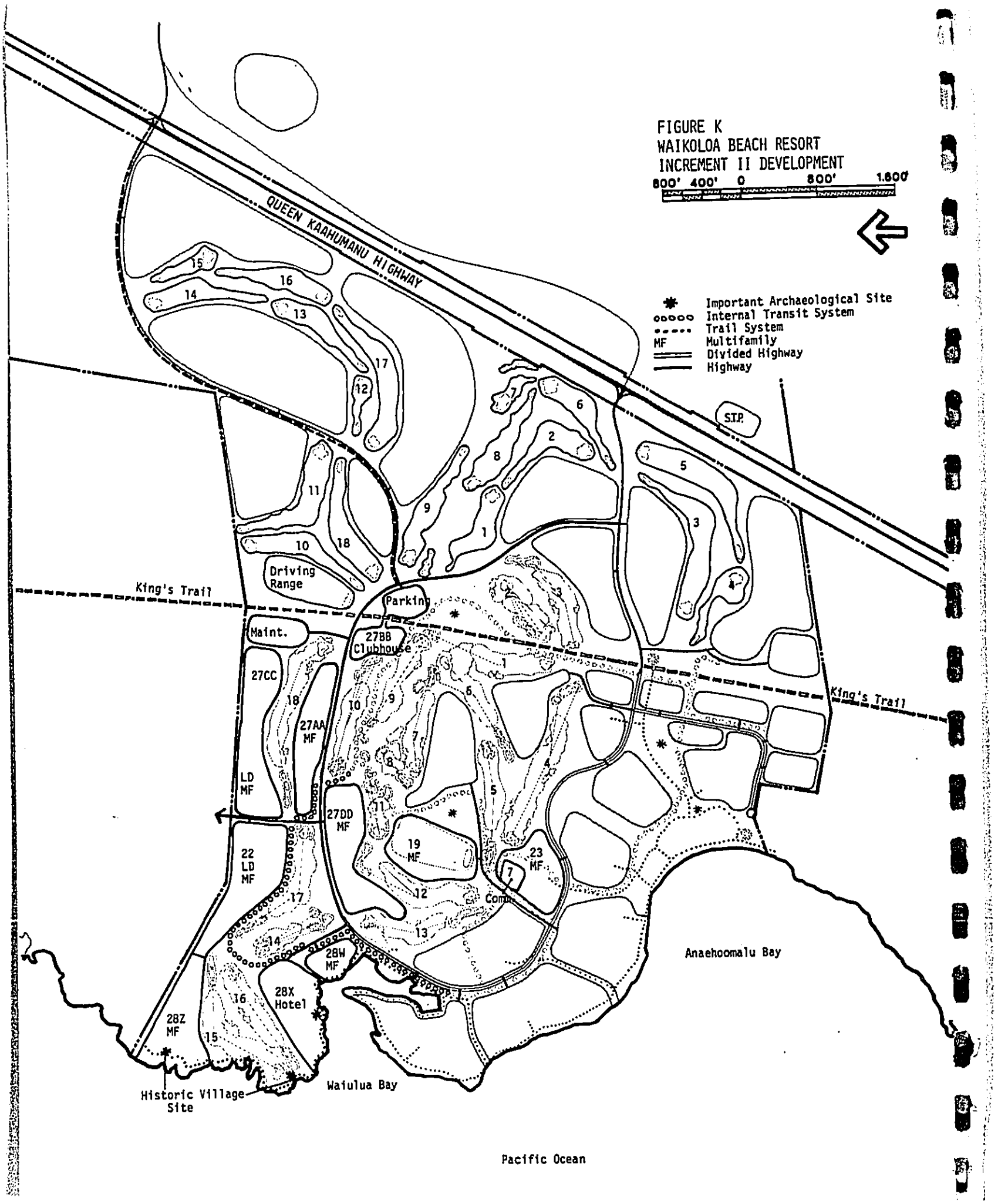


FIGURE K
WAIKOLOA BEACH RESORT
INCREMENT II DEVELOPMENT
800' 400' 0 800' 1,600'
Important Archaeological Site
Internal Transit System
Trail System
MF Multifamily
Divided Highway
Highway
QUEEN KAAHUMANU HIGHWAY
S.T.P.
Driving Range
Parking
Maint.
27BB Clubhouse
27CC
27AA MF
LD MF
27DD MF
22 LD MF
19 MF
23 MF
Comm.
28W MF
28X Hotel
28Z MF
King's Trail
Anaehoomalu Bay
Waiulua Bay
Historic Village Site
Pacific Ocean

Resort Residential Areas

Eight additional resort residential areas will be established during the second increment of development. All the residential areas will relate to the second nine holes of the initial golf course. In addition, two of the sites will share the rugged Kaniku flow shoreline with the Increment Two hotel site. Five of the sites will be developed to an average of 22 units per acre with no individual site going over a maximum of 29 units per acre. The remaining three sites will be developed at a maximum density of 14 units per acre, resulting in a multi-family unit count of 1,765 units for Increment Two. These multi-family densities give an overall average resort residential density for Increments One and Two of 20 of units per acre for a total of 3,430 residential units.

Historic Sites

With the development of Increment Two, provisions will be made for the preservation of three additional archaeological site groups. All of these groups fall on the ocean edge of the lava escarpment formed by the Kaniku lava flow.

The Waiulua Bay Settlement (Parcel 28X)

This feature will be preserved primarily as a part of the required 40 ft. shoreline setback area. At the time of the development of the hotel on Parcel 28X, the areas of the site that are found to be mauka of the 40 ft. line will be protected by easement from the hotel development.

The Nawahine Rock Settlement (Parcel 28)

Perhaps the most important of the three, this grouping is on the seaward edge of the second nine holes of the golf course. It will be in open zoned land.

The Kaniku Settlement (Parcel 28Z)

This site is on the seaward edge of a multi-family parcel. The portions of this settlement not preserved by the 40 ft. shoreline setback will be preserved by easement at the time of the multi-family development.

All three of these sites will be developed as archaeological display areas. The existing Hawaiian trail along the coast will be maintained in a safe and passable condition to allow access to each of the settlement clusters and to the shoreline. The individual sites will be stabilized where required, and interpretive plaques will be established as necessary to explain the archaeological significance of the area.

The Central Hotel Parking Facility and the Internal Transit System

The parking facility will be expanded to accommodate the parking for the additional hotel. The jitney path will be extended as shown in Figure L to accommodate the additional hotel and resort residential developments.

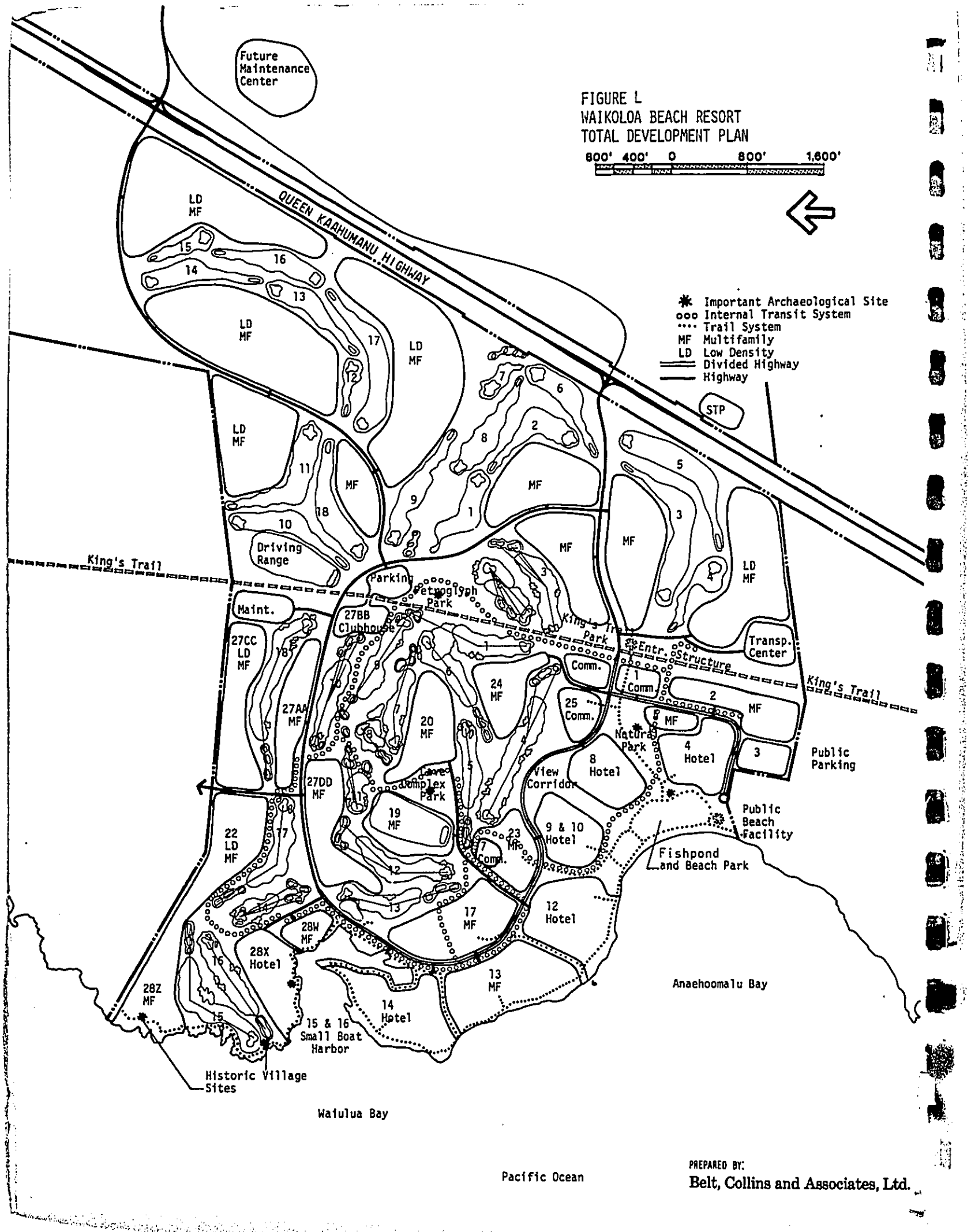


FIGURE L
WAIKOLOA BEACH RESORT
TOTAL DEVELOPMENT PLAN
800' 400' 0 800' 1,600'
Important Archaeological Site
Internal Transit System
Trail System
MF Multifamily
LD Low Density
Divided Highway
Highway
QUEEN KAAHUMANU HIGHWAY
Future Maintenance Center
STP
LD MF
MF
Driving Range
Parking
Petroglyph Park
King's Trail
Maint.
27BB Clubhouse
27CC LD MF
27AA MF
27DD MF
Comm.
Entr. Structure
Transp. Center
Public Parking
Natural Park
Lared Complex Park
View Corridor
8 Hotel
4 Hotel
9 & 10 Hotel
12 Hotel
14 Hotel
13 MF
17 MF
19 MF
20 MF
22 LD MF
23 MF
24 MF
25 Comm.
28W MF
28X Hotel
28Z MF
15 & 16 Small Boat Harbor
Public Beach Facility
Fishpond and Beach Park
Anaehoomalu Bay
Waiulua Bay
Historic Village Sites
Pacific Ocean
PREPARED BY:
Belt, Collins and Associates, Ltd.

The Shoreline Path

The last leg of the shoreline path from Waiulua Bay to the north boundary of the site along the edge of the Kaniku lava flow will follow the Hawaiian trail as a part of the archaeological display area described above.

The Golf Course

The existing 18-hole golf course (Increment One) may be expanded to another 18 holes into the unplanned area mauka of the King's Trail if use warrants it. One nine will play mauka along the edge of the Kaniku lava flow to Queen Ka'ahumanu Highway and then west across the main resort access road and back. The other nine will run east across the Kaniku lava flow to the intersection of Waikoloa Village road and Queen Ka'ahumanu Highway and then back. A permanent golf clubhouse facility will be established on the edge of the Kaniku lava flow between the first and second courses. This location affords a commanding view of the entire resort area. The existing 18 holes will be renumbered to allow a return to the clubhouse area after nine holes of play on the existing course. The final configuration will be a centrally located clubhouse with four sets of nine holes radiating away from it.

As a result of these additions to the golf course, the Increment One temporary clubhouse site, Parcel 23, will be converted to a restaurant or a multi-family use, and the temporary driving range, Parcel 22, will be freed for multi-family development. In addition, a permanent maintenance facility for the golf course will be constructed.

Increment Three of the Resort Development

This increment of the resort development will include the area between the King's Trail and the Queen Ka'ahumanu Highway. At present, this area is zoned unplanned, a holding designation. It is anticipated that some time in the future, based on increased demand, rezoning of this area will be proposed. At this time, it is envisioned that the area will be developed in cluster residential areas relating to the second 18-hole golf course extension. Also during this final increment, a permanent transportation center will be established to replace both the temporary construction yard and the central hotel parking facility.

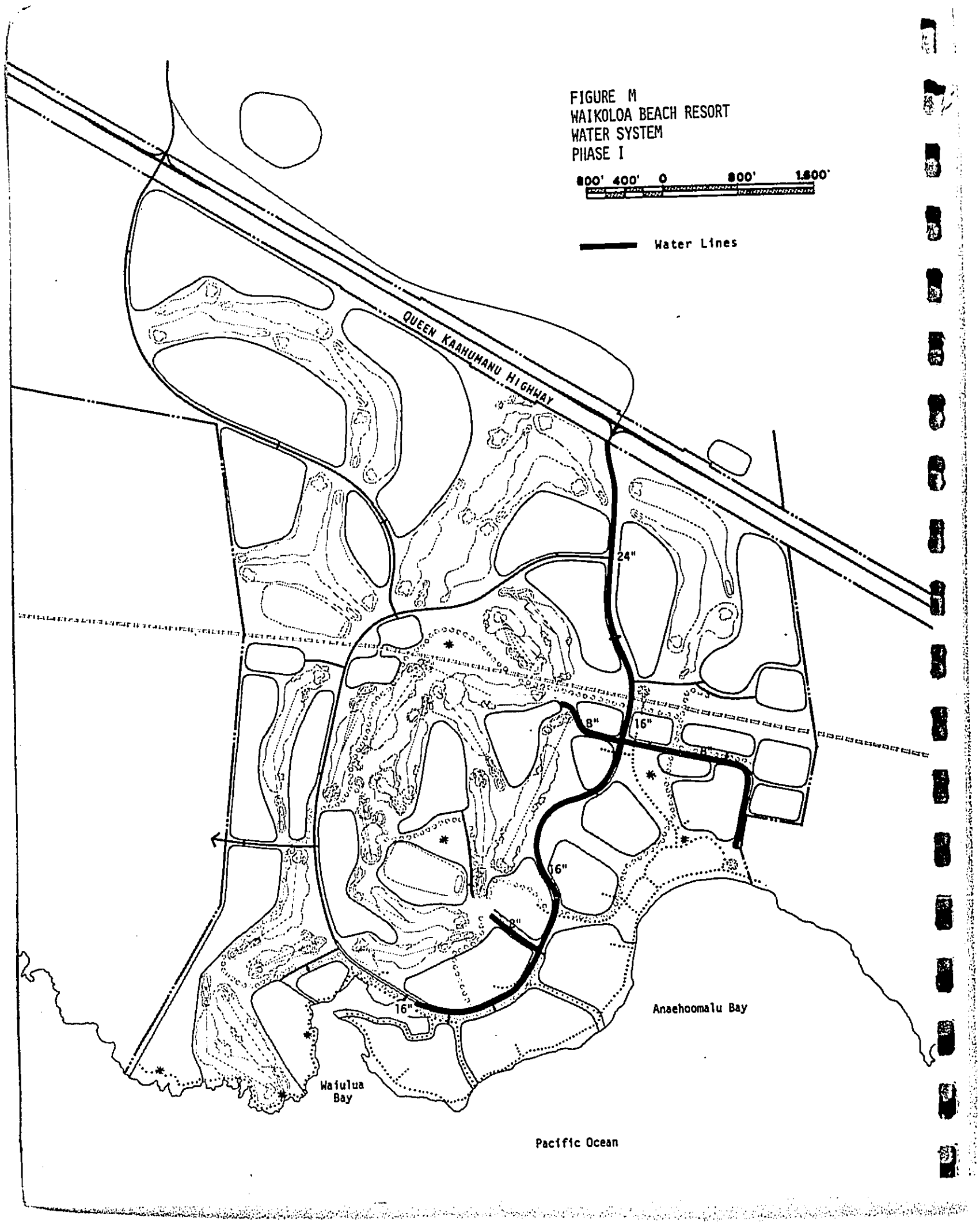


FIGURE M
WAIKOLOA BEACH RESORT
WATER SYSTEM
PHASE I
800' 400' 0 800' 1,600'
Water Lines
QUEEN KAAHUMANU HIGHWAY
24"
8"
16"
16"
8"
16"
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

E. SUPPORT FACILITIES

Basic support facilities requirements of the WBR include domestic and irrigation water systems, sewerage disposal system, electrical and communications system, cooking and heating gas system, a road network and parking and internal circulation systems. Consideration is being given to the possible financing of the domestic water system, sewerage system, and the electrical system under the County of Hawai'i Improvement Assessment Act.

1. Domestic Water System*

The existing and proposed domestic water system which serves the Waikoloa Village and which will be extended to serve the WBR is shown on Figure M.

The existing system consists of two deep wells into the Waikoloa aquifer, each with a capacity of 1.0 million gallons per day, at elevations 1,203 feet and 1,207 feet; ** chlorination facilities and a 1.0 million gallon concrete storage reservoir at the well site; transmission main of approximately 54,800 lineal feet of 14", 16" and 24" asbestos-concrete pipe; two temporary steel water tanks with storage capacities of 1,000 and 3,000 gallons and a pressure reducing unit located between the two steel tanks. The terminus of the existing 24 inch transmission main is roughly 760 lineal feet mauka of the zoned boundary limits of the WBR.

The proposed expansion of the system to serve the WBR will be in phases. Although the development stages were described in Table I-D.1, as Increment One (Step 1A and remainder of Increment One) and Increment Two, the first phase domestic water will serve not only Step 1A but a portion of the remainder of Increment One.

For engineering design purposes, domestic water requirements and waste water generation were calculated in three phases, Table I-E.1; actual construction may be in sub-phases as determined by demand and economics. All engineering is based on 100 per cent occupancy.

Table I-E.1 Phasing for Domestic Water and Waste Water Requirements

Phase		Hotels Units	Multi-Family Units	Commercial S.F.
1	Increment	1,109		
2	One	1,471	1,665	96,000 SF
3	Increment Two	420	1,765	33,000 SF
Total		3,000	3,430	129,000 SF

*Source: J. H. K. Tanaka, Inc.

**Further reviewed in Section I, B. Project History; Section II, B. 6. Ground Water; Section II, F. 1. Water System; Bowles (Ms.a); Stearns (Ms).

Phase I will consist of the construction of two 1.0 million gallon concrete storage reservoirs to replace the two existing temporary steel tanks; and the installation of approximately 7,850 lineal feet of 8", 12" and 16" ductile iron pipes.

Table I-E.2 shows the estimated domestic water requirements for the WBR. The estimated average domestic requirement for Increment One Step 1A is .269 MGD; for the total of Increment One, 1.805 MGD; and for Increments One and Two, 2.515 MGD. Table I-E.4 shows that using sewage effluent and water from Maui wells with 1,000 PPM Cl; the demand for potable water to supplement those sources for golf course irrigation will be approximately .485 MGD during the pre-opening growing season, .398 MGD during Step 1A, and work down to zero as more development in Increment One provides enough effluent to meet the irrigation requirements.

The presently served Waikoloa Village area must also be considered if demand is to be compared with the water source.

The Village is zoned for approximately 5,000 single-family lots and 1,700 multi-family lots. At 100 per cent occupancy the domestic water requirement at 600 gallons per day per unit would be 4.5 MGD. The estimated average domestic water requirement based on 75 per cent occupancy of single-family units and 50 per cent occupancy of multi-family units would be 2.37 MGD. In addition, industrial use maximum for the asphaltic concrete and concrete batching plants and for the rock quarry operation is estimated at .227 MGD. However, this will ultimately be phased out.

The total domestic water requirements for Waikoloa Village and the WBR Increments One and Two is as follows:

	100 Per Cent Occupancy Daily Demand MGD	Average Estimated Daily Demand MGD
Waikoloa Village	4.500	2.370
WBR Increments One and Two	4.084	2.515
	8.584	4.885

New wells will be drilled as development warrants.

It should be pointed out that the domestic potable water requirement could be reduced by the amount of water used for onsite irrigation for hotel and multi-family lots and the road side and common area irrigation, by tying in to the irrigation source used by the golf course when the volume of sewage effluent and Maui well mixture permits. This could reduce the ultimate potable water demand for the WBR by as much as .634 MGD, Table I-E.3, or to 3.450 MGD at 100 per cent occupancy and 1.881 MGD at estimated average occupancy.

Table I-E.2

ESTIMATED DOMESTIC POTABLE WATER REQUIREMENTS

Land Use	Lot No.	Area In Acres	Number of Units	100% Occupancy Projecting Factor Gal/Unit/Day	100% Occupancy Daily Demand MGD	Average Expected Occupancy* Projecting Factor Gal/Unit/Day	Average Expected Occupancy* Daily Demand MGD
Increment I							
Step 1A							
Hotel	12	18.8	350	600	.210	420	.147
Clubhouse	7	2.1		5,000/AC	.011	5,000/AC	.011
**Initial 18-Hole Golf Course	18, 26, 27, 28, and Unplanned	175.5					
Beach and Fishponds	11	16.3		6AC @ 5,000/AC	.030	6AC @ 5,000/AC	.030
Public Parking	3	5.0		1AC @ 5,000/AC	.005	1AC @ 5,000/AC	.005
Camel Area	6	3.4		1.7AC @ 5,000/AC	.008	1.7AC @ 5,000/AC	.008
**Burial Cave	21	5.5					
**Petroglyph Field	Unplanned	5.0					
Temp. Project Nursery	Unplanned	5.0		4.8AC @ 5,000/AC	.024	4.8AC @ 5,000/AC	.024
Temp. Construction Yard	Unplanned	7.9		2.0AC @ 5,000/AC	.010		.010
Access Roads	Unplanned						
Onsite Roads	Roads	13.6		6.7AC @ 5,000/AC	.034	6.7AC @ 5,000/AC	.034
Sub Total					.332		.269
Remainder of Increment I							
Hotel	12	18.8	50	600	.030	420	.021
Hotel	4	12.8	452	600	.271	420	.190
Hotel	8	15.7	546	600	.328	420	.230
Hotel	9 & 10	15.1	525	600	.315	420	.220
Hotel	14	18.9	657	600	.394	420	.276
Multi-family	13	20.7					
Multi-family	17	17.5					
Multi-family	20	11.0	1,665	600	1.000	300	.500
Multi-family	24	8.7					
Multi-family	2	13.5					
Multi-family	5	3.2					
Commercial	25	10.7	90,000 SF	9AC @ 5,000/AC	.045	9AC @ 5,000/AC	.045
Commercial	1	3.3	6,000 SF	5,000/AC	.020	5,000/AC	.020
Small Boat Harbor	15 & 16	5.9		.23AC @ 5,000/AC	.001	.23AC @ 5,000/AC	.001
Roads	Roads	9.9		6.6AC @ 5,000/AC	.033	6.6AC @ 5,000/AC	.033
Sub Total					2.437		1.536
Total Increment I					2.769		1.805
Increment II							
Hotel	12	18.8	38	600	.023	420	.016
Hotel	28XX	11.0	382	600	.229	420	.160
Multi-family	19	11.4					
Multi-family	23	8.5					
Multi-family	28W	7.0	1,170	600	.702	300	.351
Multi-family	27DD	13.0					
Multi-family	28Z	13.3					
Multi-family	22	16.4					
Multi-family	27CC	16.6	595	600	.357	300	.179
Multi-family	27AA	9.6					
Commercial	25	10.7	33,000 SF	1.1AC @ 5,000/AC	.006	1.1AC @ 5,000/AC	.006
Commercial	27BB	3.1			.016		.016
**Second 18-Hole Golf Course	Unplanned						
Roads	Roads	2.0		1AC @ 5,000/AC	.005	1AC @ 5,000/AC	.005
Clubhouse	27BB	3.1			.011		.011
Sub Total					1.349		.744
Less Temp. Proj. & Const. Yd.					.034		.034
Total Increments I and II					4.084		2.515

*Average occupancy 70 per cent hotels; 50 per cent multi-family.
**Included in golf course irrigation.

2. Golf Course and Landscape Irrigation System*

The golf course and other landscaped area irrigation water requirements for the WBR are shown in Table I-E.3. The figures represent probable hot, dry period irrigation requirements. The first 18-hole golf course on 172.2 acres will have approximately 143 acres landscaped with the balance left in its natural state. The second 18 holes on approximately 160 acres would have approximately 150 acres landscaped. The golf course irrigation requirements are estimated at 6,800 gallons per acre per day which is based on 1.75 inches of water a week, or about 90 inches a year. Using these figures, it is estimated that the first 18-hole golf course will require approximately .970 MGD and the second 18-hole golf course approximately 1.020 MGD.

In addition approximately seven acres of landscaped area around the burial caves and petroglyph field will be irrigated from the first 18-hole course system, using approximately .036 MGD.

Other landscape irrigation is based on 5,000 gallons per acre per day, or about 1.31 inches per week.

The golf course will initially be irrigated by brackish water from shallow wells drawing water from the basal lens supplemented as necessary with potable water from the main water system to control salinity. As effluent from the project's secondary sewage treatment plant becomes available it will be used to supplement the brackish water. At the expected occupancy rates for the hotels and resort residential units, the available effluent from the full development of Increments One and Two average about 1.706 MGD. This is more than necessary for the first 18 holes, but will not be sufficient for a second 18-hole course. Brackish water would have to be utilized to make up the difference between irrigation needs and sewage effluent.

The effluent storage will be in two holding ponds with capacities of approximately 2.0 million gallons and 4.0 million gallons located within the first 18-hole golf course. These ponds are proposed to be lined with compacted and impervious earth material.

The use of treated sewage effluent for golf course irrigation has been accepted and encouraged by the State Department of Hawai'i (Ch. 38). Keauhou Resort is doing it successfully with STP effluent quite similar to that expected at the WBR. Certain action by soil bacteria and microflora, together with sunlight, constitute a genuine third stage of treatment of the sewerage (first two stages occurring within the treatment plant).

Sewage effluent is based on estimated average occupancy. Surplus effluent could easily be disposed of on the golf courses and/or on other landscape areas as shown on Table I-E.4, thereby reducing the amount of potable water used in other landscape areas.

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*Source: J. H. K. Tanaka, Inc.

Table I-E.3 Irrigation Water Requirements

Land Use	Lot #	Area/Acres	Landscaped Area/Acres	Water Requirements
Increment I				
Step 1A				
Hotel	12	18.8	7.43	.037
Clubhouse	7	2.1	.50	.003
Golf Course (first 18 holes)	18, 26, 27, 28 and Unplanned	175.5	142.70	.970
Beach and Fishponds	11	16.3	6.00	.030
Public Parking	3	5.0	1.00	.005
Camel Area	6	3.4	1.69	.008
Burial Cave	21	5.5	2.50	.012
Petroglyph Field	Unplanned	5.0	4.80	.024
Support facilities				
Temporary Project				
Nursery	Unplanned	5.0	4.80	.024
Construction Yard	Unplanned	7.9	2.00	.010
Onsite Roads	Roads	13.6	6.74	.034
Total Step 1A				1.157
Remainder Increment I				
Hotel	4	12.8	5.00	.025
Hotel	8	15.7	6.00	.030
Hotel	9 & 10	15.1	6.00	.030
Hotel	14	18.9	7.00	.035
Multi-family (Inc. temp. hotel parking on Parcel 2)	13, 17, 20 24, 2, 5	74.6	20.00	.100
Commercial	25	10.7	.80	.004
Commercial	1	3.9	1.54	.008
Small Boat Harbor	15 & 16	5.9	.23	.001
Support Facilities				
Roads	Roads	9.9	6.65	.033
Total Remainder Increment I				.266
Increment II				
Hotel	28X	11.0	4.00	.020
Multi-family	23, 22, 28, 19, 27AA, 28Z, 27DD 27CC	95.8	30.00	.150
Commercial	25	10.7	.08	.001
Clubhouse	27BB	3.1	.20	.001
Golf Course (2nd 18 holes)	Unplanned	160.0	150.00	1.020
Support Facilities				
Roads	Roads	2.0	.99	.005
Perm. Hotel Parking Area	Unplanned	17.0	1.28	.006
Total Increment II				1.203
Less Temp. Proj. Nursery & Const. Yard.		12.9	6.80	.034
Total Increments I & II				2.660
Golf Course, Petroglyph Field and Burial Cave				2.026
Other Landscaping (Included within Domestic Water Requirement, Table I-E.2)				.634

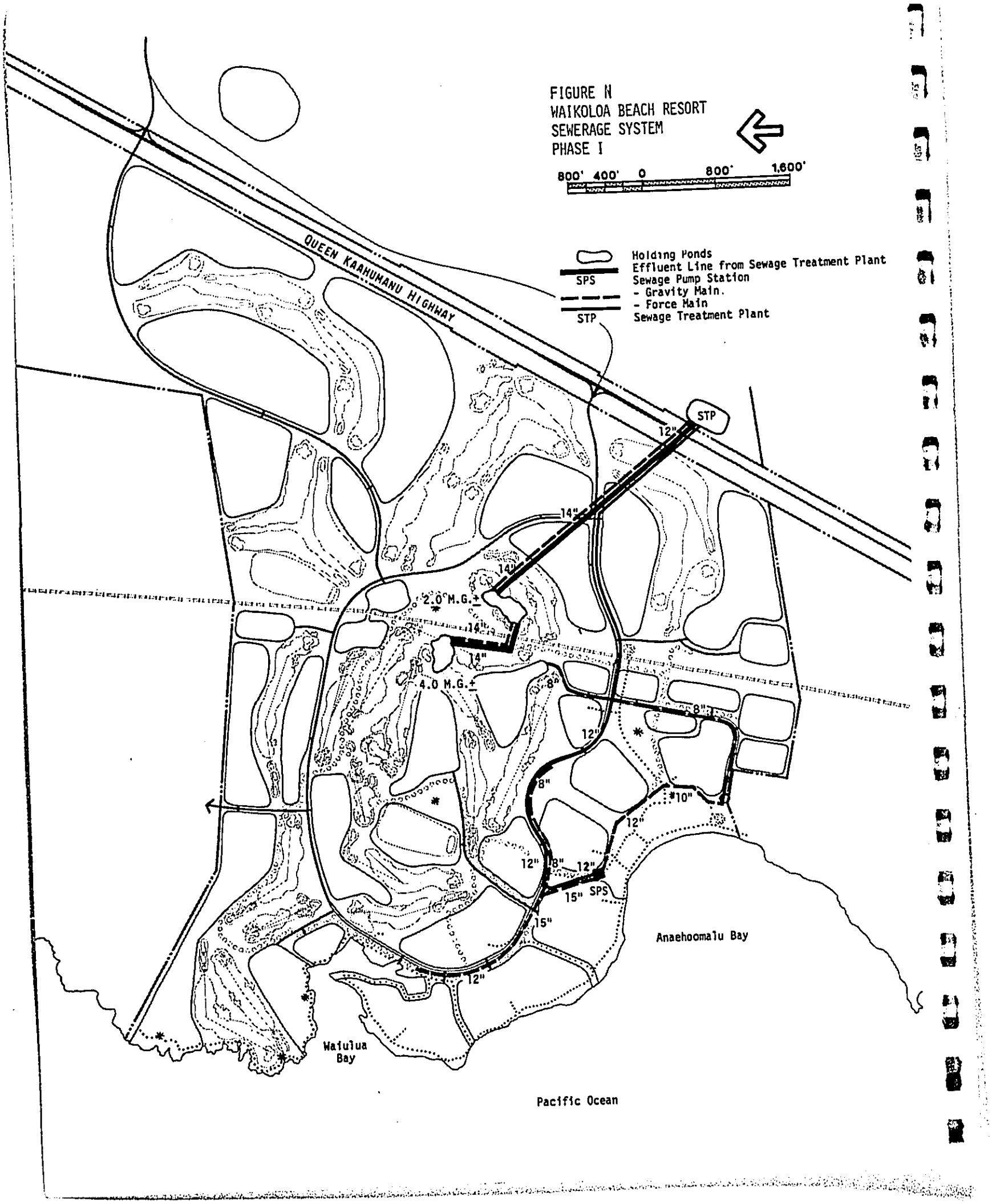
FIGURE N
WAIKOLOA BEACH RESORT
SEWERAGE SYSTEM
PHASE I
800' 400' 0 800' 1,600'
Holding Ponds
Effluent Line from Sewage Treatment Plant
SPS Sewage Pump Station
- Gravity Main.
- Force Main
STP Sewage Treatment Plant
QUEEN KAAHUMANU HIGHWAY
STP
12"
14"
14"
2.0 M.G.±
14"
14"
4.0 M.G.±
8"
8"
12"
8"
*10"
12"
12"
8"
12"
15" SPS
15"
12"
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

Table I-E.4 Source of Golf Course Irrigation

	Sewage Effluent	Brackish Wells	Potable Water	Total
Golf Course Growing Season		.485	.485	.970
Step 1A	.154	.552	.398	1.006
Increment I	1.282			1.006
Increments I and II	1.706	.319		2.026

3. Sewerage System*

The proposed WBR sewerage system is shown in Figure N and consists of a waste-water reclamation plant with two offsite holding ponds, a pump station and force main and trunk and main sewers. The generation of waste-water and the design of the sewerage system are based on the estimates shown in Table I-E.5. Per unit contributions by hotel occupants and by residential family occupants were, respectively, 511 gallons per unit per day and 316 gallons per unit per day. These contributions are from comparison of actual flow quantities measured and being experienced by comparable resort developments on Hawai'i and Maui.

The average flow quantities of waste water to be generated are calculated to be .570 MGD for Phase I and 1.282 MGD for Phase II (Total Increment One); total Phase One, Two, and Three (Increments One and Two) 1.706 MGD.

From the above quantities, the various facilities of the Phase One system were designed to either be capable of handling Phase Two flow (Total Increment One) or to be able to handle Phase One flow yet be able to expand to cover the total flow requirement. The system is designed so that it can expand in phases or subphases depending on the need and economics of development.

All gravity main and trunk sewers are to be vitrified clay or polyvinyl chloride pipes. Force mains and effluent mains will be of ductile iron material. These collection and transmission lines are to be located within the road right-of-way or within sewer easements.

The sewage pump station will be of concrete construction and the site landscaped. Top of the concrete structure will be at ground level. Above ground installation consists of a building to house a generator.

The waste-water reclamation plant will be located on raw barren lava land mauka of and adjacent to the Queen Ka'ahumanu Highway. After pre-treatment, waste-water will be treated by the aerated lagoon process where oxygen for aerobic stabilization is by mechanical aeration. The lagoon will be excavated, shaped to its dimensions and the berm slopes and floor made impervious by the use of compacted earth material.

*Source: H. J. K. Tanaka

Table I-E.5

ESTIMATED SEWAGE GENERATION

Land Use	Lot No.	Area/Acres	No. of Units	100% Occupancy Gal/Unit/Day	100% Occupancy Daily MGD	Average Expected Occupancy Gal/Unit/Day	Average Expected Occupancy Daily MGD
Increment I							
Hotel	12	18.8	350	511	.180	358	.125
Clubhouse	7	2.1		4,000/AC	.008	4,000/AC	.008
Initial 18-hole golf course	18, 26, 27, 28, UP	175.5			.001		.001
Beach & Fishponds	11	16.3					
Public Parking	3	5.0					
Camel Area	6	3.4					
Burial Cave	21	5.5					
Petroglyph Field	UP	5.0		1,500/AC	.008	1,500/AC	.008
Temp. Proj. Nursery	UP	5.0		1,500/AC	.012	1,500/AC	.012
Temp. Const. Yard	UP	7.9					
Access/Onsite Roads	UP/ROADS	21.5			.209		.154
Remainder of Increment I							
Hotel	12	18.8	50	511	.026	358	.018
Hotel	4	13.0	452	511	.231	358	.162
Hotel	8	15.7	546	511	.279	358	.195
Hotel	9 & 10	15.1	525	511	.268	358	.188
Hotel	14	18.9	657	511	.336	358	.235
Multi-family	13	20.7					
Multi-family	17	17.5					
Multi-family	20	11.0	1,665	316	.526	158	.263
Multi-family	24	8.7					
Multi-family	2	13.5					
Multi-family	5	3.2					
Commercial	25	10.7	90,000 SF	9AC @ 4,000/AC	.036	9AC @ 4,000/AC	.036
Commercial	1	3.3	6,000 SF	4,000/AC	.016	4,000/AC	.016
Small Boat Harbor	15, 16	5.9		2,600/AC	.015	2,600/AC	.015
Total Increment I					1.733		1.128
							1.128
Increment II							
Hotel	12	18.8	38	511	.019	858	.013
Hotel	28X	11.0	382	511	.195	358	.136
Multi-family	19	11.4					
Multi-family	23	8.5					
Multi-family	28W	7.0					
Multi-family	27DD	13.0					
Multi-family	28Z	13.3	1,170	316	.370	158	.185
Multi-family	22	16.4					
Multi-family	27CC	16.6	595	316	.188	158	.094
Multi-family	27AA	9.6					
Multi-family	25	10.7	33,000 SF	1.1AC @ 4,000/AC	.004	1.1AC @ 4,000/AC	.004
Commercial	27BB	3.1	10,000 SF	4,000/AC	.012	4,000/AC	.012
Commercial					.788		.444
Less Temp. Nursery and Const. Yard					.020		.020
Total Increments I and II					2.710		1.706

The effluent will then be clarified by mechanical means, chlorinated and piped to two lined holding ponds arranged in series. The two ponds will be located within the initial 18-hole golf course and the effluent disposed of by irrigating the golf course turf and plantings and, should there be a surplus, by irrigating hotel, multiple family and road lawns and plantings.

Sludge collected in the clarifier will be returned to the aerated lagoon for further biological action. No sludge drying bed will be required.

Structures and improvements within the plant site will consist of an access road 16 feet in width, a control building approximately 16 feet wide by 32 feet long, a concrete comminuting structure, a concrete division box, a lagoon approximately 2.8 acres in area, a concrete clarifier tank approximately 22 feet in width and 67 feet in length, and a concrete chlorine contact tank approximately 17 feet wide by 46 feet long. The perimeter of the plant site visible from the road as well as certain areas within the plant will be landscaped.

All structures will be at graded ground level except for the control building which will be roughly 13 feet above ground level.

Odor, if any, could be generated during the start up period until the mechanical aerators are in operation. Odor could also be generated if all mechanical aerators malfunction and are not repaired before septicity occurs.

4. Electricity, Telephone and CATV*

Electric power, telephone and CATV services will be provided by the Hawai'i Electric Light Company, Hawaiian Telephone Company and by West Hawai'i Cable Vision.

During Step 1a, the services will be extended from the Waikoloa Village Substation, located approximately 6.2 miles inland from the resort area, by overhead installation to a new substation to be located adjacent to and mauka of the Queen Ka'ahumanu Highway. The substation will also be adjacent to the resort's Wastewater Reclamation Plant and will be landscaped.

From the new substation, the utilities will be placed underground to cross the highway, then rise overhead after crossing the highway to the southerly corner of the resort boundary. Service from the southerly corner to the entire resort area will be underground.

The onsite distribution system will be installed in a concrete encased buried conduit system. The conduit system will be made up of polyvinyl chloride ducts varying in sizes from two inches for the CATV system, four inches for the telephone system and three, four and five inches for the electrical system. The number of electrical ducts in

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*Source: J. H. K. Tanaka, Inc.

Table I-E.6

ELECTRIC POWER DEMAND*

Land Use	Lot. No.	Area in Acres	Number of Units	Connected Electrical Power: Projecting Factor KW/Unit	Connected Electrical Power: Connected Demand KW
Step 1A of Increment I					
Hotel	12	18.8	350	2.5	875
Temporary Clubhouse	7	2.1			225
Initial 18-Hole Golf Course	Unplanned	175.5			50
STP and Lift Station	18, 26, 27, 28				
Temporary Construction Yard					150
Misc. Common Areas					25
Sub Total					15
					1,340
Remainder of Increment I					
Hotel (Expansion)	12	18.8	50	2.5	125
Hotel	4	12.8	452	2.5	1,130
Hotel	8	15.7	546	2.5	1,365
Hotel	9/10	15.1	525	2.5	1,312
Hotel	14	18.9	657	2.5	1,642
Multi-family	13, 17, 20, 24, 2, 5	74.6	1,665	5.0	8,325
STP and Lift Station					150
Commercial	25	10.7	90,000 S.F.	.008 KW/sq. ft.	720
Commercial	1	3.3	6,000 S.F.	.008 KW/sq. ft.	48
Small Boat Harbor	15, 16	5.9			100
Misc. Common Area					15
Sub Total					14,932
Total Increment I					16,272
Increment II					
Hotel (Expansion)	12	18.8	38	2.5	95
Hotel	28X	11.0	382	2.5	955
Multi-family	23, 22, 28, 19, 27CC, 27AA, 28ZZ, 27DD	95.8	1,765	5.0	8,825
STP and Lift Station					150
Commercial	25	10.7	33,000 S.F.	.008 KW/sq. ft.	264
Clubhouse	27BB	3.1			225
Second 18-Hole Golf Course	Unplanned	160			50
Misc. Common Area					15
Sub Total					10,579
Total Increments I & II					26,851

*Source: Belt, Collins and Associates, Ltd.

the various areas will vary depending on demand. Table I-E.6 shows the estimated electric power demand for the resort area.

Ground level installations will consist of handholes and pull boxes whose sizes vary from a minimum two feet width by four feet length to a maximum six feet width by eleven feet length. The tops of these structures will be flush with the ground surface.

Above ground facilities will be amplifiers for CATV signals, transformer stations and switch vault stations. Street lights will also be installed. These luminaire and stand structures will not be more than 30 feet above ground.

Electrical and telephone cables will be installed by the utility companies during Step 1A. CATV cable will be installed when the demand warrants.

5. Gas*

Consideration is also being given to using natural gas as a fuel in the operation of hotels, commercial activities, and possibly for residential developments. For initial phases of the development, Gasco, Inc. proposes to install temporary, individual project LPG installations. Gas piping laterals under proposed roadways would be installed at the crossings indicated on Figure O at time of road construction. Ultimately a central tank farm and a distribution system will be developed. The 30,000 gallon tank will be located mauka of the King's Trail in the Ahu-o-Lono area as a part of the construction yard and eventual transportation area. The distribution system will consist of a 4" gas line running parallel to the loop road from the tank farm to the hotel sites.

6. Road System**

The Access Road System

The major highway that provides access to WBR is the Queen Ka'ahumanu Highway connecting Kawaihae and Kailua-Kona. This highway is supplemented by Waikoloa Road, constructed by Boise and dedicated to the County, connecting Mamalahoa Road to the Queen's Highway via Waikoloa Village. Access from the Queen's Highway to the zoned area of WBR is via a 3,000 foot two-lane paved access road within a 120 foot right-of-way.

Step 1A of Increment One construction, as shown in Figure F, will include a 5,000 foot long divided two-lane resort entrance road from the King's Trail to hotel Parcel 14 on an 80 foot right-of-way. A branch two-lane divided public beach access road 2,300 feet long on a 60 foot right-of-way will also be constructed as a part of Step 1A. These roads will provide access to five hotel and six multi-family sites.

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*Source: Gasco, Inc.
**Source: Belt, Collins and Associates, Ltd.

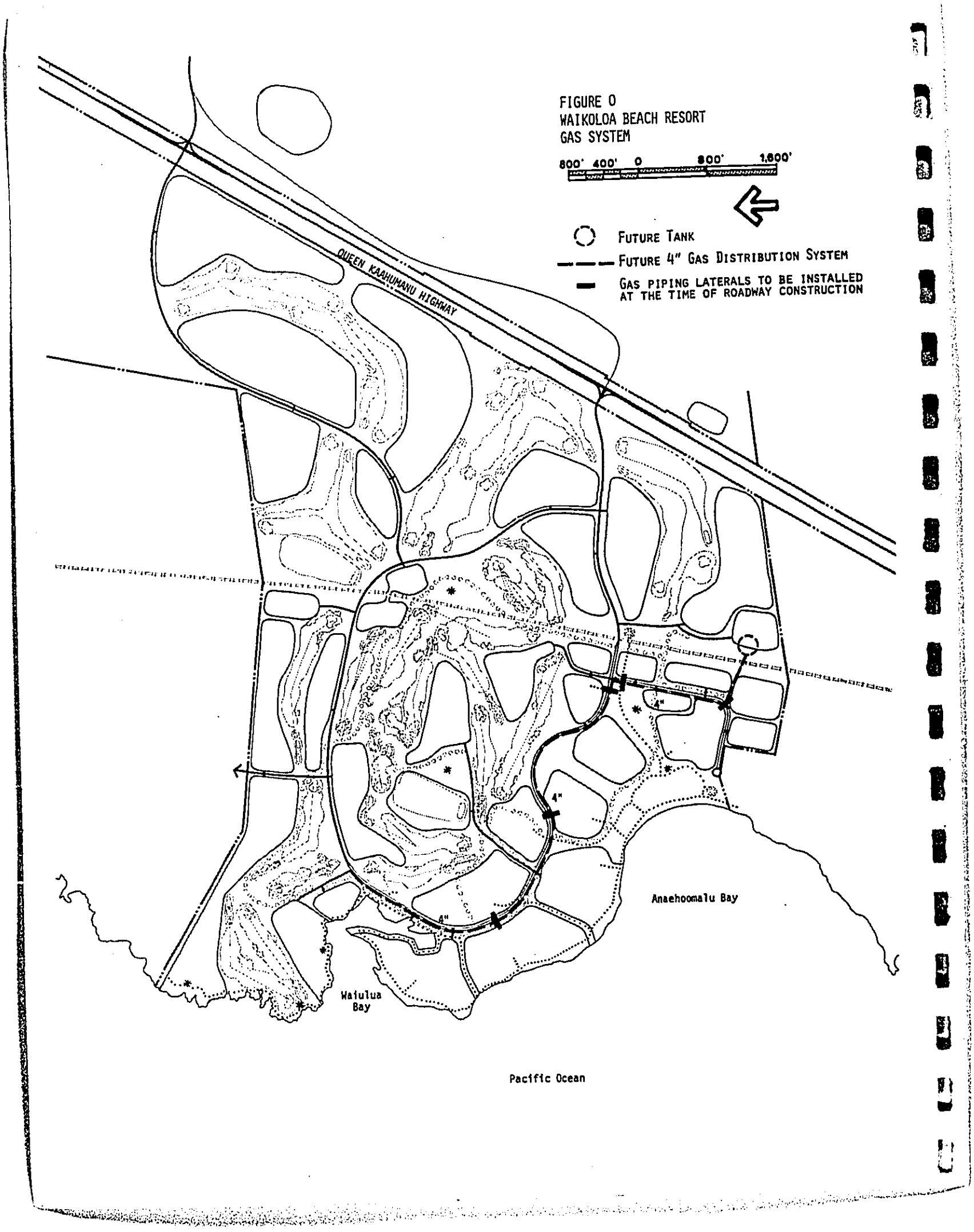


FIGURE O
WAIKOLOA BEACH RESORT
GAS SYSTEM
800' 400' 0 800' 1,600'
FUTURE TANK
FUTURE 4" GAS DISTRIBUTION SYSTEM
GAS PIPING LATERALS TO BE INSTALLED AT THE TIME OF ROADWAY CONSTRUCTION
QUEEN KAAHUMANU HIGHWAY
4"
4"
4"
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

The typical section of the divided highway, shown in Figure P, consists of two 12 foot traffic lanes divided by a 16 foot landscaped median strip. Also to be installed during Step 1A will be a two-lane clubhouse access road 600 feet long on a 80 foot right-of-way.

Increment Two construction will include the extension of the divided configuration of the resort entrance road 1,400 feet to the hotel Parcel 28X access road intersection. From this point, the road will be reduced to a two-lane configuration and extended 6,000 feet along the Kaniku lava flow and back to intersect with the then existing access road to form a loop. Access roads from the resort entrance road to the various multi-family and hotel parcels to be developed during Increment Two will also be constructed.

The Anticipated Traffic Load

The traffic analysis is divided into construction employment and deliveries, resort employment and deliveries, and visitor traffic. Each of these functional requirements are then analyzed for the points in time that will correspond to the increments of the development; Step 1A construction, normal operation of Step 1A, normal operation of Increment One, and normal operation of Increment Two.

Construction Employee Traffic. The number of workers involved in the construction of the initial Step 1A facilities is expected to average about 300. The number of workers required for the construction of the remainder of Increment One and Increment Two will probably be less. The major road and utilities construction will have been completed so the average construction force will probably be no more than 150 people.

It is assumed that 130 of the initial construction force will live in the existing construction camp adjacent to Waikoloa Village and some eight miles mauka of the construction site. An additional 20 people will live in Waikoloa Village itself. The remaining 150 will commute to the site from their homes: North Kohala, 34 miles and Waimea, 20 miles. It is assumed the distribution of employees will be 75 from each of these areas. The actual demand for the group quarters in the construction camp may be less than 130, but since the quarters exist some employees may live there.

It is also assumed that the 150 employees who will be involved with the remaining Increments One and Two work will be distributed as follows: 50 per cent from the construction camp and Waikoloa Village, 20 per cent North Kohala, 20 per cent Waimea and 10 per cent from Kailua-Kona. As shown in Table I-E.7, using these assumptions, construction workers will travel about 6,000 vehicle miles a day during Step 1A and about 3,040 vehicle miles a day during the remaining increments of construction.

FIGURE P
WAIKOLOA BEACH RESORT
TYPICAL CROSS-SECTION OF
DIVIDED HIGHWAY

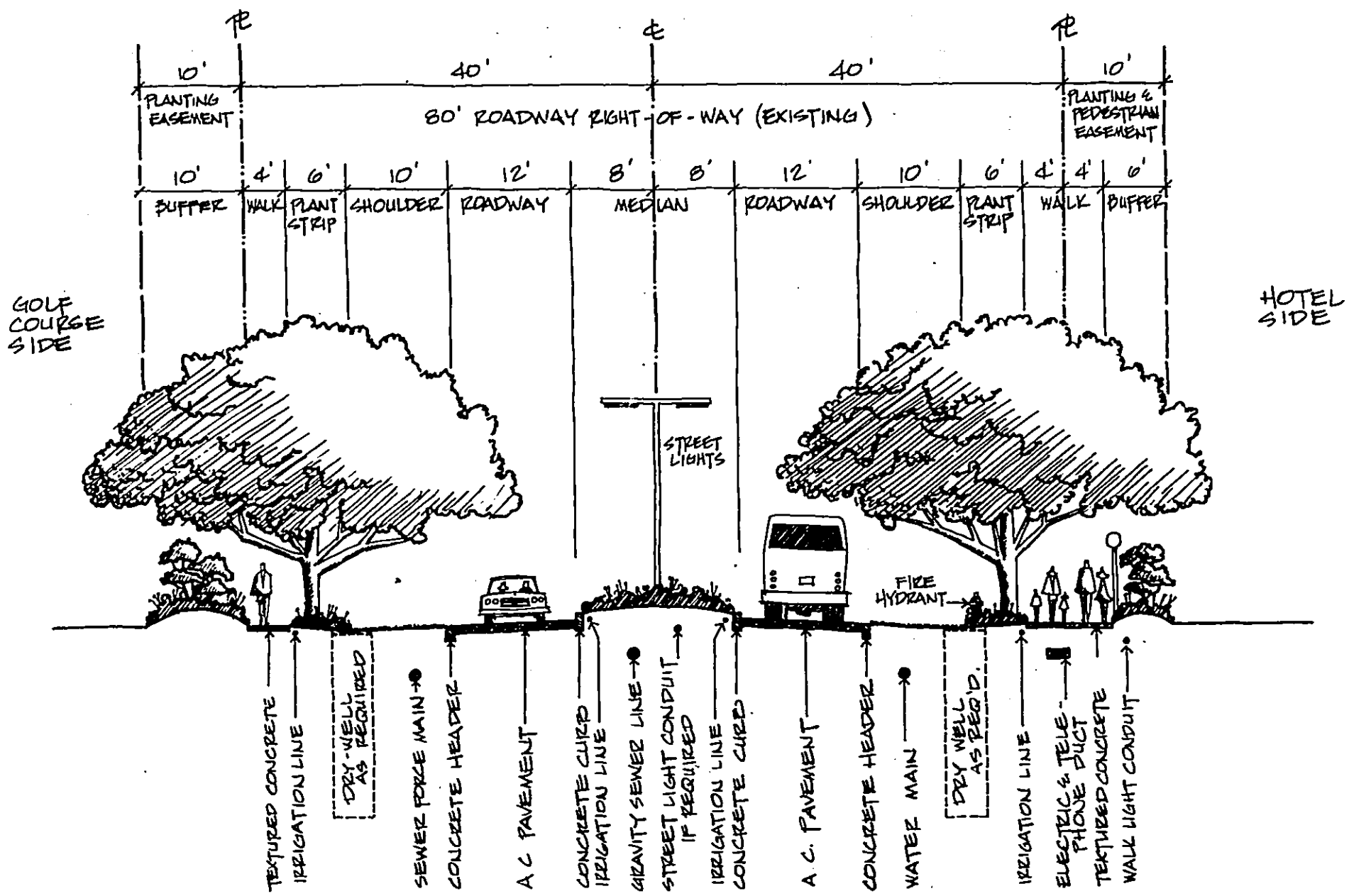


Table I-E.7: Analysis of Construction Employee Traffic

Employee Residence Area	No. of Employees	Distance from WBR	No. of Employees per Vehicle	Number of one way vehicle trips per day	Vehicle miles per day
Step 1a Initial Construction Period					
No. Kohala	75	34	1.5	100	3,400
Waimea	75	20	1.5	100	2,000
Waikoloa Village & Constr. camp	150	8	4.0	75	600
TOTAL	300			275	6,000
Increments 1 and 2 Construction Periods					
N. Kohala	30	34	1.5	40	1,360
Waimea	30	20	1.5	40	800
Kailua-Kona	15	24	1.5	20	480
Waikoloa Village & Constr. Camp	75	8	3.0	50	400
TOTAL	150			150	3,040

Construction Material Delivery Traffic. Material deliveries for all increments of construction will consist primarily of various kinds of fill for the construction of the golf course, landscaped areas, roads, and building pads from the Boise Quarry just mauka of the Queen Ka'ahumanu Highway, and/or other nearby areas, asphalt and concrete from batch plants at the Boise Quarry; and deliveries of steel, cement, wood and equipment from ships and barges docking at Kawaihae Harbor. Some material will be moved around on site in response to golf road and building pad elevation requirements. Table I-E.8 gives a breakdown of the material movement, and is based on the projected land transformations described in a subsequent section of this EIS.

Anticipated Resort Employee Traffic. Projections of the traffic to be generated by resort employees is based on assumptions on where these employees are likely to be living. The first step in traffic projection is to estimate the employees required to operate the various functions of the resort. Table I-E.9 shows the projected employment at the WBR site by increments. Data relating to employment ratios, characteristics, and composition were derived from an analysis of the Mauna Kea Beach Hotel and comparable standard hotels situated in West Hawai'i, from State Department of Planning and Economic Development (DPED) studies, (1972 and 1972a) and from results of research by Merrill (1974).

Table I-E.8 Analysis of Construction Material Delivery Traffic

Material	Total Amount Cu Yd	Amount/ Load	Total Trips Requ.	One Way Trips/ Day*	Distance/ O/W Trips (in miles)	Total Vehicle Distance/Day (in miles)
Step 1a of Increment 1 Initial Construction Period						
Fill from quarry	118,840	8.0	14,850	58	3	174
Volcanite soil mix from quarry	246,480	8.0	30,810	120	3	360
Asphaltic conc. from quarry	6,760	7.5	900	4	3	12
Conc. from Boise batch plant	9,000	7.5	1,200	5	3	15
Material delivered from Kawaihae Harbor		-		4**	9	36
TOTAL				191		597
Increment 1 Remainder Construction Period						
Fill from quarry	116,370	8.0	14,550	11	3	33
Volcanite soil mix from quarry	92,990	8.0	11,620	9	3	27
Asphaltic conc. from quarry	20,240	7.5	2,700	2	3	6
Conc. from Boise batch plant	84,400	7.5	11,250	9	3	27
Material delivered from Kawaihae Harbor		-		4**	9	36
TOTAL				35		129
Increment 2 Construction Period						
Fill from quarry	157,790	8.0	19,720	31	3	93
Volcanite soil mix from quarry	236,430	8.0	29,550	46	3	138
Asphaltic conc. from quarry	14,170	7.5	1,890	3	3	9
Conc. from Boise batch plant	36,500	7.5	4,870	8	3	24
Material delivered from Kawaihae Harbor		-		4**	9	36
TOTAL				92		300

*258 work days a year--for 2 years during Step 1a, for 10 years during the remainder of Increment One and five years during Increment Two, for an estimated continuous construction time of 17 years.

**Assumes an average of two round trips per day to Kawaihae Harbor for material pickups.

Table I-E.9: Projected Resort Employment

Step 1a of Increment I	
Hotel (350 rooms x 1.30 employee/room)	455
Golf course/clubhouse	30
Service/landscaped areas and beach	10
TOTAL	495
Increment 1 Total	
Hotel No. 1 (400 rooms x 1.30 employees/room)	520
Hotels (2,180 rooms x .76 employees/room)	1,657
Resort residential (1,665 units x .15 employees*/unit)	250
Resort commercial (96,000 sf x 1 employee/200 sf)	480
Small boat harbor recreation areas	2
Golf course/clubhouse	30
Beach area	4
Archaeological sites	4
Service/landscaped area maintenance	12
TOTAL	2,959
Increment 1 and 2	
Hotel No. 1 (438 rooms x 1.30 employees/room)	569
Hotel (2,562 rooms x .76 employees/room)	1,947
Resort residential (3,430 units x. 15 employees/unit)	514
Resort commercial (129,000 sf x 1 employee/200 sf)	645
Golf Courses	50
Additional Areas	22
GRAND TOTAL	3,747

Within the planned resort community, hotels will be the largest single generator of direct employment. The first hotel to be constructed (Step 1a) will be a very high quality, 350-room hotel. An employee to room ratio of 1.3 is projected by the hotel operator.

Other facilities and functions within Step 1A which will generate direct employment are the golf course and clubhouse, service and maintenance of infrastructure, and landscaping. Based on the number of jobs at Mauna Kea Beach and other resort golf courses, it can be expected that WBR's 18-hole resort golf course and clubhouse facility will employ a total of about 30 employees for the initial 10-year period. Possible future expansion of the course to 36-holes will require an estimated 20 additional employees.

The service and maintenance of infrastructure will encompass principally the operations of the water and sewage-treatment facility and landscape maintenance along the main access road to the resort hotel and golf clubhouse. Ten employees are projected for these functions in Step 1A, as well as for maintenance of the beach and archaeological

*Source: Hastings, Martin, Hallstrom and Chew, Ltd. (1974)

Table I-E.10

Analysis of Resort Employment Traffic

Employee Residence Area	No. of Employees	Distance from WBR (in miles)	No. of Employees per vehicle		No. of O/W vehicle trips/ day employees 50% by car 50% by bus		Vehicle Miles per Day	
			Car	Bus	Car	Bus	Car	Bus
Step 1a of Increment 1								
N. Kohala	197	34	1.5	15	131	13	4,450	440
S. Kohala	198	20	1.5	15	131	13	2,620	260
Kailua-Kona	50	24	1.5	15	33	3	790	70
Waikoloa Village	50	8			33	3	260	30
TOTAL	495	Av. commute dist. 24 miles			328	32	8,120	800
Increment 1 including Step 1a								
N. Kohala	592	34	1.5	15	390	40	13,260	1,360
S. Kohala	592	20	1.5	15	390	40	7,800	800
Kailua-Kona	295	24	1.5	15	200	20	4,800	480
Waikoloa Village	1,480	8	1.5	15	990	100	7,920	800
TOTAL	2,959	Av. commute dist. 19.5 miles			1,970	200	33,780	3,440
Increment 1 and Increment 2								
No. Kohala	750	34	1.5	15	500	50	17,000	1,700
S. Kohala	750	20	1.5	15	500	50	10,000	1,000
Kailua-Kona	373	24	1.5	15	250	24	6,000	580
Waikoloa Village	1,874	8	1.5	15	1,250	124	10,000	990
TOTAL	3,747	Av. commute dist. 18 miles			2,500	248	43,000	4,270

sites.

With respect to resort condominiums and other residential dwellings, it has been assumed that about 50 per cent of the units will be put into rental pools, and these will require maintenance, room service, and administration. Drawing from a study by Hastings, Martin, Hallstrom and Chew, Ltd. (1974), condominium manpower requirements have been estimated at about 0.15 employee per gross dwelling unit. In other words, approximately 250 employees are expected to service the 1,665 resort condominium units planned for Increment One.

Increments One and Two of the resort community development are zoned to include five additional hotels, for a total room count of about 3,000 rooms. For these additional hotels, 0.76 employee per room is anticipated, a rate comparable to existing first-class hotels located on the Neighbor Island (Merrill 1974). Using these factors and the hotel room counts, we can project a total of about 2,177 jobs for the Increment One hotel development, which will then increase to about 2,516 jobs at the end of Increment Two.

The anticipated resort employee traffic is shown in Table I-E.10. Mauna Kea Beach Hotel employee records show that the average one way commute distance for employees is 23 miles, comparable to the figure of 24 miles used in the table for Step 1a. It is assumed that no more than 50 resort employees will be living at Waikoloa Village by the completion of Step 1a. The remaining employees will include 198 living in South Kohala, 197 living in North Kohala and 50 living in Kailua-Kona. For Increment One, it is assumed that at least 1,480 employees would live in Waikoloa Village; the successful completion of the first hotel and the prospect of additional development should have stimulated considerable growth in the Village by the end of Increment 1a. As growth of the resort continues, a constant portion of 10 per cent of (or 295 for Increment One) new employees will come from Kailua-Kona. The available labor from the Kohalas will be 592 each. This trend will begin in Increment One and continue in Increment Two. Waikoloa Village will also continue to expand, and this is reflected in the decreasing average commute distance used in Table I-E.10.

It is assumed the employees will travel 50 per cent by bus and 50 per cent by private car. This is similar to the existing situation at Mauna Kea Beach Hotel; about 50 per cent of the employees come by bus from North Kohala.

Anticipated Resort Deliveries. It is assumed that the number of pick-ups and deliveries will be the same for each WBR hotel as it is for the Mauna Kea Beach Hotel (28/week). The distance traveled on each delivery is assumed the average distance from Waimea, Kona, and Hilo--45 miles one way. (Table I-E.11).

Table I-E.11 Analysis of Resort Pickups and Deliveries

Development Stage	# of O/W Vehicle Trips/Day	Vehicle Miles/Day
Step 1a		
1 Hotel	4	360
Increment 1 Total		
5 Hotels	20	1,800
Increments 1 and 2		
6 Hotels	24	2,160

Visitor Traffic. The traffic generated by visitors is estimated by calculating both the maximum number of visitors possible at 100 per cent occupancy and the number at expected average occupancy. The trips per day taken by various modes of transportation are then estimated using experience from the West Hawai'i area.

Table I-E.12 shows the projected resort visitor population. The average party size is estimated to be 1.9 per room hotel and 2.5 per resort residential unit. (Hastings, Martin, Hallstrom and Chew, Ltd., 1974). A factor of 10 per cent of this visitor population is added as an estimate of day visitors to the area from other resort areas. The average expected occupancy rate is 70 per cent for hotels and 50 per cent for resort residential units (Harris, Kerr, Forster & Co., 1973).

The analysis of visitor generated traffic is shown in Table I-E.13. The number of offsite round trips per day is estimated at 1.0 for both hotel visitors and for resort residential visitors. The average round trip distance traveled on the tour or drive on the island of Hawai'i is assumed to be about 100 miles. From WBR one round trip to Ke-ahole Airport is about 32 miles; one trip around the island is 225 miles; a round trip to the Volcano is 210 miles. The mode of transportation used by hotel visitor is estimated to be 50 per cent by organized tour (bus); 33 per cent by private or rented car; and 17 per cent by public conveyance (bus). The average number of hotel visitors in each type of conveyance is estimated to be 1.8 per private car; 35 per tour bus and 15 per public bus. The mode of transportation used by resort residential visitors is assumed to be 100 per cent private or rented car, with an average of two persons per car per trip.

For day visitors to the beach and golf course from other resort areas or residential areas, it is assumed that two-thirds will come by car and one-third by bus. The trips per day over the access roads are calculated, but the vehicle miles are not included in the hotel attributed to WBR.

Table I-E.12 Projected Resort Visitor Population

Facility	# units	Guests/ unit	Population at 100% Occupancy Occup.	Population at 100% Occupancy Pop.	Population at Expected Average Occupancy Occup.	Population at Expected Average Occupancy Pop.
Step 1A of Increment 1						
Hotel	350	1.9	100%	665	70%	465
Resort Residential	-0-	2.5	100%	-0-	50%	-0-
Other*				70		50
TOTAL				735		515
Increment 1 Total						
Hotel	2,580	1.9	100%	4,900	70%	3,430
Resort Residential	1,665	2.5	100%	4,160	50%	2,080
Other*				910		550
TOTAL				9,970		6,060
Increments 1 and 2						
Hotel	3,000	1.9	100%	5,700	70%	3,990
Resort Residential	3,430	2.5	100%	8,580	50%	4,280
Other*				1,430		830
TOTAL				15,710		9,100

*Assumes that day visitors will be 10 per cent of the resident population.

The Adequacy of the Access Road Design

The adequacy of the access road design is tested by summing all the different traffic loads estimated above and then testing the resultant peak load against the lowest capacity link in the access road design. The section of road tested was the road connection between Queen Ka'ahumanu Highway and the internal loop road system. All offsite traffic must use this road. Table I-E.14 shows a summary of offsite trips per day.

The estimated peak hour traffic is estimated using a factor of 11 per cent of daily traffic flow to represent a peak period of one hour. This is a safe estimate considering the even distribution of traffic throughout the day in a resort operation. Table I-E.15 shows the peak hour traffic estimate compared to the capacity of the access road.

Table I-E.13

ANALYSIS OF VISITOR GENERATED TRIPS

Source of Visitor	# O/W Trips/Day	Av. R/T Distance	% Visitors Using Each Mode		Av. # Pass. Each Mode		# Visitors	100% Occupancy				# Visitors	Average Expected Occupancy			
			Car	Bus	Car	Bus		O/W Veh. Trips/Day		Veh. Miles Per Day			O/W Veh. Trips/Day		Veh. Miles Per Day	
								Car	Bus	Car	Bus		Car	Bus	Car	Bus
Step 1a of Increment 1																
Hotel	2	100	33	67	1.8	35	665	240	24	12000	1200	465	168	16	8400	840
Resort Residential	2	100	100	0	2.0	0	0	0	0	0	0	0	0	0	0	0
Outside Visitors	2		67	33	2.0	15	70	50	6	0	0	50	40	4	0	0
TOTAL							735	290	30	12000	1200	515	208	20	8400	840
Increment 1 Total																
Hotel	2	100	33	67	1.8	35	4900	1800	190	90000	9500	3430	1260	133	63000	6650
Resort Residential	2	100	100	0	2.0	0	4160	4160	0	208000	0	2080	2080	0	104000	0
Outside Visitor	2		67	33	2.0	15	910	610	40	0	0	550	370	24	0	0
TOTAL							9970	6570	230	298000	9500	6060	3710	157	167000	6650
Increments 1 and 2																
Hotel	2	100	33	67	1.8	35	5700	2090	220	104500	11000	3990	1460	154	73150	7700
Resort Residential	2	100	100	0	2.0	0	8580	8580	0	429000	0	4280	4290	0	214500	0
Outside Visitor	2		67	33	2.0	15	1430	960	62	0	0	830	560	36	0	0
TOTAL							15710	11630	282	533500	11000	9100	6310	190	287650	7700

Table I-E.14 Offsite One-Way Trips Per Day

Basis of Trip	Initial Constr. Period	Step 1A	Incre. 1 Total	Incres. 1 and 2
Construction Employees	275	150	150	0
Construction Materials	191	35	92	0
Resort Employees		360	2,170	2,748
Resort Deliveries		4	20	24
Hotel and Resort Residential visitors considering 100 per cent occupancy		320	6,800	11,912
TOTAL	466	869	9,232	14,684

Table I-E.15 Peak Period Traffic Load on Access Road

	Average Estimated Daily Load Veh/Day	Peak Load Veh/Hr	Road Design Capacity*
Initial construction period	466	51	1,420
Step 1a	869	96	1,420
Increment 1	9,232	1,016	1,420
Increments 1 and 2	14,684	1,615	2,840**

*The ideal two-lane road has a maximum capacity of 2,000 vehicle/hour.

**A second access road will be added some time during the construction of Increment 2.

The highway carrying capacity is estimated by starting from a theoretical maximum two-lane road capacity of 2,000 vehicles per hour for two-way traffic or 1,000 vehicles per lane. This is then reduced depending on the design characteristics of the specific road in question.

The figures in Table I-E.15 indicate that the original two lanes on the main access road are capable of carrying the total projected Increment One traffic but will become over loaded sometime during the development of the second increment. The roadway right-of-way and landscaping have been designed so that the pavement can be expanded to four lanes when necessary. There are, however, reasons why it may be more desirable to develop a completely separate second access road linking the internal loop road with Queen Ka'ahumanu Highway than to expand the original road.

First, two smaller roads provide considerably more flexibility than a single road. A dual system is also less susceptible to blockage as the result of accidents and natural disasters. Perhaps most importantly, the use of two roads will significantly reduce the impact of WBR-generated traffic on Queen Ka'ahumanu Highway.

In this respect, it should be noted that the preceding discussion focused only on the capacity of the roadway in general. In the case of WBR, however, the controlling point is much more likely to be the intersection of the main access road and Queen Ka'ahumanu Highway. At present, there are so many unknowns (frequency and direction of turning movements, traffic volume on the highway, type of traffic control devices, etc) that it is impossible to quantify the intersection capacity. However, the traffic congestion at this point will probably require construction of additional facilities before the theoretical capacity of the remainder of the road is reached.

7. Parking and Internal Circulation System*

Hotel Parking

The County of Hawai'i Comprehensive Zoning Ordinance (CZO) requires hotel parking as follows:

One hotel parking space for each three hotel rooms.
One parking space for each 200 square feet of commercial area in the hotel.
One parking space for each 200 square feet of floor area used for restaurants or nightclubs.
Recreational facility parking requirements vary with the facility:
Tennis - three spaces per court
Golf - three spaces per hole

A projection of the parking required by the CZO, based on the above requirements, for the hotel portion of the resort complex can be estimated using the following assumptions:

Approximately 25 square feet of commercial area will be incorporated into each hotel for each hotel room. This works out to .12 parking space per room for in-house commercial parking.
Approximately two seats or 80 square feet of restaurant or nightclub will be provided in each hotel for each hotel room. This works out to .40 parking space per hotel room for in-house restaurants.
One parking space per three hotel rooms works out to .33 parking spaces per room.
.08 parking spaces per room for tennis and other onsite recreational facilities.

The area of parking required is 28 per cent of the total hotel zoned area. This combined with the estimated coverage of buildings, access roads, bus parking and pathways from Table IV-A.1 in Section IV-A-1, Land Transformation and Construction, will require 60 per cent of the entire hotel zoned area. This will leave only 38 acres to accommodate

*Source: Belt, Collins and Associates, Ltd.

the required shoreline setback and hotel landscaping. Two factors that create this dense situation are the building height limit and the on-site parking requirements.

The means chosen at WBR to reduce site coverage without decreasing the density is to develop a planned unit development where feasible and to move 50 per cent of the parking requirement off the hotel sites. Offsite parking would be accomplished in a two-step process. During the initial development period, a temporary central hotel parking facility will be located on multi-family zoned Parcel Two. After the Increment Three area has been zoned (some time late in the development of Increment One), the temporary construction yard would be converted into a transportation center for employee parking, some guest parking, bus and taxi stands and rent-a-car facilities. These areas will be connected to the hotels via an internal jitney transportation system. This system would run on the access roads during the initial development period. After sufficient demand has built up the system would be provided with pathways that are in some cases separate from the access road.

As each Increment One hotel is built, half of the required parking will be placed in the central hotel parking area. The internal transit system will be initiated when the first hotel is completed and the first section of parking is built in the central hotel parking area. At first, the transit system will use only the initial access road down to the turnaround at Parcel 14. After Parcels Eight, Nine, and Ten are developed, an independent path for the system would be developed from the access road adjacent to the orientation facility down to the fishpond area and then back up the the temporary clubhouse over a bridge across the access road where it cuts through the lava ridge between Parcels 10 and 12, then up to the cave complex and petroglyph park and then back parallel to the King's Trail to the parking area. As additional facilities in later increments are added the transit system will be expanded to accommodate them. (Figure L.)

The parking strategy outlined above can be further justified by an analysis of the actual parking requirements for the projected visitor and employee population. The required parking may be estimated using the following assumptions:

> Based on the figure of 33 per cent of the visitors using private or rented cars (used in the traffic projection section) with an average of 1.9 visitors per car and 1.9 visitors per room the required visitor parking will be .33 parking spaces per room.
>
> Based on the figure of 50 per cent of employees using private cars (in the traffic projection section) at 1.5 employees per car, the required parking can be estimated by providing parking for 50 per cent of the expected cars; since the employee count includes all three shifts, it is assumed that no more than 50 per cent will be present at any one time. This works out to .14 parking spaces per room or .28 parking spaces if all employees come to work by car.

Based on a figure of ten per cent resident/visitor population as an estimate of average day visitors to the resort hotels. This does not include visitors to beach, golf course, or archaeological areas which will have their own parking facilities. The parking requirements for day visitors at two visitors per car is .1 parking space per room. Considering all of these assumptions the parking required per room is from .57 to .71 spaces per room.

If employee parking is provided for elsewhere, this lowers the onsite parking requirement to .43 parking spaces per hotel room or about half that required by the CZO. Table I-E.16 shows the proposed parking configuration. It should be noted that the total number of parking spaces provided is the same as the total required by the CZO. In other words, the scheme shows a parking redistribution rather than a reduction.

Table I-E.16

PARKING PLAN

Parcel	# Area Acres	# Rooms	Parking Required by the CZO Number @.93 parking spaces per room	Parking Required by the CZO Acres @.00918 acres per space	Proposed Parking Scheme: Parking for hotel Res/visitors @.465 parking spaces/room Number	Proposed Parking Scheme: Parking for hotel Res/visitors @.465 parking spaces/room Acres	Proposed Parking Scheme: Parking center for employees @.465 parking spaces/room Number	Proposed Parking Scheme: Parking center for employees @.465 parking spaces/room Acres	Total Spaces
Step 1A									
12	18.8*	350*	326	3.00	163	1.50	163	1.50	326
Increment I (Remainder)									
12	18.8*	50*	47	.42	-0-	-0-	47	.42	47
4	12.8	452	420	3.86	210	1.93	210	1.93	420
8	15.7	546	508	4.66	254	2.33	254	2.33	508
9 & 10	15.1	525	488	4.48	244	2.24	244	2.24	488
14	18.9	657	611	5.60	306	2.80	305	2.80	611
Increment II									
12	18.8*	38*	35	.32	0	0	35	.32	35
28X	11.0	382	355	3.26	177	1.62	178	1.63	355
TOTAL	92.5	3,000	2,790	25.60	1,354	12.42	1,436	13.17	2,790

*Parcel 12 in Step 1A and in Increments I & II are the same, the hotel size is increased from 350 rooms to 400 rooms, then possibly to 438.

II. Description of Environmental Setting

A. LOCATION

1. Area Description

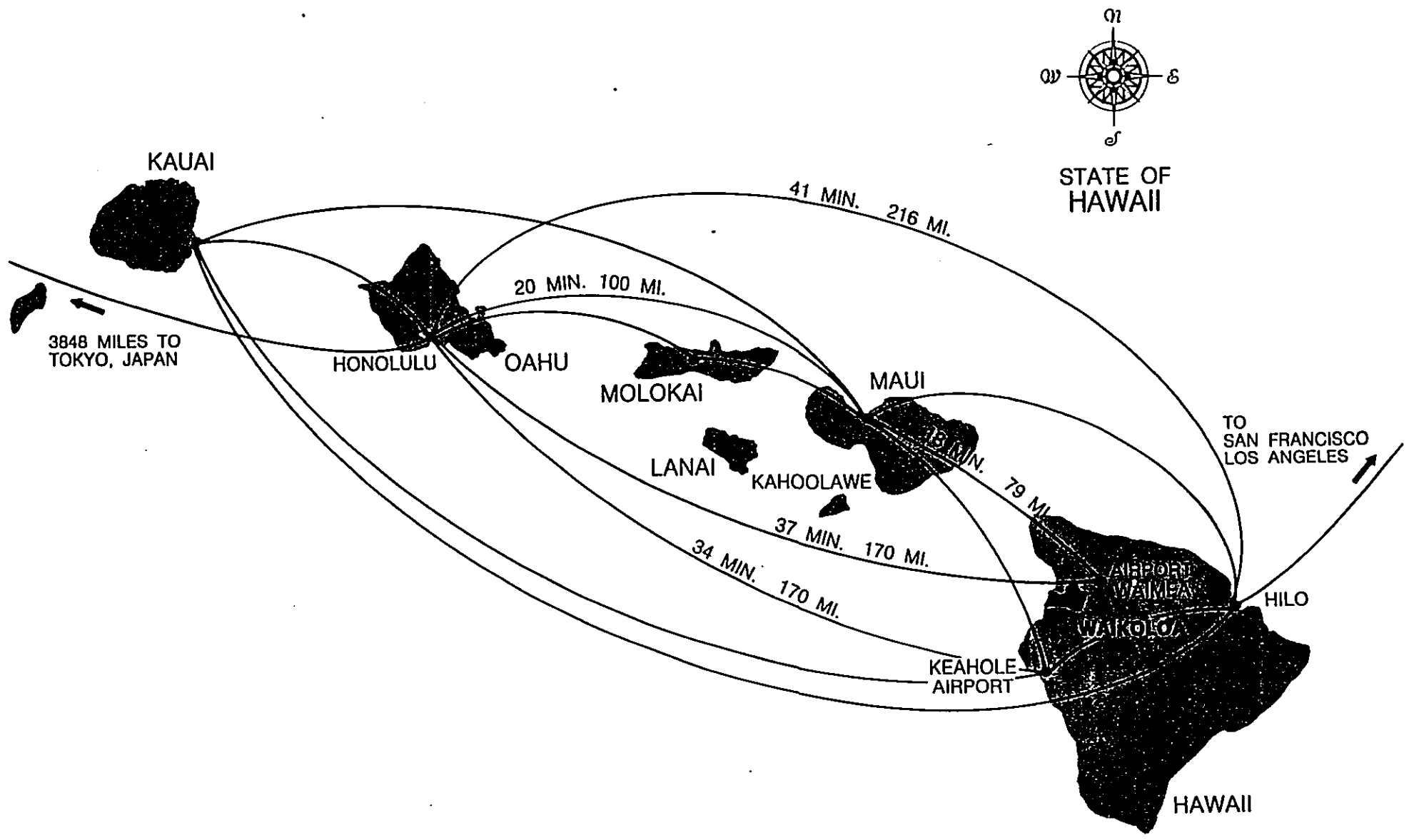
The State of Hawai'i consists of eight major and 124 minor islands having a total land area of approximately 6,425 square miles. Hawai'i County (Island of Hawai'i) has an area of approximately 4,038 square miles, and contains 62.8 per cent of the total State land area. This island comprises nine judicial 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 an environment more diverse than that of any of the other islands within the state. Therefore, in analyzing the subject property, only the west coast of Hawai'i was investigated thoroughly with particular attention directed to the South Kohala District.

The District of South Kohala is located on the northwest coast of the Island of Hawai'i and includes topography ranging from white sand beaches to the Kohala Mountains and a portion of Mauna Kea's lower leeward slope. The District of South Kohala has two distinct physical environments: the Waimea highland which is characterized by green rolling hills used for diversified agriculture, and the coastal area from Kawaihae to 'Anaeho'omalu Bay which consists of an arid plain of large lava flows, sharply contrasting with white sand beaches and bright aquamarine bays.

Over the ten year period from 1960 to 1970, the population of the South Kohala District increased by 50 per cent to 2,310 according to the 1970 Census. This was the greatest percentage increase of population of any district in the County of Hawai'i. The basic commercial center within the South Kohala District is at Waimea where a variety of small businesses cater to local farming and ranching.

The primary industries within this area are cattle ranching, diversified agriculture and tourism. Due to the topography and climatic conditions, the upper plains are best suited for intensive cultivation; however, 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. The combination of these characteristics is an absolute requisite for successful resort development in Hawai'i.

Until early 1975, the primary road leading into the South Kohala District from Kailua-Kona was the Mamalahoa Highway, a narrow, winding road through lava flows and the upland hills. The new Queen Ka'ahumanu Highway extending from Kailua-Kona to Kawaihae, the only deep water harbor in West Hawai'i, opened in early 1975. This new high speed 33-mile road was completed at a cost of $16 million. This new coastal highway, part of the Island's Belt Highway System, vastly increased accessibility to the South Kohala District which is now only approximately 20 minutes by car from Ke-ahole Airport. The Waimea-Kohala Airport, located at an elevation of 2,700 feet, is the highest


STATE OF
HAWAII
KAUAI
3848 MILES TO
TOKYO, JAPAN
HONOLULU
OAHU
MOLOKAI
LANAI
KAHOOLAWE
MAUI
HAWAII
41 MIN. 216 MI.
20 MIN. 100 MI.
37 MIN. 170 MI.
34 MIN. 170 MI.
13 MIN.
79 MI.
TO
SAN FRANCISCO
LOS ANGELES
HILO
KEAHOLE
AIRPORT

airport in the state. This air terminal handles only a limited number of inter-island air carriers, scheduled charter flights, and private aircraft. It has a runway length of 5,200 feet. The major airport for West Hawai'i is the Ke-ahole Airport with a 6,500-foot runway, situated approximately 16 miles south of Waikoloa. This unique open air terminal began operation in July, 1970.

Kawaihae Harbor, which is located approximately ten miles north of 'Anaeho'omalu Bay, 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 small boat marina represents a portion of this harbor complex.

Tourism on the west coast of Hawai'i has been primarily confined to the Kona coast. The major tourism attraction within the South Kohala District has been the 310-unit Mauna Kea Beach Hotel resort complex located approximately nine miles north of Waikoloa. This Laurance Rockefeller resort facility has become an internationally renowned hotel, contributing greatly to the prestige, reputation and economic activity of Kohala. The Mauna Kea Beach Hotel and golf course opened in 1965, and has a proposed development plan consisting of resort and permanent residential uses entailing approximately 4,000 acres.

The South Kohala ranching industry was initiated in 1815 when John Palmer Parker settled in the Kohala area. The Parker Ranch, which is headquartered in Waimea, is the largest privately owned cattle ranch in the United States. This ranch recently acquired 108,000 acres of land in the Ka'u District from C. Brewer Company, Ltd. which increased the size of the ranch lands to about 370,000 acres.

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 developed recreation areas are Hapuna Beach State Recreation Area and the Samuel M. Spencer Beach Park. Both are located from five to ten miles from Waikoloa, as seen in Figure Q. Hapuna is 65 acres in size, and is the major water-oriented recreation area in the county with an extremely attractive wide, white sand beach. Spencer Park near Kawaihae Harbor has an area of approximately 13 acres and a sandy coastline of 1,200 feet. The water is shallow, calm, clear and aquamarine in color, and provides a good swimming 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 such as at 'Anaeho'omalu Bay and Puako Beach.

Other major recreational activities or sports include wild game hunting for pheasant, wild boar and bighorn sheep. Deep sea fishing along the Kona and Kohala coasts produces world records for marlin and tuna. Horseback riding and hiking are two other activities which abound in this area.

The U. S. National Park Service recently established the Pu'ukohola

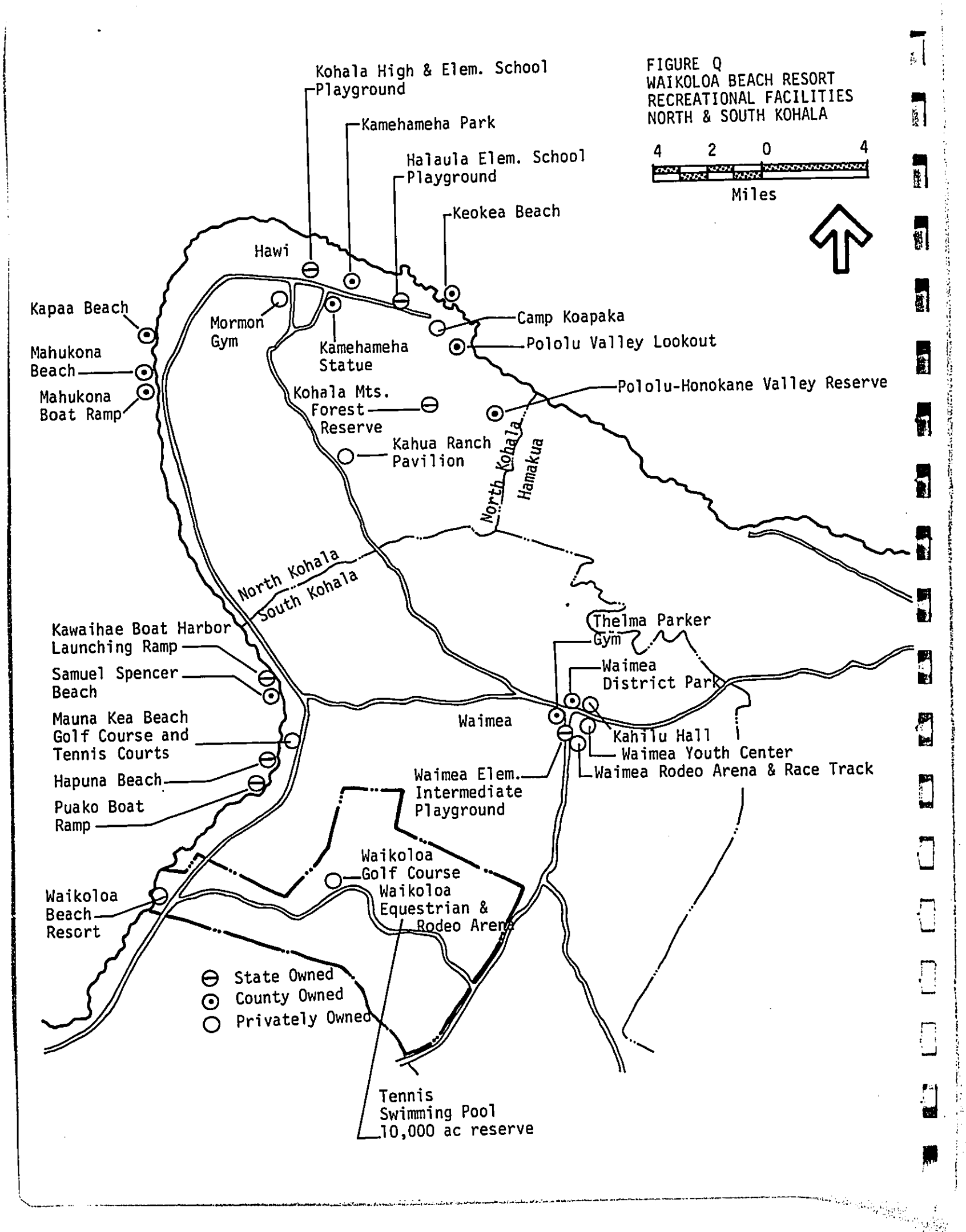


FIGURE Q
WAIKOLOA BEACH RESORT
RECREATIONAL FACILITIES
NORTH & SOUTH KOHALA
4 2 0 4
Miles
Kohala High & Elem. School Playground
Kamehameha Park
Halaula Elem. School Playground
Keokea Beach
Hawi
Kapaa Beach
Mormon Gym
Kamehameha Statue
Camp Koapaka
Pololu Valley Lookout
Mahukona Beach
Mahukona Boat Ramp
Pololu-Honokane Valley Reserve
Kohala Mts. Forest Reserve
Kahua Ranch Pavilion
North Kohala
Hamakua
North Kohala
South Kohala
Thelma Parker Gym
Kawaihae Boat Harbor Launching Ramp
Samuel Spencer Beach
Waimea District Park
Mauna Kea Beach Golf Course and Tennis Courts
Waimea
Kahilu Hall
Waimea Youth Center
Waimea Rodeo Arena & Race Track
Hapuna Beach
Waimea Elem. Intermediate Playground
Puako Boat Ramp
Waikoloa Golf Course
Waikoloa Equestrian & Rodeo Arena
Waikoloa Beach Resort
State Owned
County Owned
Privately Owned
Tennis
Swimming Pool
10,000 ac reserve

Heiau National Historic Site as the third National Park facility on the island, and as only the fourth in the state. This site will contain two major heiaus near Kawaihae and also include a historic house previously used by John Young, who was made a full chief by King Kamehameha and who was governor of the Island of Hawai'i from 1802 to 1812.

Public utilities are generally available throughout the district. The Waimea Water System, including the Kawaihae-Puako and the Waimea-Pu'ukapu, has a present daily consumption of approximately 1.6 million gallons. The primary source for this water system is the Waikoloa Stream. The Kawaihae and Puako areas are supplemented by two deep wells. Boise has drilled two wells at Waikoloa which provide approximately two million gallons of potable water per day. To meet projected water demand, the Kahena Water Ditch Development estimated at a cost in excess of $15 million has been proposed by the State. Another potential water source is the proposed Kohakohau Dam in the Kohala Mountains.

Single family residents within this district are primarily served by cesspools. As the population is increased, municipal sewerage systems are anticipated. Existing sewerage systems within the Kawaihae-Puako area consist mainly of a pump station and a sewage treatment plant servicing the Mauna Kea Beach Hotel and a sewage plant serving the multi-family and commercial areas of Waikoloa Village. Electricity and telephone service is distributed throughout the island.

2. Property Description

Waikoloa is a planned residential community situated in a planned resort destination region located in the South Kohala District on the Island of Hawai'i. The Waikoloa project includes approximately 31,000 acres which Boise purchased from Richard Smart, the owner of the Parker Ranch. This property fronts the ocean at 'Anaeho'omalu Bay and extends approximately 12 miles mauka to Mamalahoa Highway, and ranges in elevation from sea level to about 2,500 feet. The property averages about five miles in width, narrowing to about one and one-half miles at the shoreline. (Figure B). This West Hawai'i site lies approximately 17 miles south of Waimea and 24 miles north of Kailua-Kona. Ke-ahole Airport, the State's newest air facility, is located 16 miles away. Site features include a white sand beach at 'Anaeho'omalu Bay and large lava fields and rolling pasture lands at the higher elevations. Two ancient Hawaiian fishponds, Kahapapa and Ku'uali'i, are situated immediately mauka of the white sand beach. Petroglyphs (rock carvings or inscriptions), burial caves, portions of the King's Trail and other remnants of ancient Hawaiian culture are located throughout the site.

A summary of the land use designation for Waikoloa is outlined in Table II-A.1. Included in this development are approximately 8,400 acres of ranch parcels, an approximate 2,800 acre village complex and an approximate 500 acre resort and condominium complex. Recreation facilities currently in the village include an 18-hole Robert Trent

Table II-A.1 LAND USE SUMMARY
Waikoloa
South Kohala, Island of Hawai'i, State of Hawai'i

Description	County Zoning Classification	Zoning Description	Land Area (Acres)
Ranch Parcels	AG-20	Agriculture	8,440
Urban Reserve	U	Unplanned	4,653
Open Area	O	Open	9,877
Waikoloa Village	RS-10	Single Family Residential	1,641
	RM-1.5	Multi-Family Residential	136
	RM-3.0	Multi-Family Residential	36
	CV	Resort Commerical	71
	O	Open	910
Unplanned Reserve	U	Unplanned	4,675
Resort	RM-1.5	Multi-Family Residential	129
	RM-3.0	Multi-Family Residential	43
	V-1.25	Resort	92
	CV-10	Resort Commercial	19
	O	Open	191
Roads and Miscellaneous			30
Total			30,943

Source: Boise Cascade Home and Land Corp. and County of Hawai'i.

Jones golf course and clubhouse, restaurant, pool, tennis courts and equestrian facilities. In addition to the white sand beach at 'Anaeho'omalu Bay, a 10,000-acre open recreation reserve has been set aside for hunting, riding, hiking, camping and other outdoor recreational activities.

3. Waikoloa Beach Resort Description

The resort portion of the Waikoloa complex contains approximately 502 acres comprising hotel, condominium, and commercial properties, and open areas for beach, golf course and road use.

Hotel Parcels: A total of 92.5 acres (81.5 acres in Increment One and 11 acres in Increment Two) are zoned for hotel development. All of the hotel parcels are located makai of 'Anaeho'omalu Street and contain ocean frontage or front on the fishponds, which will be maintained as salt water pools, surrounded by tropical gardens. All parcels are zoned V-1.25, allowing one dwelling unit per 1,250 square feet of land area. Recreation facilities will be available to all hotel parcels, including a new Robert Trent Jones golf course to be developed immediately mauka of the hotel parcels. Land is also available for a second 18-hole golf course.

Multi-Family Parcels: A total of 171.5 acres (87.8 in Increment One and 83.7 in Increment Two) are zoned for multi-family use. Of these, 128.9 acres have RM-1.5 zoning, allowing one unit per 1,500 square feet of land area, and 42.6 acres have RM-3.0 zoning, allowing one unit per 3,000 square feet of land area. The prime site, located between two hotel sites, contains 20.7 acres and is located makai of 'Anaeho'omalu Street. It has some 1,500 feet of ocean frontage. The remaining multi-family parcels are golf course oriented or are adjacent to a hotel parcel.

Commercial Properties: A total of 19.4 acres, including 16.1 in Increment One and 3.1 in Increment Two, are zoned village commercial. The commercial property will be available to accommodate ancillary commercial services for hotel patrons and condominium users.

4. Property Data*

Legal Description, Increments One and Two: The WBR property, (Figure D) is legally described as: Waikoloa Beach Resort Phase 1, File Plan 1256, situated at 'Anaeho'omalu, South Kohala, Island of Hawai'i, Hawai'i. Being a portion of Royal Patent 7522, Land Commission Award 4452, Apana 4 to H. Kalama subdivided into lots 1 to 28, inclusive, and lots R-1 to R-7, inclusive, easements "PW-1" to "PW-4", inclusive, easement "PWU-1", easements "P-1" to "P-4", inclusive and easements "D-1" to "D-5", inclusive. Area: 501.571 acres (In-

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*File Plans 1256 and 1435.
William Hee & Associates, Inc., Civil Engineers-Surveyors, Honolulu, Hawai'i.

crements One and Two.)

Plus additional sites in Waikoloa Parcel Four, Subdivision File Plan 1435, being a portion of Royal Patent 5671, Land Commission Award 8521-B, Apana 1 to G. D. Hueu:

A portion of Lot 3:
- 5.00 acres (temporary project nursery).
- 7.096 acres (temporary maintenance and construction yard).
- 17.423 acres (golf course holes seven and eight).
- 5.000 acres (archaeological reserve--petroglyph field).
- 20.000 acres (archaeological reserve--King's Trail buffer strip).

Lot R-1, 7.959 acres (access road).

Legal Description Increment Three: Includes the balance of Lot Three, Parcel Four, File Plan 1435, 796.226 acres.

TMK parcel # ≠ lot #

Table II-A.2

ZONING (EXISTING)*

File Plan 1256	Lot No.	Zoning	Tax Map Key	Area Acres (#)	Land Use Code	
Resort Hotel	4	V-1.25	6-9-07-17	12.961	2	
	8	V-1.25	6-9-07-21	15.735	2	
	9 & 10	V-1.25	6-9-07-22/23	15.101	2	
	12	V-1.25	6-9-07-24	18.778	2	
	14	V-1.25	6-9-07-26	18.855	2	
	28X*	V-1.25	6-9-07-29	11.000	2	
Total				92.430		
Multi-family	2	RM-1.5	6-9-07-13	11.493	2	
	5	RM-1.5	6-9-07-18	3.136	2	
	13	RM-1.5	6-9-07-25	20.742	2	
	16	RM-1.5	6-9-07-28	.856	1	
	17	RM-1.5	6-9-07-07	14.094	2	
	19	RM-1.5	6-9-07-05	8.358	2	
	20	RM-1.5	6-9-07-02	10.647	2	
	22	RM-3.0	6-9-07-04	1.472	2	
	23	RM-1.5	6-9-07-08	5.205	2	
	24	RM-1.5	6-9-07-09	11.830	2	
	27AA*	RM-3.0	6-9-07-01	37.101	2	
	27CC*	RM-3.0	6-9-07-01	4.000	2	
	27DD*	RM-1.5	6-9-07-01	22.300	2	
	28W*	RM-1.5	6-9-07-29	6.160	2	
	28Z*	RM-1.5	6-9-07-29	14.200	2	
Total				171.594		
Commercial	1	CV	6-9-07-12	3.193	3	
	7	CV	6-9-07-20	.975	3	
	25	CV	6-9-07-11	11.915	3	
	27BB*	CV	6-9-07-01	3.068	3	
Total				19.151		
Open	11	O	6-9-07-16	16.300	6 & 7	Beach/Fishponds
	3	O	6-9-07-14	5.210	7	Parking
	6	O	6-9-07-19	1.680	7	Archaeological Reserve (Camel)
	15	O	6-9-07-27	5.053	7	Small Boat Harbor
	21	O	6-9-07-03	2.737	7	Archaeological Reserve (Burial Caves)
	18	O	6-9-07-06	24.109	7	Golf Course
	26	O	6-9-07-10	75.666	7	Golf Course
	28	O	6-9-07-29	21.423	7	Golf Course
	27	O	6-9-07-01	38.833	7	Golf Course
	Roads	O	6-9-07-30	27.385	1	Roads
Total				218.396		
Total File Plan 1256				501.571		
*Zoning Increment II						
File Plan 1435	3	U	6-8-01-26	5.000	5	Temporary Project Nursery
	3	U	6-8-01-26	7.096	5	Temporary Maintenance and Construction Yard
	3	U	6-8-01-26	17.423	5	Golf Course
	R-1	U	6-8-01-26	7.959	5	Roads
	3	U	6-8-01-26	5.000	5	Archaeological Reserve (Petroglyph Field)
	3	U	6-8-01-26	20.000	5	King's Trail Buffer Strip
Total				62.478		
Total Acreage Within Development Increments I and II				564.049		
Balance File Plan 1435 Lot Three Increment Three		U		796.226	5	(Includes 160 acres for additional golf course which may be built prior to Increment III development).
Total Acreage Increment I, II, III				1,360.275		

Land Use Code	General Land Class
1	Improved residential
2	Hotel and Apartment
3	Commercial
4	Industrial
5	Agricultural
6	Conservation
7	Unimproved residential

*Source: Director of Taxation, State of Hawai'i; William Hee and Associates, Inc.

EXTRACTS FROM HAWAII COUNTY ZONING ORDINANCE (ORDINANCE 63 – CHAPTER 8 HAWAII COUNTY CODE)

DISTRICT DESIGNATION	DISTRICT	PERMITTED USES	HEIGHT LIMIT	MINIMUM BUILDING SITE AREA	MINIMUM BUILDING SITE WIDTH	MINIMUM YARDS	OTHER REGULATIONS
RS	SINGLE FAMILY RESIDENTIAL (NUMBER AFTER "RS" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT)	SINGLE FAMILY DWELLING AND ACCESSORY USES, GOLF COURSE, COUNTRY CLUB, PARKS, PLAYGROUND, TRUCK GARDEN, HOME OCCUPATIONS.	2 1/2 STORIES - 35 FEET	RS-7.5 7,500 SQ. FT RS-10 10,000 SQ. FT RS-15 15,000 SQ. FT RS-20 20,000 SQ. FT	60 FT PLUS 2 FT FOR EACH 500 SQ. FT. IN EXCESS OF 7,500 SQ. FT. UP TO 100 FT.	7,500 SQ. FT TO 9,999 SQ. FT FRONT & REAR - 15', SIDE - 6' 10,000 SQ. FT TO 19,999 SQ. FT FRONT & REAR - 20', SIDE - 10' 20,000 SQ. FT OR MORE FRONT & REAR - 25', SIDE - 10'	1 MORE THAN ONE STRUCTURE MAY PROVIDED ONE BUILDING SITE FOR EACH 2 BUILDING SITE SUBSTANDARD - MEET APPLICABLE STANDARD GOVERNS 3 ONE OFF-STREET PARKING FOR EACH UNIT 4 VISUAL CLEARANCE ON CORNER LOTS
RD	DOUBLE FAMILY RESIDENTIAL (NUMBER AFTER "RD" INDICATES MIN LAND AREA PER DWELLING UNIT)	"RD" USES PLUS DUPLEX OR TWO SINGLE FAMILY DWELLINGS.	2 1/2 STORIES - 35 FEET	MINIMUM 7,500 SQ. FT.	SAME AS ABOVE	SAME AS ABOVE	1 NO MORE THAN 2 DWELLING UNITS ON ANY BUILDING SITE 2 MINIMUM 10' BETWEEN 2 BUILDINGS 3 AREA LESS THAN 9,500 SQ FT ONLY 1 UNIT PERMITTED 4 ONE OFF-STREET PARKING FOR EACH UNIT
RM	MULTIPLE FAMILY RESIDENTIAL (NUMBER AFTER "RM" INDICATES REQUIRED LAND AREA IN THOUSANDS OF SQ. FT. PER DWELLING UNIT)	"RS" AND "RD" USES PLUS BOARDING HOUSES, CLINIC, INCIDENTAL COMMERCIAL SERVICES WITH NO SIGNS ON STREET FRONTAGE, ACCESSORY USES.	3 STORY - 45 FT; 4 STORY 60 FT WITH PERMISSION OF COMMISSION, CITY OF HILO, 10 STORY - 100 FT;	7,500 SQ. FT.	MINIMUM AVERAGE WIDTH 60'	FRONT & REAR - 20', SIDE YARD - 1 STORY - 6' PLUS ADDITIONAL 2' FOR EACH ADDITIONAL STORY PERMITTED	1 THERE MAY BE MORE THAN 1 MAIN BUILDING 2 MINIMUM 10' BETWEEN BUILDINGS 3 DORMITORY AREA REQUIREMENT FOR EACH 2 BEDS 4 MAXIMUM DENSITY, 250 SQ FT PER UNIT 5 INCREMENTS FOR DISTRICTS - 7A, 1.5, 2, 2.5, 3, 3A, 4 6 PLAN APPROVAL FOR ALL USES & BUILDINGS
RA	RESIDENTIAL AND AGRICULTURAL (NUMBER AFTER "RA" INDICATES REQUIRED NUMBER OF ACRES PER BUILDING SITE)	SINGLE FAMILY DWELLING (ONE PER BUILDING SITE), BOTANICAL GARDENS, TRUCK GARDENING, PHYSICAL PROCESSING (EXCLUSIVE OF COOKING AND CANNING, RAISING OR KEEPING OF ANIMALS EXCEPT PIGS SUBJECT TO REQUIREMENTS OF DEPT OF HEALTH & APPROVAL OF THE DIRECTOR, GOLF COURSES, PUBLIC PARKS, HOME OCCUPATIONS, COMMERCIAL STABLES (MIN. 5 ACS.), PRIVATE CLUBS, RESORT RANCHES, AIRFIELDS, DRIVING RANGE, DRIVE-IN THEATRES, STADIUMS, VETERINARIAN'S OFFICE, ANIMAL HOSPITAL INVOLVING IN-PATIENT BOARDING ONLY, PIGS SUBJECT TO DEPT OF HEALTH REQUIREMENTS & CHARACTER OF NEIGHBORHOOD (MIN. 3 ACS.), ACCESSORY USES.	2 1/2 STORIES - 35 FEET	1/2 ACRE MINIMUM, 1/2 AC. INCREMENTS UP TO 3 AC, BUT NOT LIMITED TO MAXIMUM OF 3 AC.	MINIMUM AVERAGE WIDTH 100' FOR 1/2 AC. PLUS 20' FOR EACH ADDITIONAL 1/2 AC. UP TO 300 FT.	FRONT & REAR - 25', SIDE - 10'	1 AREA LESS THAN 1/2 ACRE - USE RS REGULATIONS
A	AGRICULTURAL (NUMBER AFTER "A" INDICATES REQUIRED NUMBER OF ACRES PER BUILDING SITE)	SINGLE FAMILY DWELLING (ONE PER BUILDING SITE), GOLF COURSES, PARKS, PRIVATE CLUBS, TRAILER PARK WITH PLAN APPROVAL OF THE DIRECTOR (1,500 SQ FT OF LAND AREA PER TRAILER), HOME OCCUPATIONS, DORMITORIES & ADDITIONAL SINGLE FAMILY DWELLING FOR PERSONS EMPLOYED ON THE PREMISES, PUBLIC DUMPS, PIGGERIES AND APIARIES APPROVED BY DEPT OF HEALTH & THE DIRECTOR, AIRFIELDS, FISH & POULTRY HATCHERIES, PROCESSING, STORAGE, PACKING, & SALE OF PRODUCTS PRODUCED ON THE PREMISES, HOME ACADEMIES, DOG KENNELS, ANIMAL HOSPITALS, COMMERCIAL EXCAVATION, GUEST RANCHES, HUNTING & FISHING LODGES, ACCESSORY USES.	3 STORIES - 45 FEET	1 ACRE MINIMUM, 1 AC. INCREMENTS UP TO 10,000 ACRES	MINIMUM AVERAGE WIDTH 100' FOR FIRST AC., 20' FOR EACH ADDITIONAL 1 ACRE, UP TO 1,000 FT	FRONT & REAR - 20', SIDE - 20' ACCESSORY BUILDINGS, 100' FROM FRONT PROPERTY LINE	1 AREA LESS THAN 1 ACRE - USE RS REGULATIONS 2 ACCESSORY SHADE STRUCTURES (PLASTIC/SARAN ROOFED ETC.) FOR HORTICULTURE - SIDE & FRONT - 10'
U	UNPLANNED	SINGLE FAMILY DWELLING (ONE PER BUILDING SITE), AGRICULTURAL USES & BUILDINGS, PROCESSING, HANDLING, AND SALE OF AGRICULTURAL PRODUCTS PRODUCED ON THE PREMISES, HOME OCCUPATIONS, PIGGERIES & APIARIES ON SITES APPROVED BY DEPT OF HEALTH & THE DIRECTOR, HUNTING & FISHING LODGES, ACCESSORY BUILDINGS & USES.	3 STORIES - 45 FEET	5 ACRES	250 FEET	FRONT, SIDES, & REAR - 50'	1 MAIN USE OR MAIN BUILDING SHALL HAVE A MIN BUILDING SITE OF 5 ACRES
V	RESORT - HOTEL (NUMBER AFTER "V" INDICATES REQUIRED LAND AREA IN THOUSANDS OF SQ FT PER HOTEL OR APARTMENT UNIT "V" INDICATES 10 STORIES HILO, 7 STORIES KAMALUM & KEAUHOU)	HOTELS, RESORTS, RESORT HOTELS, SINGLE - FAMILY RESIDENTIAL, ACCESSORY COMMERCIAL USES WHICH SUBORDINATE TO IN LOCATED IN A HOTEL OR MAIN RESORT BUILDING & ACCESS TO SUCH USES IS NOT DIRECTLY FROM ANY STREET OR ADJOINING PROPERTY, PARKING LOTS OR BUILDINGS, TAXICAB STATIONS AND OFFICES, SMALL BOAT HARBORS & DOCKS, DANCE PAVILIONS, OPEN AIR THEATRES, TRAVEL AGENCIES & INFORMATION CENTERS, OTHER USES THE DIRECTOR DETERMINES TO BE NECESSARY TO THE PROPER FUNCTIONING OF A RESORT AREA, DUPLEX OR DOUBLE - FAMILY & MULTIPLE - FAMILY RESIDENTIAL DWELLINGS.	3 STORIES - 45 FT; USE PERMIT FOR 60 FT, OR 4 STORIES, CITY OF HILO, 10 STORIES - 100 FT, KAMALUM & KAHALUU BAYS 2 STORIES - 90 FEET	10,000 SQ FT	AVERAGE WIDTH - 90 FT	FRONT & REAR - 20', SIDE - 6' FOR 1 STORY PLUS ADDITIONAL 2' FOR EACH ADDITIONAL STORY PERMITTED	1 THERE MAY BE MORE THAN ONE MAIN BUILDING 2 DISTANCE BETWEEN BUILDINGS - 15' 3 MAXIMUM DENSITY, 750 SQ FT PER UNIT 4 DENSITY .75, 1, 1.25, 1.5 & UPWARD IN INCREMENTS OF 250 SQ FT. 5 PLAN APPROVAL REQUIRED OF ALL STRUCTURES & USES
CO	COMMERCIAL - OFFICE (NUMBER AFTER "CO" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT)	MEDICAL & DENTAL CENTERS NOT PERMITTING IN-PATIENTS, PRESCRIPTION PHARMACIES, BANKS, LENDING AGENCIES, PHOTOGRAPHER OR COMMERCIAL ARTIST STUDIOS, COFFEE SHOPS - BARBER & BEAUTY SHOPS - NEWS STANDS PROVIDED THESE USES ARE LOCATED WITHIN A BUILDING CONTAINING ONE OF THE USES LISTED ABOVE AS A PRINCIPAL USE, PARKING LOTS OR BUILDINGS, DRUG STORES, RESTAURANTS, COCKTAIL LOUNGES, NIGHT CLUBS, BUSINESS & TECHNICAL SCHOOLS, SCHOOLS & STUDIOS FOR PHOTOGRAPHY, ART, MUSIC, & DANCE, HOTELS & APARTMENT - HOTELS PROVIDED DENSITY NOT EXCEED ONE UNIT PER 1,250 SQ FT OF LAND AREA, ACCESSORY USES.	3 STORIES - 45 FT, CITY OF HILO, 10 STORIES - 100 FT	20,000 SQ. FT	MINIMUM AVERAGE WIDTH 100'	FRONT & REAR - 25', SIDE - NONE EXCEPT BY PLAN APPROVAL	1 PLAN APPROVAL REQUIRED OF ALL STRUCTURES & USES
CN	NEIGHBORHOOD COMMERCIAL (NUMBER AFTER "CN" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT)	ALL RETAIL USES CONDUCTED WITHIN BUILDING, SERVICE STATIONS, PARKING LOTS OR BUILDINGS, BANKS, BARBER & BEAUTY SHOPS, LAUNDERETTE & PICKUP STATION, COFFEE SHOPS, RESTAURANTS, BAR & COCKTAIL LOUNGES PROVIDED NO LIVE ENTERTAINMENT IS PROVIDED OR DANCING IS ALLOWED, MEDICAL & DENTAL CENTERS NOT PERMITTING IN-PATIENTS, PUBLIC BUILDINGS, PHOTOGRAPHY OR COMMERCIAL ART STUDIOS, PRESCRIPTION PHARMACIES, REPAIR SHOPS FOR PERSONAL OR HOUSEHOLD ITEMS, TAILOR SHOPS, "RM" USES WITH MAX. DENSITY OF 1,250 SQ FT. OF LAND AREA PER RENTABLE UNIT, SHOE REPAIR SHOPS, ACCESSORY USES.	3 STORIES - 40 FEET	5,000 SQ. FT	MINIMUM AVERAGE WIDTH 50'	FRONT & REAR - 15', SIDE - NONE EXCEPT BY PLAN APPROVAL	1 PLANNING COMMISSION MAY PERMIT ON REQUIRE OVERHANG 2 ANY PRODUCT PRODUCED WITHIN A CN DISTRICT MUST BE SOLD ON THE PREMISES WHERE PRODUCED 3 PLAN APPROVAL REQUIRED OF ALL STRUCTURES & USES
CG	GENERAL COMMERCIAL (NUMBER AFTER "CG" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT)	"CN" & "CO" USES PLUS PERSONAL SERVICE SHOP, MANUFACTURING OF NON-NOXIOUS TYPE GOODS WHERE THE ONLY SALES OUTLET IS ON THE PREMISES, ART GALLERIES, CATERERS, CLEANING PLANTS USING NON-FLAMMABLE CLEANING AGENTS, PRINTING SHOPS, BAKERIES, RADIO & TV STATIONS & STUDIOS, BOWLING ALLEYS, POOL HALLS, DRIVE-IN USES, USED CAR LOTS, GYMNASIUMS & REDUCING SALONS, HOSPITALS & SANITARIUMS, HOTEL & APARTMENT - HOTELS PROVIDED DENSITY NOT EXCEED ONE RENTABLE UNIT FOR EACH 500 SQ FT OF LAND AREA, AUDITORIUMS & THEATRES, MODEL HOMES FOR DISPLAY ONLY, ACCESSORY USES.	3 STORIES - 45 FT, CITY OF HILO, 10 STORIES - 120 FT	7,500 SQ. FT	MINIMUM AVERAGE WIDTH 60'	FRONT OR REAR - 15', SIDE - NONE EXCEPT BY PLAN APPROVAL	1 PLAN APPROVAL REQUIRED OF ALL STRUCTURES & USES
CV	VILLAGE COMMERCIAL (NUMBER AFTER "CV" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT)	"CN" USES PLUS CLEANING PLANTS USING NON-FLAMMABLE CLEANING AGENTS, NEWSPAPERS, JOB PRINTERS & SIMILAR USES DESIGNED TO SERVE THE LOCAL AREA, RESTAURANTS, BARS & COCKTAIL LOUNGES, MANUFACTURING OF PRODUCTS & DISTRIBUTED TO RETAIL OUTLETS IN THE IMMEDIATE COMMUNITY, COMMUNITY CLUBS, ROOMING OR BOARDING HOUSES, RESIDENTIAL USE IN CONNECTION WITH OPERATION OF ANY PERMITTED USES, BUS & TOUR STOPS, TICKET AGENCIES, COMMERCIAL AMUSEMENT ESTABLISHMENTS, USED CAR LOTS, SMALL SCALE CRAFT SHOPS (MAX 5 EMPLOYEES), AUTO SERVICE STATIONS, ACCESSORY USES.	2 STORIES - 30 FEET	7,500 SQ. FT	MINIMUM AVERAGE WIDTH 60'	SAME AS ABOVE	SAME AS ABOVE
ML	LIMITED INDUSTRIAL (NUMBER AFTER "ML" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT, IF NUMBER IS FOLLOWED BY AN "A" IT INDICATES ACRES)	LIGHT INDUSTRIAL USES WITH NO MEASURABLE NUISANCE QUALITIES, ANIMAL HOSPITALS WITH FACILITIES FOR BOARDING OF MORE THAN 20 ANIMALS, SERVICE STATIONS, BAKERIES, LAUNDRIES, CARPENTRY & ELECTRICAL SHOPS & STORAGE, CONTRACTORS' YARDS, PRESENTING YARDS, INCIDENTAL LIVING QUARTERS, LUMBER YARDS, MACHINE, & SHEET METAL SHOPS, NEWSPAPER & PUBLISHING HOUSES, EQUIPMENT SALES & SERVICES, TRANSPORTATION TERMINALS, WHOLESALING & WAREHOUSING, AIRFIELDS, STONE CUTTING, PUBLIC DUMPS, JUNK YARDS, RETAIL SALES INCIDENTAL TO A PERMITTED USE, ACCESSORY BUILDINGS & USES.	3 STORIES - 45 FEET	10,000 SQ. FT	MINIMUM AVERAGE WIDTH 75'	FRONT & REAR - 20', SIDE - NONE EXCEPT BY PLAN APPROVAL	SAME AS ABOVE
MG	GENERAL INDUSTRIAL (NUMBER AFTER "MG" INDICATES MIN LOT SIZE IN THOUSANDS OF SQ FT, IF NUMBER IS FOLLOWED BY AN "A" IT INDICATES ACRES)	"ML" USES PLUS BRICK FACTORIES, BULK STORAGE OF EXPLOSIVE PRODUCTS BY "USE PERMIT," CONCRETE PRODUCTS MANUFACTURING, BATCHING PLANTS, STEEL FABRICATION PLANTS, SHIPYARDS, POWER PLANTS, SLAUGHTER, INCIDENTAL SERVICES, ANIMAL HOSPITALS & QUARANTINE STATIONS, ANIMAL SALES & FEED YARDS, CEMENT PLANTS, BREWERIES, FERTILIZER PLANTS, CANNERIES, MEAT PACKING PLANTS, WOOD PROCESSING PLANTS, SMELTING PLANTS, SAWMILLS, SLAUGHTERHOUSES, TANNERIES, SUGAR MILLS OR REFINERIES, LIVING QUARTERS FOR WATCHMEN IN INDUSTRIAL PROPERTIES, PUBLIC DUMPS, ACCESSORY BUILDINGS & USES.	3 STORIES - 50 FEET PLAN APPROVAL TO 100'	20,000 SQ. FT	MINIMUM AVERAGE WIDTH 100'	FRONT & REAR - 20', SIDE - NONE EXCEPT BY PLAN APPROVAL	SAME AS ABOVE
O	OPEN	PUBLIC PARKS, GOLF COURSES & COUNTRY CLUBS, HISTORICAL MONUMENTS, TOURIST ATTRACTIONS, PRIVATE RECREATIONAL USES, ACCESSORY USES.	NONE SPECIFIED	NONE IN PLAN	NONE APPROVAL OR	NONE USE PERMIT	1 PLANNING COMMISSION TO DETERMINE

PREPARED BY: PLANNING DEPARTMENT
COUNTY OF HAWAII
[illegible]

B. THE PHYSICAL ENVIRONMENT

1. Geology*

In December 1969, Dames & Moore, consulting engineers in the applied earth sciences, completed a geological site study of the WBR for Boise. The data contained herein is a result of that study:

General Site Conditions

This Island of Hawai'i was formed by five volcanoes. Three of these volcanoes have been active during historic time. At present, only two of them, Mauna Loa and Kilauea, are considered active; the remaining three, Mauna Kea, Kohala and Hualalai, are considered dormant.

The site is located in an area covered by at least two separate lava flows. Both flows are believed to be from prehistoric Mauna Loa eruptions. The summit of Mauna Loa is located some 35 miles southeast of the site. The older flow is pahoehoe lava. The hard dense pahoehoe lava is characterized by a relatively smooth undulating surface with cavities and caverns under the surface. The surface is broken in some places by "stacks" and "blisters". Characteristics of these features are sketched on Figure R, Geologic Map. The southern two-thirds of the site is covered by pahoehoe lava.

As shown on Figure R, the pahoehoe lava is buried by a younger 'a'a flow north of a line trending southeast from the north shore of Waiulua Bay and crossing Kiholo-Puako Trail at a point 2,000 feet inside the southeast corner of the site boundary line. The 'a'a lava covers roughly one-third of the site, and it is 20 to 40 feet thick. In contrast to pahoehoe lava, 'a'a lava is composed of a core of very dense basalt rock which is mantled by a cover of broken rock fragments termed "clinkers" and "cinders". As exposed in test pits dug during the studies, the broken rock cover varies in thickness from six feet to 15 feet. In general, the average size of the rock fragments in this layer decreases noticeably with an increase in depth. At the surface, the clinkers average 18 inches in diameter. Near the hard basalt core, one inch diameter rock fragments are mixed with sand and silt sized particles.

The Island of Hawai'i is an area classified as Zone 3, the highest risk zone, on the seismic probability map published by the Seismological Society of America. The earthquake history of the island would justify seismic considerations in the design of major structures.

Based on a review of the volcanic activity during historic times, we believe the risk of damage from new lava flows within the next 100 years is remote.

The site can be divided into three general areas in relationship to

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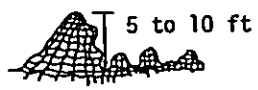
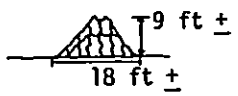
*Source: Dames and Moore, Geology Site Studies, 1969.

EXPLANATION:



SCALY PAHOEHOE LAVA
Dense basalt with thin scaly crust

SINKHOLE
Depression caused by collapse of cave roofs in pahoehoe lava



LAVA BLISTERS
Broken blocks of pahoehoe lava forced upward into a cone shaped mound by gas explosion

LAVA STACK
Bulbous and jagged basalt extruded through localized ruptures or pressure ridges in the pahoehoe lava

ASH MOUND
Surface cover of highly friable scoria fragments over ash and cinders.
Caused by violent steam explosion.

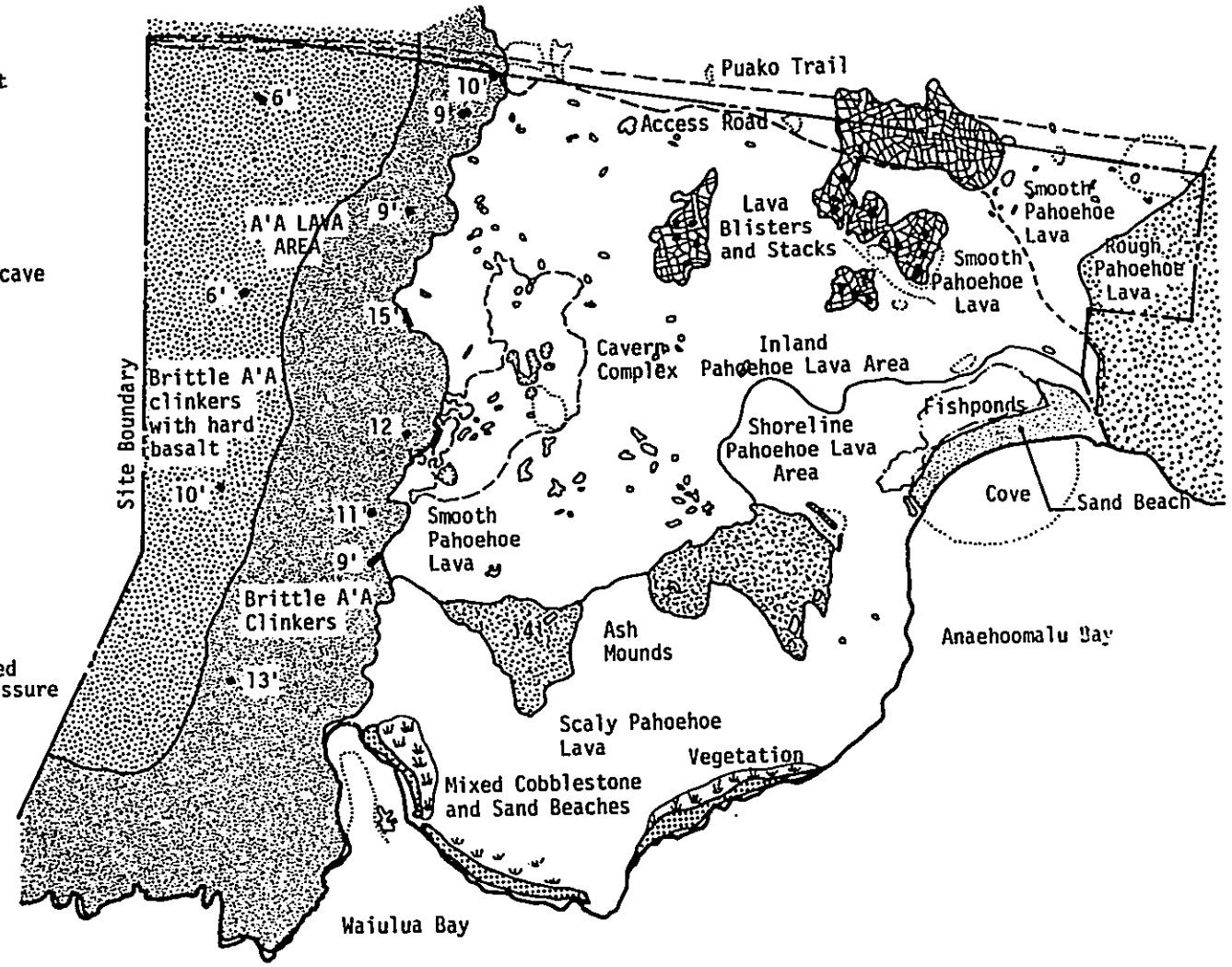


FIGURE R
WAIKOLOA BEACH RESORT
GEOLOGIC MAP
TAKEN FROM DAMES AND MOORE
GEOLOGICAL REPORT ON ANAEHOOMALU AREA

800' 400' 0 800' 1,600'

Exposed Cavity 1' to 3' High

Historic Artifacts

Sinkhole

Average Thickness of A'A Clinkers

Maximum Combined Thickness of Friable Scoria and Ash in Test Pit Exposure

topography, location, and physical factors. These areas are:

1) 'A'a lava area

2) Inland pahoehoe lava area

3) Shoreline pahoehoe lava area

The 'a'a lava consists of two general environments. As shown in Figure R, there is a 500 to 900 foot wide belt at the southern extremity of the 'a'a flow which has a moderately uniform surface clinker layer on the order of nine to 15 feet thick. North of this belt, the 'a'a flow is characterized by a series of solid basalt rock ridges which protrude through a clinker layer which is on the order of six feet thick.

The inland pahoehoe lava area is composed of features including smooth pahoehoe lava, rough pahoehoe lava, lava blisters, stacks, pinnacles, and a cavern.

The shoreline pahoehoe lava area includes scaly pahoehoe lava areas, the ash mound beach areas, the small boat harbor area and the fishponds.

In July 1971, Dames & Moore performed a geologic and engineering investigation for small boat harbor development at the WBR. The study reveals the following:

Geologically, the planned small boat harbor area is located in a small tidal basin formed by broad undulations in the low lying terrain south of Waiulua Bay. The low profile land mass south of the bay is underlain by pahoehoe lava which exhibits sharp contrast to the jagged 'a'a lava that forms a 20-foot high bank along the north side of Waiulua Bay. The rocky shorelines of Waiulua Bay form a buttress against high seas that would otherwise inundate the existing tidal basin. The prevailing ocean waves break on basaltic reefs near the mouth of the Waiulua Bay inlet at a point located several hundred yards seaward from the tidal basin. Occasional storm waves surge past the reefs as evidenced by accumulations of littoral debris in the shallow Waiulua Bay inlet. A five-foot high gravel bar exists between the tidal basin and Waiulua Bay, and it delineates the inland reach of storm waves.

Detailed Description of Site Conditions

'A'a Lava Area

"Surface Conditions: The 'a'a lava on the northern end of the site reaches a maximum elevation of about 69 feet near the southeast corner of the site. Because of its high viscosity, the 'a'a flowed in a shell of very coarse clinders, as shown on the sketch below:

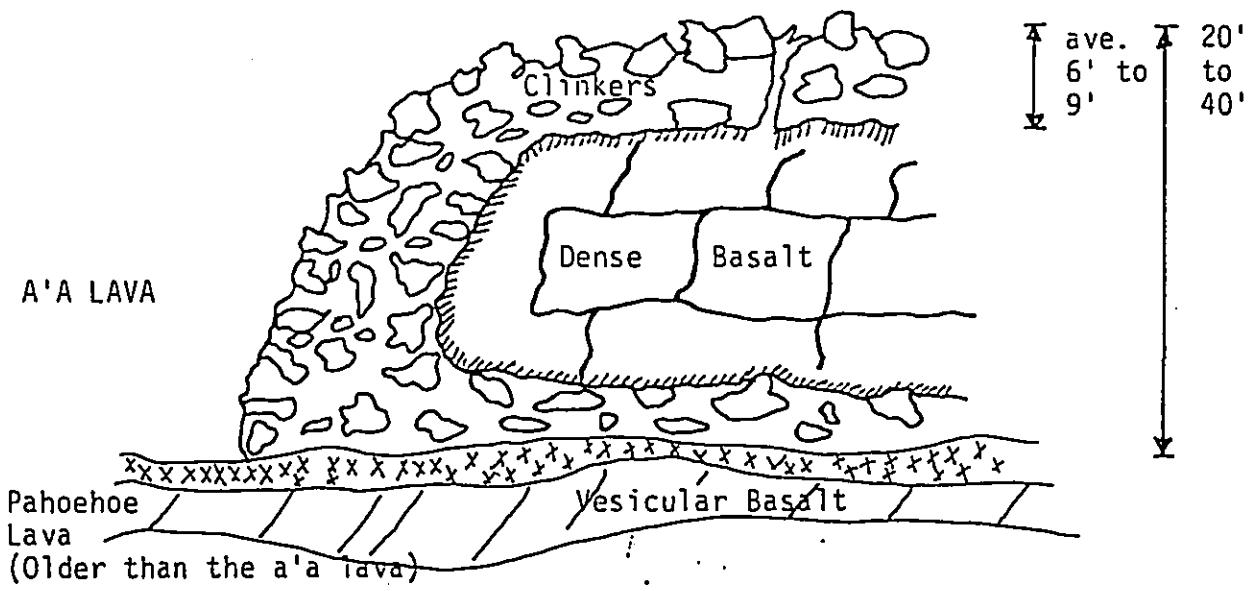


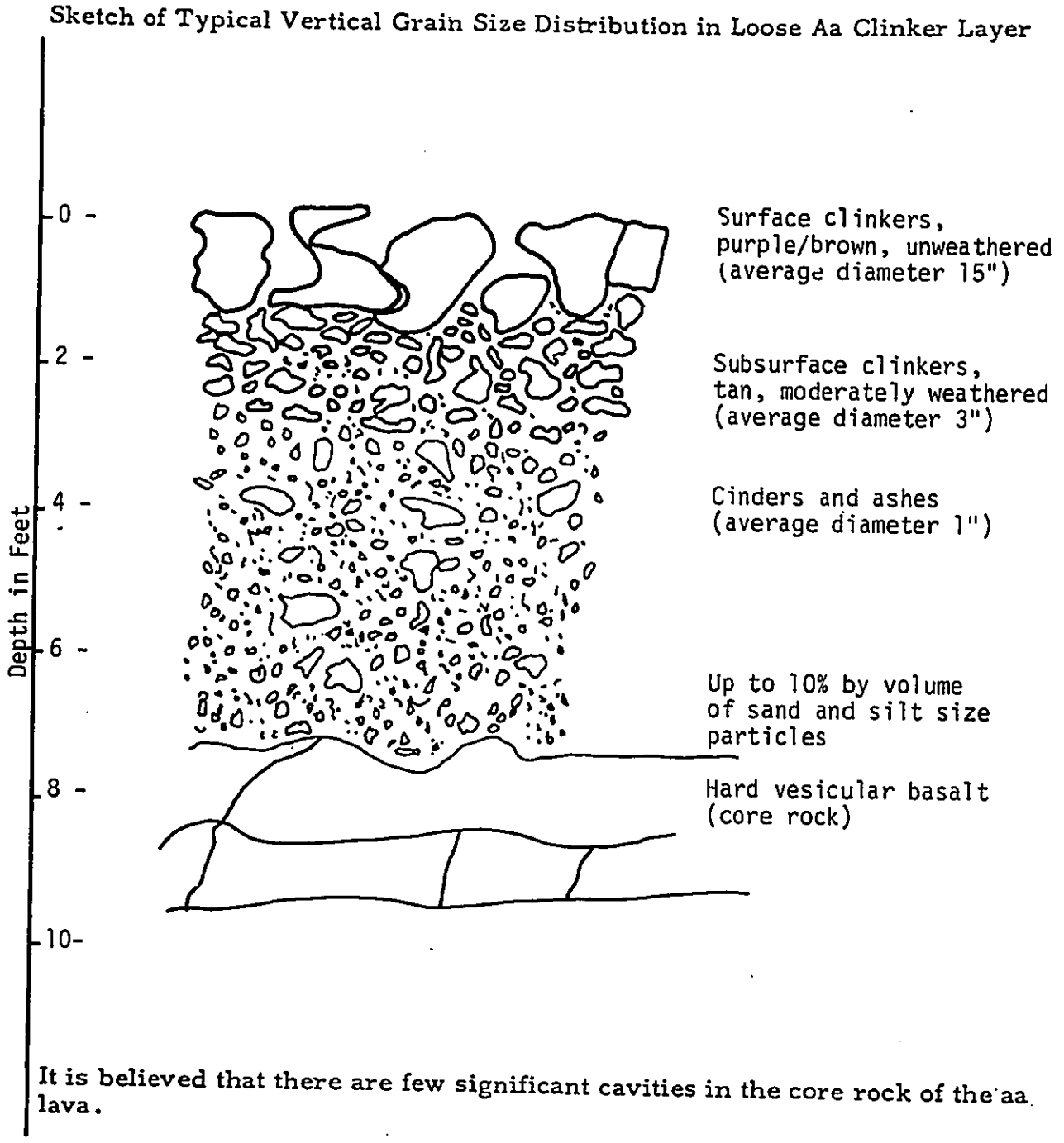
Figure S Sketched Cross Section of 'A'a Lava

"The clinkers produced a jagged topography in sharp contrast with the underlying pahoehoe. Local relief on the surface of the 'a'a lava clinkers is on the order of five feet near the edge of the flow. The local relief increases to an average of about 10 feet north of a line trending northwest approximately 500 to 800 feet behind the edge of the 'a'a lava as indicated on the geologic map. The greater relief over the inner part of the flow is attributed to a larger number of shrinkage cracks and basalt ridges.

"There is no surface water in this area, and the 'a'a lava is practically devoid of vegetation. The 'a'a lava formed a rocky shoreline with irregular escarpments where it flowed into the sea.

Subsurface: The subsurface conditions were explored by digging a series of test pits and by examining other exposures in the aa lava at the locations shown on the geologic map. The dense core rock which is hard basalt is blanketed by nine to 15 feet of loose clinkers near the edge of the flow. Massive core rock protrudes locally through the clinkers to form hard ridges north of the line described above. The layer of clinkers varies in thickness from six feet to more than ten feet between the hard ridges. The surface clinkers are on the order of 1½ feet in diameter, but the subsurface clinkers grade downward from an average diameter of three inches at a depth of 1½ feet to an average diameter of one inch below a depth of three feet. The subsurface clinkers are mixed with about ten percent by volume of sand and silt sized grains. The vertical gradation is illustrated on the sketch below.

Sketch of Typical Vertical Grain Size Distribution in Loose Aa Clinker Layer



It is believed that there are few significant cavities in the core rock of the aa lava.

Inland Pahoehoe Lava Area

Surface: The pahoehoe lava from Mauna Loa flowed northwest across the entire site. It formed the present topography of the site except where it is buried under the younger 'a'a lava described above. The pahoehoe lava thickness near the terminal edge of the flow as evidenced by a reversed surface gradient sloping southeast from an average elevation of 35 feet in a plateau area near the center of the site, to an average elevation of 15 at the extreme southern end of the site.

Except for local iregularities, the pahoehoe surface is distinguished by smooth, rolling topography with average local relief generally less than six feet. Local irregularities resulted from numerous sinkholes or collapsed cavities in the plateau area, and from localized eruptions of the lava flow in a pressure ridge area at the southern end of the site. The pressure ridge is implied on the geologic map (Figure R) by the features identified as "Lava Blisters and Stacks". Jagged, cavernous lava blisters and stacks of bulbous, scaly lava rise ten to 20 feet above the general topography near Kiholo-Puako Trail. The undulating pahoehoe crust is severely broken at the extreme southern end of the site where it resembles the rough surface of 'a'a lava.

The only inland surface water appears to be several brackish springs located between the area designated on the geologic map (Figure R) as "cavern complex" and the edge of the 'a'a lava. The springs appear wherever surface depressions extend down to elevation 1.0. A chemical analysis for the water indicated a salt content of 915 milligrams per liter. The results of this analysis conform with the ground water appraisal performed by others.

Inland vegatation on the pahoehoe lava is sparse. Random tuffs of grass and an occasional scrub tree take root in some of the surface cracks.

Subsurface: Pahoehoe basalt is generally vesicular because of the high gas content in the pahoehoe flow. The gas bubbles or vesicles are more numerous near the surface of the flow. Smooth swells in the lava surface reflect larger gas pockets immediately under the crust. The lava hardens with a brittle crust because of the greater concentration of vesicles near the surface, and the larger gas pockets remain as cavities generally one to three feet high.

Unusually large cavities on the order of five to 20 feet high connected to form a cavern complex near the center of the site at the location indicated on the geologic map (Figure R). Approximately 90 per cent of the smooth pahoehoe in the inland area is undermined by cavities. Judging from sinkhole exposures, the crust ranges in thickness from several inches to several feet. The crust is cracked and jointed into blocks up to three feet thick. The older basalt under the crust is expected to be jointed into rocks generally one to two feet thick.

permeable. For a few days after a heavy rain the interiors of these caverns drip with water.

In many places in the WBR the relief dips below sea level, and in these places one often finds brackish-water pools.

There is a beautiful sand beach at 'Anaeho'omalu Bay. This crescent-shaped beach is composed of lava, coral, and shell sand, and exhibits a rather steep foreslope (up to 30 degrees) with a well-developed berm along its entire length. Behind this beach are two large fish-ponds, Ku'uali'i and Kahapapa.

Just to the south of Ku'uali'i Fishpond is another, smaller pond, almost obscured by a dense growth of vegetation, including palms, pandanus, and Indian mulberry.

The area between 'Anaeho'omalu and Kaauau Points is for the most part rather low, with numerous tide pools, It rarely reaches an elevation greater than ten feet. The only exceptions to this are two areas of littoral cones, where the local relief is 10 to 20 feet. Beaches exist along these points as small pockets of mixed coral and lava sand. To the north near Waiulua Bay, is a tidal flat with a pebble and cobble floor. All along this length of the coast there is an abrupt transition from the beach deposits to the lava beds inland. Waiulua Bay is rather shallow, with an average low-tide depth of five feet.

On the south boundary of the area is a region of rough pahoehoe that is just as treacherous to walk through as the 'a'a of the Kaniku Lava Flow. The major portion of this formation, lays outside of the WBR.

Generally the overall slope of the land is considerably less than 10 per cent. Almost all of the topographic relief is a consequence of the layering and buckling of lava flows rather than from erosion, as would typically be found in geologically older and/or wetter environments. (Figure U).

What is not indicated on the topographic maps is the grading that has already been done, namely certain rough graded portions of 'Anaeho'omalu and Waikoloa Roads, Ku'uali'i Place and Kahapapa Street and portions of parcels 10, 12, 13, 14, 20, 22, and 26. This is clearly shown in Figure AL. The grading has been basically to the existing contours.

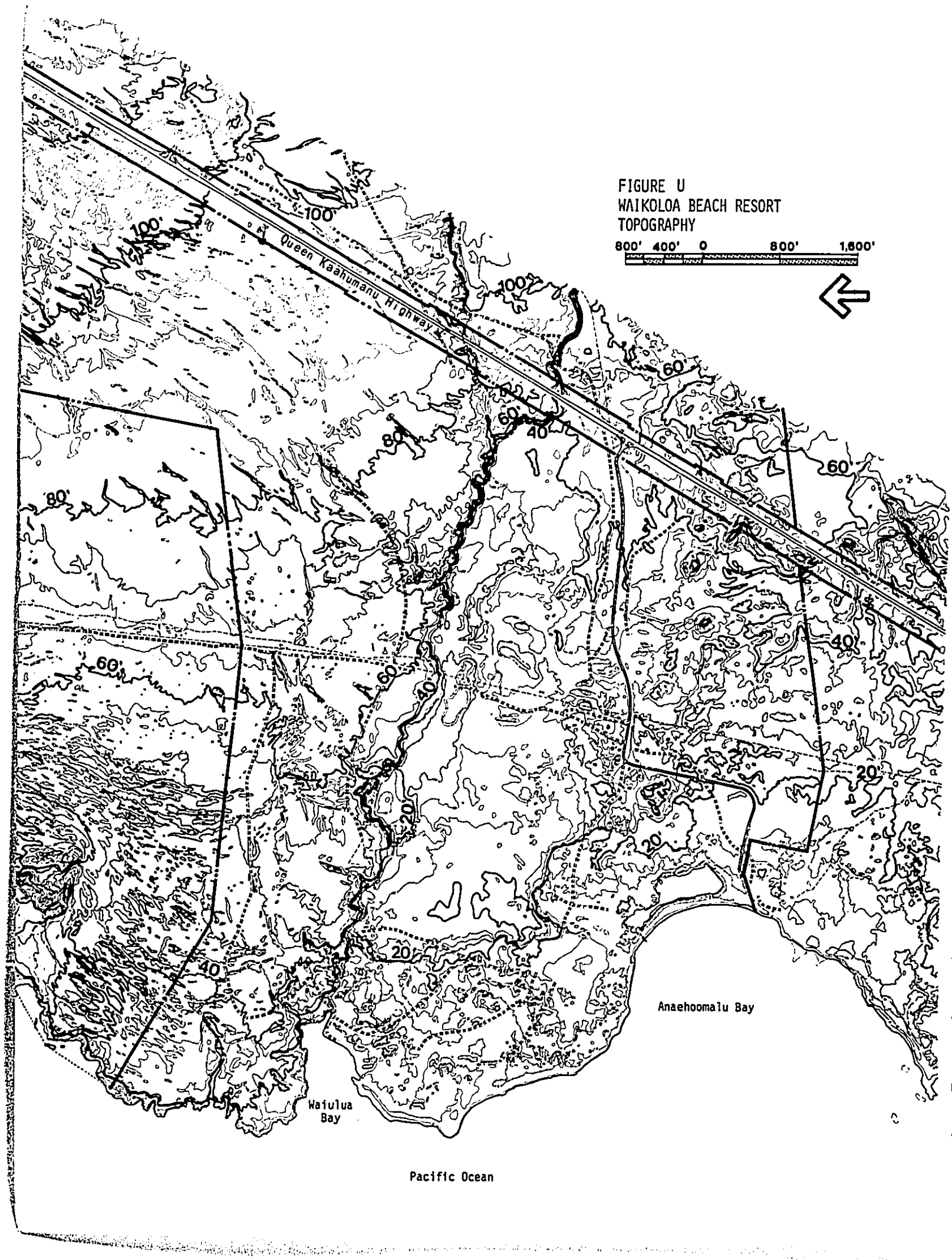


FIGURE U
WAIKOLOA BEACH RESORT
TOPOGRAPHY
800' 400' 0 800' 1,600'
Queen Kaahumanu Highway
100'
100'
100'
60'
60'
40'
80'
80'
60'
60'
40'
60'
40'
20'
20'
20'
20'
40'
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

3. Soils

Three different soil and land types at the WBR, (Increments One, Two and Three), have been identified by the Soils Conservation Services (SCS) (Sato et al, 1973), as mapped on Figure V, and briefly described in Table II-B.1. None of the soils can be considered an agricultural resource. The lack of soil covering is really the dominant characteristic.

Table II-B.1 Soil and Land Types and their Respective Areas*

Soil or Land Type	SCS Identifying Symbol	Area Acres	Per Cent of Total Area of Site
Lava Flow, 'a'a	vLV	812.8	60
Lava Flow, Pahoehoe	vLW	507.1	37
Beach	BH	40.4	3
TOTAL		1,360.3	100

The following descriptions of the three soil and land types are largely summarized from Sato (Ibid.) and Dames and Moore.

'A'a Lava Flows

'A'a lava flow (vLV) has been mapped as a miscellaneous land type by the SCS. This lava has practically no soil covering and is bare of vegetation. The 'a'a lava is north of a line trending southeast from the north shore of Waiulua Bay and crossing the Kiholo-Puako Trail at a point 2,000 feet inside the southern boundary of the property. The 'a'a lava area consists of two general environments. There is a 500 to 900-foot wide belt at the southern extremity of the 'a'a flow which has a moderately uniform surface clinker layer on the order of 9 to 15 feet thick. North of this belt, the 'a'a flow is characterized by a series of solid basalt rock ridges which protrude through a clinker layer which is on the order of six feet thick.

Pahoehoe Lava Flows

The area designated as pahoehoe lava (vLW) is also considered by the SCS as a miscellaneous land type because of its meager soil covering. The pahoehoe lava covers about two-thirds of the southern portion of the property about one-third of the pahoehoe lava (shoreline pahoehoe lava area) is dense basalt with scaly crust, rough to bulbous. There are numerous shrinkage cracks (local relief five to ten feet). There are also two ash mounds (local relief 10 to 20 feet). The balance of the pahoehoe lava (inland pahoehoe area) is basically smooth pahoehoe lava with brittle crust (local relief generally less than six feet). With-

*Source: Belt, Collins and Associates, Ltd.

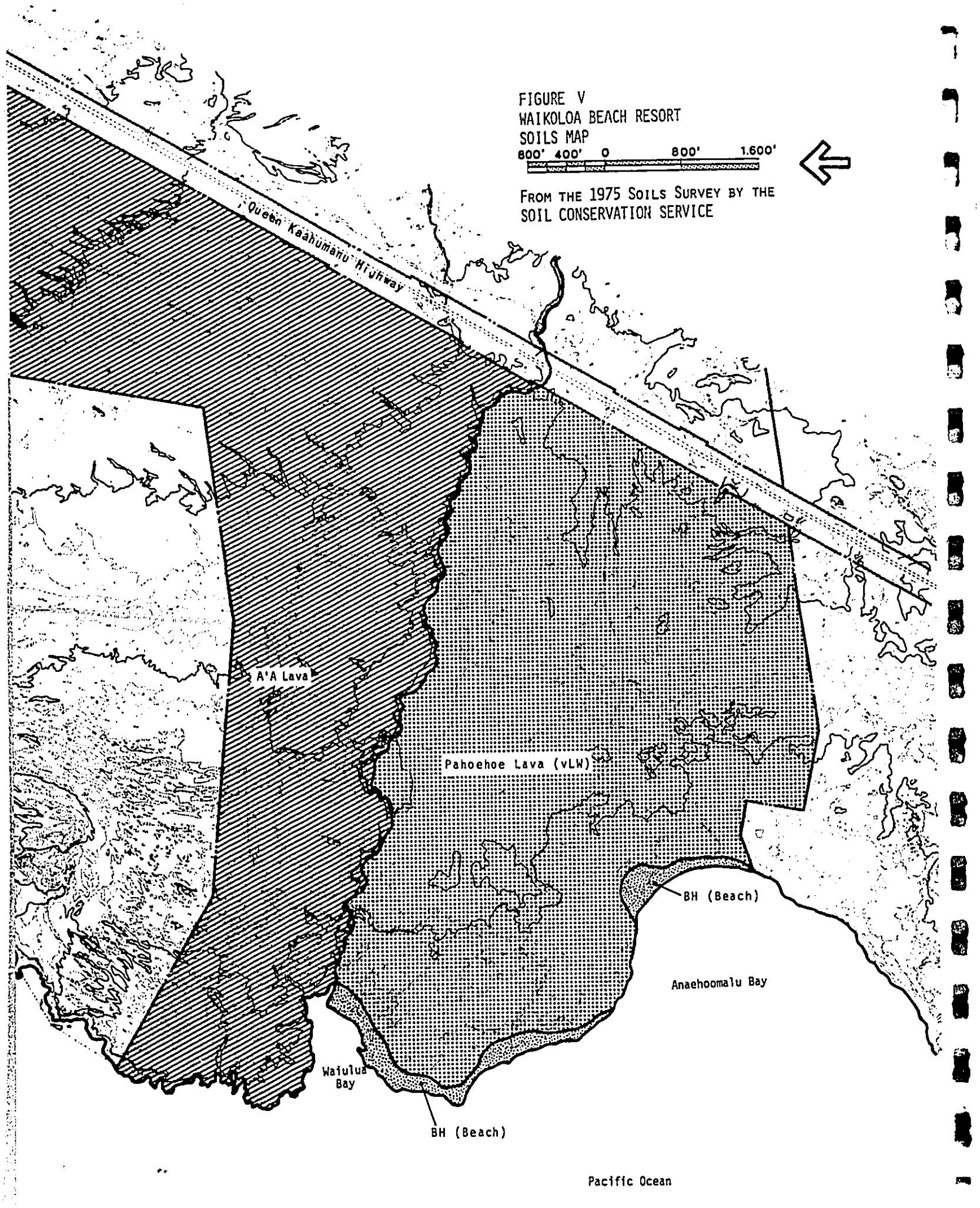


FIGURE V
WAIKOLOA BEACH RESORT
SOILS MAP
800' 400' 0 800' 1,600'
FROM THE 1975 SOILS SURVEY BY THE
SOIL CONSERVATION SERVICE
Queen Kaahumanu Highway
A'A Lava
Pahoehoe Lava (vLW)
BH (Beach)
Anaehoomalu Bay
Waiulua Bay
BH (Beach)
Pacific Ocean

in this area there is also an area of lava blisters and stacks which are jagged to bulbous and cavernous (local relief 10 to 20 feet); lava blisters, which are hummocky (local relief generally 6 to 12 feet); and lava blisters and pinnacles (local relief generally 6 to 12 feet). In addition, there is one small area of rough pahoehoe lava (local relief generally less than six feet) on the southern boundary of the property.

Beach Areas

The SCS has mapped two beach (BH) areas along the WBR shoreline. The 'Anaeho'omalu Beach is about 1,200 feet long extending from the southern boundary of the WBR Development to the old masonry channel connecting the ocean to the fishponds just inshore of the beach. The beach covers approximately 11 acres and the ponds approximately five acres. The sand is clean, coarse grained, and well sorted. It is a mixture of particles of marine origin (fragments of sea shells and coral) and basalt chips (black lava). The beach as shown in Figure V between 'Anaeho'omalu Point and Waiulua Bay is not a continuous sandy beach but more like a series of small sand pockets of mixed coral and lava sand.

4. Climate

State of Hawai'i

The state consists of a chain of islands with a northwesterly-southeasterly orientation situated between latitudes 19° North and 22° North, and is approximately 2,500 miles southwest of San Francisco. (For comparison, the latitude of Key West, Florida is approximately 25° North and Puerto Rico approximately 18° North.) Volcanic in origin, the topography on each of the major islands varies dramatically within short distances. With trade winds from the northeast, the northern sides of the islands are windward and the southern sides leeward. As the trade winds are deflected by the various topographical features on the islands, certain climatic conditions are created. Air absorbs moisture when crossing the ocean at these latitudes. As it is deflected upward by the mountains, condensation and rainfall occur on the windward sides. Thus, the air which reaches the leeward side is drier. Rainfall depends largely upon the coastal topography. For example, the northeast coast of Moloka'i rises sharply from the ocean which results in a substantial amount of rainfall even at the coastline. On O'ahu, some parts of the coastline are relatively flat for some distance; therefore, the tradewinds pass over the coastal area without depositing unusual amounts of rainfall.

The leeward areas usually have less rainfall, lower humidity, calmer waters, and more exposure to sunshine--particularly in the winter months. For these reasons, most of the resort areas are on the leeward sides of the islands. Only the Hanalei resort region of Kaua'i and the Hilo resort region on Hawai'i are windward. The average temperatures of these designated resort regions do not differ significantly. They range from 71°F. to 73°F. in the coolest months and from about 76°F. to 81°F. in the warmest months. The average annual percipitation, however, does vary from 137 inches per year at Hilo to 9 inches at the Kohala coast. Table II-B.2 shows the general climatic conditions at selected resort regions in the state. All of the resort regions shown are within approximately 45 minutes driving time from airports where inter-island commercial jet service is provided.

South Kohala Coast, County of Hawai'i*

Most of the inland portion of the coast has an arid, hot, desert-like atmosphere. Nearer to the shoreline, relatively cooler sea breezes moderate this to create a more comfortable environment.

Rainfall

The South Kohala coastline is one of the driest regions on the island and in the state--annual rainfall at the Weather Bureau's Puako gauge has averaged nine inches in the past 36 years. Up the coast at Kawaihae, 22 years of record at one station showed an annual maximum of

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*Source: Mauna Loa Land, Inc. EIS.

Table II-B.2 GENERAL CLIMATIC CONDITIONS
Selected Resort Regions

	Normal Average Temperature of		Normal Annual Precipitation, Inches
	Coolest Month	Warmest Month	
Hawai'i			
Hilo	71	76	137
Kohala Coast	73	80	9
Kona Coast	72	77	25
Kaua'i			
Hanalei - Pu'upoa Point	71	78	45
Hanalei Town	--	--	90
Lihu'e - Wailua	71	79	43
Po'ipu - Port Allen	72	79	36
Maui			
Ka'anapali - Lahaina	71	78	15
Ma'alaea - Wailea	71	78	13
O'ahu			
Hale'iwa - Waimea	--	--	25
Honolulu (Waikiki)	72	81	29
Wai'anae (Makaha)	72	80	20

Sources: State of Hawai'i, Department of Planning and Economic Development, 1974 Data Book; Princeville Corporation.

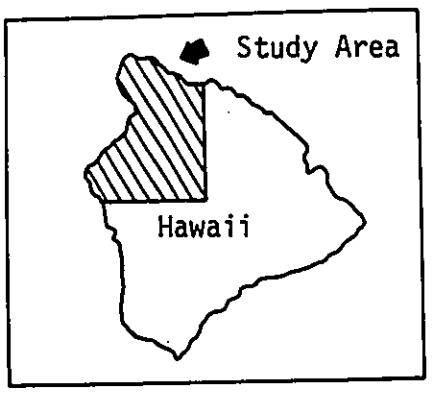
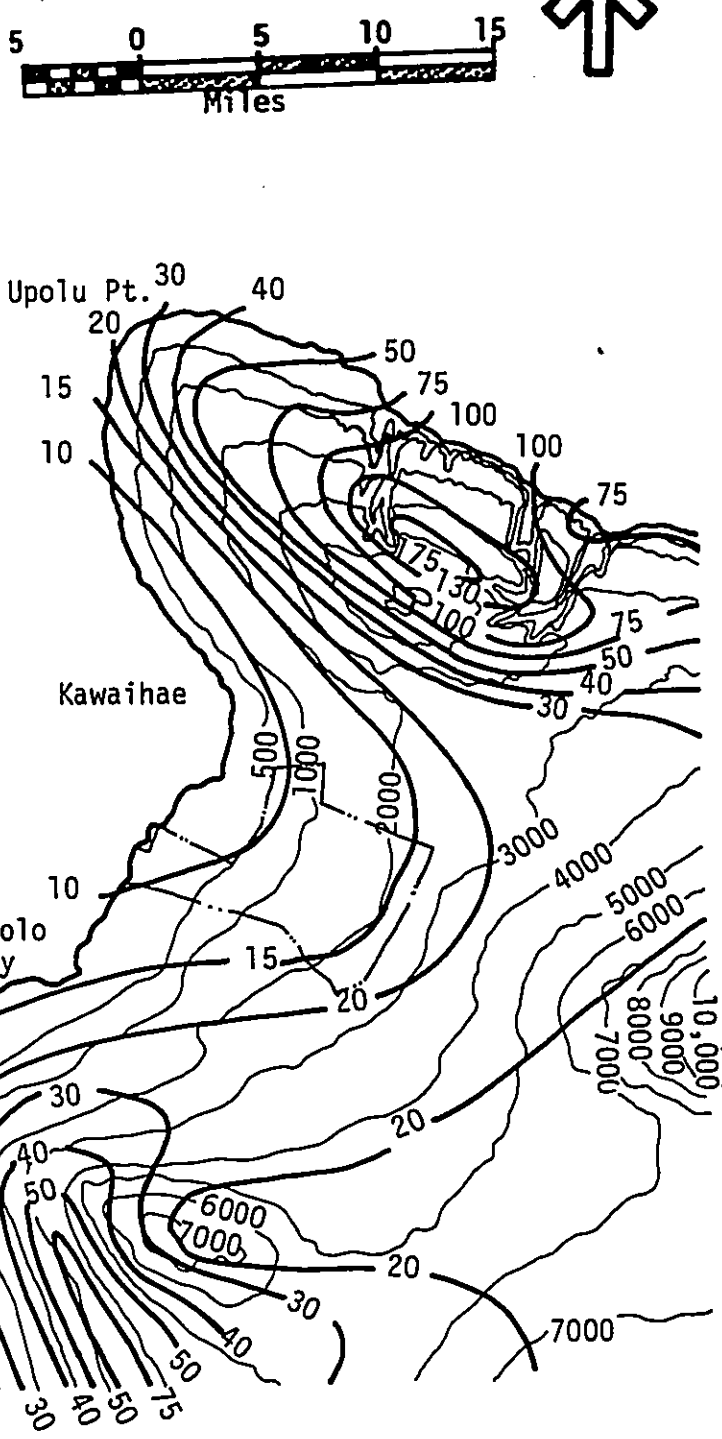


FIGURE W
WAIKOLOA BEACH RESORT
AREA RAINFALL

Source: State of Hawaii
Dept. of Land & Natural Resources



just 9.1 in. (one year with only 0.2 in.) and a median annual value of 6.6 in. (Taliaferro 1959: 118, 132). Usually most of the year's meager rainfall occurs in several storms during the October-to-April winter season, but one or two unseasonable rains at other times can alter the annual distribution significantly.

The "Rainfall Frequency Atlas of the Hawaiian Islands" (Weather Bureau 1962) indicates that expected storm intensities are closely correlated with mean annual rainfall. This finding has been borne out at South Kohala over the years, as intense storms along this coast are very rare. Rain squalls or isolated storm conditions some distance inland on the Waimea plains are a more common occurrence. (Figure W).

Temperature

Mean annual temperature in this coastal region is 78°F. with relatively small daily and seasonal fluctuation. Daytime temperatures above 88°F. or nighttime lows below 63°F. are extremely rare. Average summer temperatures are only 4°F. higher than those in winter. The temperatures vary more in a day than average temperatures vary season to season.

Wind

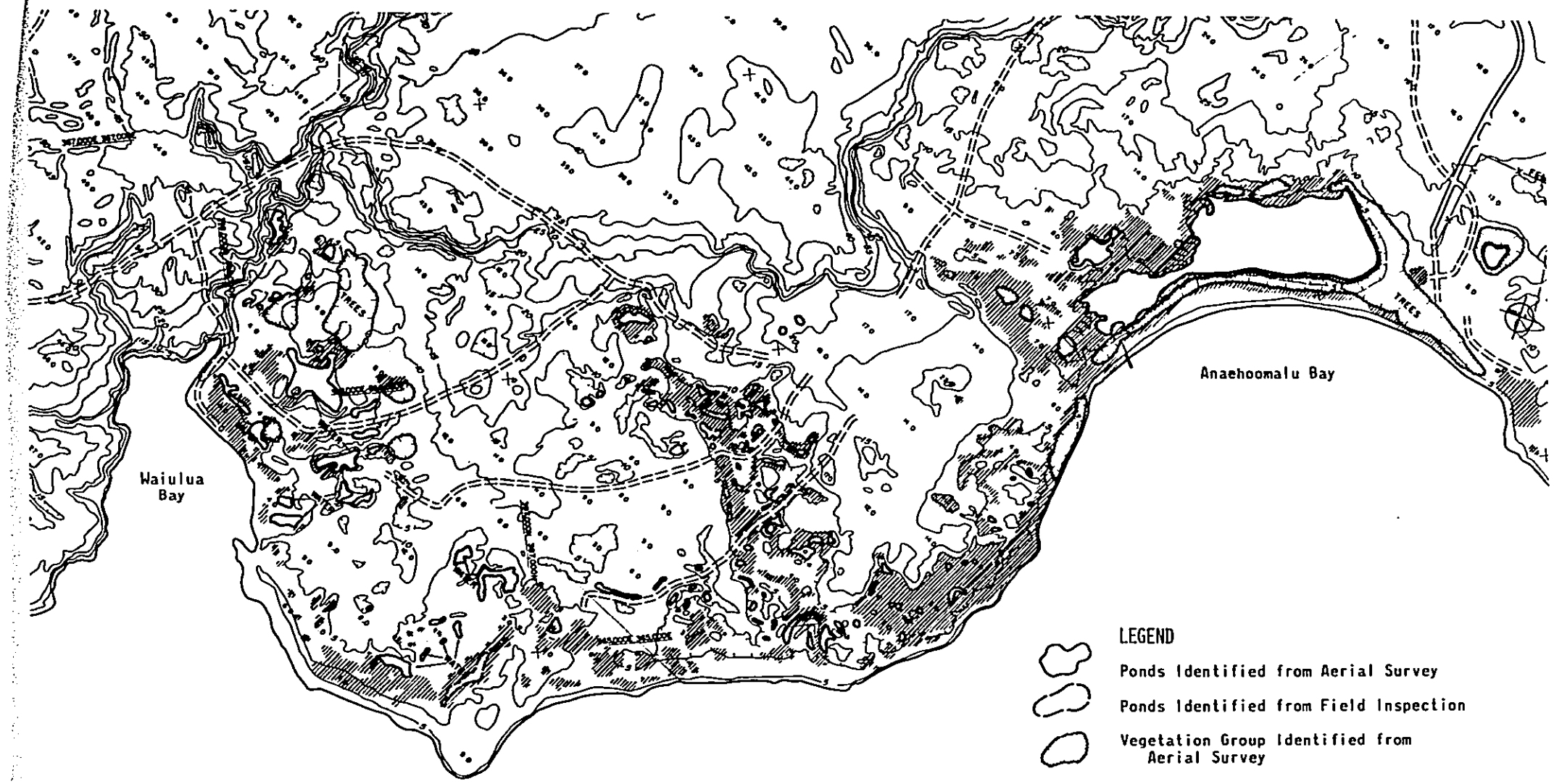
Airflow is most commonly onshore from mid-morning till just before sunset and offshore from early evening till the following morning. This diurnal pattern contrasts to the relatively constant NE tradewinds prevalent in most other areas of the state. The average wind velocity is also less seven to eight mph for the land-to-sea breeze at the South Kohala coast compared with 12 to 14 mph for the trades elsewhere.

The cause of the land and sea breezes is the temperature differential between sea and land. During the day, the land is hotter, causing the air above it to expand and rise and thus drawing in the denser air from over the ocean to replace it; at night, land temperatures drop below the ocean's and the process reverses. This process is actually at work along all coastlines, but only in areas in which the trades are blocked or deflected is the diurnal seabreeze pattern evident.

The trades come from Hamakua (to the northeast), are directed between the masses of the Kohala and Mauna Kea volcanoes, and sweep the Waimea plain at high velocities. This wind continues down the gradual slope to the coastline until counteracted by the onshore seabreezes mentioned above.

Humidity

As would be expected in this arid environment, the humidity is generally below that of most other areas in the State. Relative humidity under 40 per cent is common during the late morning and afternoon hours of warm cloudless days; this is about 20 per cent below values typical for most leeward areas, and 30 per cent below those for windward areas. The humidity is also relatively constant all year round, showing a significantly smaller summer-winter difference than is



LEGEND

Ponds Identified from Aerial Survey

Ponds Identified from Field Inspection

Vegetation Group Identified from Aerial Survey

Vegetation Identified from Field Inspection and Aerial Photos

FIGURE X
WAIKOLOA BEACH RESORT
BRACKISH WATER PONDS

300' 0 300' 600' 900'

common elsewhere.

Summary

This combination of low rainfall, high percentage of sunny days, low humidity and gentle winds produce a near perfect climate for WBR.

5. Surface Water*

Rainfall Runoff

Surface water as rainfall runoff in the Waikoloa Beach Resort (WBR) area is essentially non-existent. Extremely permeable bare pahoehoe and 'a'a lava cover the entire site (Dames and Moore Ms.); and except for some grasses and shrubs in isolated locations, the bare lava extends for miles inland as well (Sato, et al, 1973). The permeability of the lava exceeds rainfall intensities, so storm water percolates downward, rather than moving on the surface as overland flow.

Despite the fact that there are no stream channels tributary to the WBR site,** several drainage culverts were installed in the highway above it. There are two relatively large culverts--one 96-inch pipe at one location and two 84-inch pipes at the other--in the highway just north of the WBR access road intersection. Three small pipe culverts are beneath the highway at various points south of the intersection. There is no evidence that flow has occurred at any of these structures for the approximately two years since their installation. Only one of these culverts--the double 84-inch--appears to drain a topographic feature which might be considered a gulch. This formation is actually just the southern boundary of the Kaniku lava flow, however, and there are no physical indications that it is an intermittent waterway in the vicinity of the highway.

Two flood hazards studies by the Corps of Engineers (1970 and 1973) acknowledge that storm runoff is not a concern in this area. The Corps found that the only problems in the South Kohala coastal region are confined to the Kamakoa and Auwaiakekua Gulches, some four miles up the coast. The Corps' flood hazard map for Puako to 'Anaeho'omalu shows only Puako Bay and the Puako Beach lots within a potential flood plain.

Ponds and Waterholes

There are approximately 80 ponds and waterholes within the WBR site, all of them a short distance in from the 'Anaeho'omalu Bay to Waiulua Bay shoreline (see Figures X and Y). These surface water features

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*Source: Belt, Collins and Associates, Ltd.

**The USGS quad map shows two intermittent mauka stream channels terminating 4,000 and 6,000 ft inland from Queen Ka'ahumanu Highway. However, no waterway of any kind can be found in the vicinity of the highway itself. (See Figure Z).

Ponds are shown in their approximate locations by size symbols:

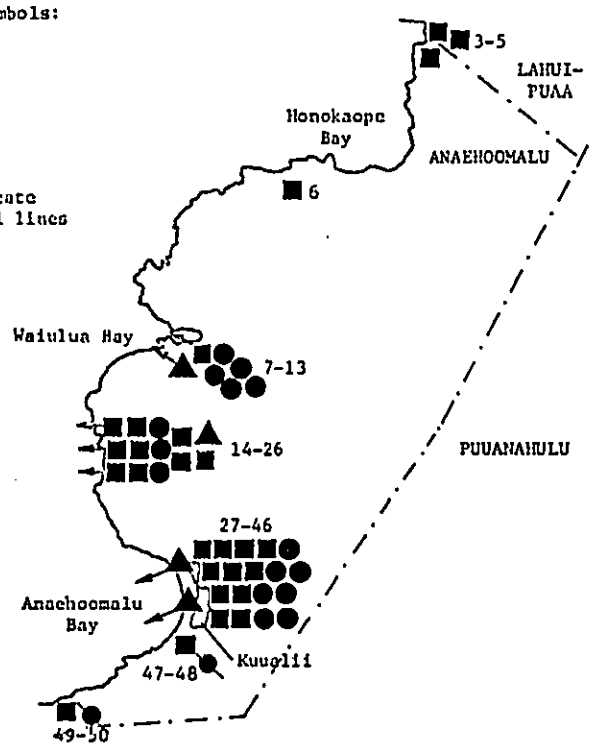
● = small, <10m^2 surface area

■ = intermediate, 10 - 100m^2 surface area

▲ = large, >100m^2 surface area

Pond symbols are qualified by arrows (e.g., ◄▲) to indicate surface connection to the sea (open ponds) and by diagonal lines (e.g., ■) to show waters in caves or fissures.

FIGURE Y
WAIKOLOA BEACH RESORT
PONDS



Pond No.	Latitude	Riparian Plants	Bottom Type	Depth	Salinity ‰
7	55.8'	G	S	"	7-19
8	55.7'	T,G,V	R,S	D	4-5
9	"	T	R	S	5
10	"	O	S	M	6
11-12	"	"	R	S	5-6
13	"	"	"	M	3
14-16	55.5'	"	R,S	"	?
17-18	"	V	R	M/S	12-14
19-20	"	O	"	?	12
21	"	V	R,S	M	12
22-23	"	"	R	S/?	11-12
24	"	V,T	"	?	9-11
25	"	T,V	"	S	7-11
26	"	"	R,S	?	7
27	55.2'	G,V,T	S	S	17
28	55.1'	T,G,V	"	D	4-18
29	"	V	R,S	S	2
30	"	V,G,T	R	"	4-7
31	"	V,T	"	M	2-4
32	"	V	R,S	S	2
33-34	"	V,T	R	?	1-2
35	"	"	S	M	1
36-37	"	V,G,T	R	S	2-5
38	"	V,G	"	?	2
39	"	G,V,T	"	M	2
40	"	T,V,G	R,S	S	2
41	"	G,V	R	M	3
42	"	T,G,V	S	"	4-10
43-44	"	T,V	"	?	3-10
45-46	"	T,G,V	R,S	?	5

Pond 8, largest of the many water exposures at Waiulua Bay (cf., Appendix F). Several marine fishes are present including the rare moray eel, *Gymnothorax hilonia*.

Explanation of column headings:

Riparian Plants--coded in groups (G = grasses, etc., T = trees and shrubs, V = vines and succulents, O = no bordering vegetation) in relative order of abundance;
Bottom Type--distinguished as R = rock (rubble, bedrock, etc.) and S = sediment (silt, sand, organic detritus);
Depth--coded in 3 ranges as S = shallow (< 0.5 m), M = moderate (0.5 - 1.5 m) and D = deep (> 1.5 m).
Salinity--given in parts per thousand (‰) with ranges indicating vertical, horizontal or temporal variations.

range in size from the 3.9 acre Ku'uali'i Fishpond to small holes in the lava just several feet across. Twenty-five of the 80 features have minimum dimensions of 20 feet or more. The ponds and waterholes are all brackish, with their salt contents determined by the dynamic relationship of "fresh" ground water moving toward the shoreline mixing with ocean water intruding inland. (A fuller explanation of this sea water intrusion phenomenon is given in the next section, on groundwater).

The ponds and waterholes are significant aesthetic and biological resources. As such, they have been included in two relatively recent surveys and evaluations of the hundreds of brackish ponds all along Hawai'i Island's western shoreline. Excerpts from these studies follow.

a. From the Kikuchi and Belshe study done for the Hawai'i County Planning Commission in 1971 (Ms.:B57-B64); the emphasis of this survey was on pools and ponds which had archaeologic or historic significance as Hawaiian fishponds and waterholes:

Name and Place
Ku'uali'i Pond
'Ili of 'Anaeho'omalu, South Kohala

Physical Description
Ku'uali'i is the southern and larger of the two fishponds at the head of 'Anaeho'omalu Bay. It is four acres in size and approximately rectangular in shape. Near the center of the pond the water is about two feet deep. Muck one to three feet deep is underlain by about three feet of sandy silt which in turn rests on pahoehoe lava. The bottom is quite sandy and firm along the makai edge of the pond.

The water temperature was 23 to 25°c. in a surface layer of two to four inch thickness and 26 to 27°c. beneath this. The upper layer had a salinity of 15 per cent and the lower layer 21-23 per cent. The ph was generally close to 8.8 and the dissolved oxygen content was 7-9 ppm. The water drains into the adjacent Kahapapa pond through a narrow channel. A small tidal fluctuation appears to occur in this pond, two to six inches.

Large areas of floating filamentous algae occur on the surface of the pond and patches of it are also on the bottom. Some bottom areas have a floculent algal mat. The biota of the pond includes mullet, barracuda, aholehole, gobi, black crab, limpet, snails and opai.*

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*It should be noted that Boise has dredged out a considerable amount of this "muck" since the Kikuchi and Belshe survey. Much of the algal mat described in this excerpt was also removed in the dredging process.

Anthropological Association
Ku'uali'i fishpond is classified as a loko pu'uone and not a loko Kuapa as Ching states (1971: 246). A very long, high sand dune fronts the ponds, while the inland sides are bounded by an ancient pahoehoe flow. The same flow forms the base of the pond and extends out forming the shallow shelf of the bay. Beachrock found at the present beachline indicates the presence of an ancient beach here with the same back angle. Thus the formation of this pond is quite ancient.

The present beach side of Ku'uali'i pond was fortified when coconut trees were planted along its edge. The thick interlacing mat of roots now has fossilized the edges and acts as an effective erosion preventor. No man-made features were noted around the pond's edge except at the point where a narrow natural channel connects Ku'uali'i to its twin pond of Kahapapa. Here concrete posts suggest that a sluice gate once existed.

Significance of the Pond
The only significance of Ku'uali'i fishpond is that it was once an operating fishpond. The notable lack of oral and written traditions attests to the marginal nature of the role of the pond in the local lore. However, the paucity of tradition may be due to the loss of local informants and to the lack of concentrated study by early scholars.

The pond itself is a typical example of a type II pond with almost no prehistoric alterations to the site. Its location, however, provided a convenient resting stop where brackish water, littoral and marine foods, and coconuts provided an oasis setting between harsh and barren lava flows. Currently the setting provides the same recreational opportunities for visitors.

Name and Place
Kahapapa Pond
'Ili of 'Anaeho'omalu, South Kohala

Physical Description
This is the second and northern-most pond adjacent to 'Anaeho'omalu Bay. It is about one acre in size and roughly elliptical in shape.

Kahapapa has a water depth generally less than 12 inches, the water getting shallower along the inland edge. The pond bottom is a firm sand near the seaward edge but this quickly gets covered with about 12 inches of algal mat as one proceeds into the pond. Near the center the sand is about three to five feet in thickness, overlying a pahoehoe lava flow. A sandy bottom with a very thin algal cover occurs along the arm which leads into the channel connecting to the Ku'uali'i pond. The sand is composed of about 70 per cent coral and 30 per cent lava particles.

The waters had a temperature of 23.4°c., a salinity of 15.2 per cent, a ph of 8.8, and a dissolved oxygen content of nine ppm. Tidal fluctuations of four to eight inches appear to occur.

Green filamentous algae occur along the inland edge of the pod and

on some patches of the bottom. A blue-green algal mat covers most of the bottom. There is a considerable infauna on the pond floor. Mullet, gambusia, aholehole, and crabs were seen in the pond.

Anthropological Associations

Kahapapa is the twin of Ku'uali'i pond located to the south of it. A smaller and shallower pond, Kahapapa is connected to Ku'uali'i by a natural channel, which in historic times has been reinforced with concrete posts and a probable sluice gate now destroyed. Kahapapa contains a second, major sluice gate at its northern-most tip allowing at low tide, for the flow of water from Ku'uali'i into Kahapapa and then out into the sea.

Kahapapa is a loko pu'uone type fishpond formed by sand dune action. Its northern and eastern edges are marked by an old pahoehoe flow. No prehistoric features were noted in the pond or as being associated with it.

Significance of the Pond

Kahapapa is as significant as its twin pond of Ku'uali'i, an example of a producing fishpond and of how its produce helped to augment the status of its owner. Its role was to produce fish at call, alive and fresh for the plates of the chiefs. It is significant in that the pond itself has had minimal work done to it in order to produce fish. As an example of prehistoric aquacultural techniques, it is an interesting pond, quite simple but once productive.

b. From the conclusion section of the Kikuchi and Belshe study (Ibid.: 17-29); it should be noted that both Ku'uali'i and Kahapapa are liman type ponds:

The nine most significant ponds of West Hawai'i, as evaluated in Section II-B-8, Nearshore Marine Biology, include five ponds formed naturally behind a barrier beach (what has been referred to in this report as a liman type pond or pu'uone) and four formed by man's construction of a sea wall (the loko kuapa type pond).

This survey and evaluation of the ponds yielded the following ranking of these nine ponds:

(1) 'Aimakapa'a
(2) 'Opae'ula
(3) 'Ai'opio
(4) Kaloko
(5) Kiholo
(6) Ku'uali'i
(7) Kahapapa
(8) Lahuipua'a
(9) Waipuhi

Several points considered in making this ranking are enumerated below.

. . .The liman type pond is the most typical form found in West Hawai'i

and may also have historical significance. It is likely that man first used natural ponds such as these to hold fish. Later he may have cut a channel through the barrier beach and lined it with stone to make a sluice gate. The success of these operations would encourage him to try a more ambitious undertaking--the construction of a sea wall.

. . .Kahapapa ranks high because of its association with Ku'uali'i. Both should play an important role in the open space and recreational needs of the Waikoloa resort-residential development.

c. From the ranking in an aquatic survey by Maciolek and Brock (1974: 16), a study in which the emphasis was on natural values of water features, rather than archaeologic or historic significance:

Class A. Pond sites of exceptional natural value based on physical structure, diversity, representative aquatic communities, and new or unusual endemic species. Locations are generally remote and in pristine condition. Preservation as a unique resource is recommended strongly.

'Anaeho'omalu: ponds D-7 to D-26 (Kahapapa and Ku'uali'i designated D-27 and D-28, are not included in this group) plus numerous unsampled ponds. The largest single concentration of anchialine ponds on the Kona coast and in the state is located in pahoehoe adjacent to Waiulua Bay and extending southward to the northern side of 'Anaeho'omalu Bay. Principal biological features include representative anchialine communities (including mineral-encrusting algae, mollusks, and shrimps), the unusual occurrence of many marine fishes in low-salinity water, and the presence of the moray eel, *Gymnothorax hilonis*. (Appendix 2.)

The difference in emphasis of the two surveys excerpted above led to quite different rankings of the water features. The smaller water features along Kaauau Point and in back of Waiulua Bay were found to have "exceptional natural value" by Maciolek and Brock, but were not even mentioned by Kikuchi and Belshe, undoubtedly because none were large enough to function as fishponds for Hawaiians. In contrast, the larger Ku'uali'i and Kahapapa were rated highly by Kikuchi and Belshe for their archaeologic and historic significance, but were of lesser aquatic natural value to Maciolek and Brock (1974: 8):

"Turbid waters occurred mostly in large ponds, especially those with meager growths of aquatic plants, suggesting that small water exchange per unit volume is a relevant factor. Planktonic turbidity apparently is a natural phenomenon in some ponds. Evidences are the occurrence of temporary streaks and plumes in some remote ponds and Hawaiian lore related by Kelly (1973) that attributes periodic turbidity to the menstruation of female mo'o (pond spirits). This explanation would seem especially apropos to the red-brown turbidity noted above.

"The principal factors promoting aquatic primary productivity, dissolved nutrients and light energy, seem to have the most time for interaction in large, open ponds. Apparently that is why such ponds have luxuriant growths of aquatic plants. If dissolved nutrients are

not absorbed by benthic flora such as filamentous algae and pondweeds, phytoplankton may develop to cause turbidity as it did after the "cleaning" of pond D-28 (Ku'uali'i). Before the ponds were dredged, both had well-developed benthic flora and fairly clear water; after removal of aquatic plants and sediments, significant turbidity developed in each. Sediment disturbance also liberates nutrients bound in the substratum and may increase the intensity and duration of phytoplankton blooms."

6. Groundwater*

There are now more than 15 drilled wells in the region from the Waimea-Kawaihae Road on the north to Kiholo Bay on the south (see Figure Z for the locations of these wells). The data obtained from these wells-essentially all of it coming since about 1960--have established several regional groundwater charactertistics which will be summarized here. It should be emphasized, however, that the understanding of the region's subsurface geology, and hence direction and quantity of groundwater flow, is far from complete.

Groundwater Occurrence

All along the shoreline and for a distance of at least several miles inland, groundwater occurs in a basal lens configuration. A layer of relatively fresh water (i.e., brackish water) saturates the lavas at and near sea level, lying as a lens over the seawater, which saturates the lavas below sea level. The lens configuration results from the density difference between brackish and ocean water; its thickness at any point is due to several factors: the permeability of the lava; the amount of recharge flow from rainfall that percolates down to the lens and then moves horizontally to the coast; the distance inland from the effects of waves and tides, which tend to break down the lens structure; and local geologic features such as lava tubes, 'a'a clinker layers, cooling cracks, or perhaps a layer of weathered volcanic ash between lava flows.

A good indication of the thickness of the brackish basal lens beneath the WBR area is provided by measurements of the static water levels in the five small irrigation wells about 3,500 feet from the shoreline (see Figure Z). These levels were surveyed by Claude Jenkins of Waikoloa on December 10, 1975, to be +1.55 feet (msl), and indicate a brackish lens on the order of 60 feet thick at that point. The lens gradually increased in thickness with distance inland, perhaps to approximately 80 feet (just a rough estimate) at Queen Ka'ahumanu Highway. It should be mentioned that the static level has been measured only once; it will vary seasonally, perhaps even in cycles of years, depending on the recharge the lens receives from inland rainfall.

An exception to the basal-lens configuration was discovered at Waikoloa in 1969. Boise's Parker Wells Nos. 4 and 5, drilled 4.7 miles

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*Source: Belt, Collins and Associates, Ltd.

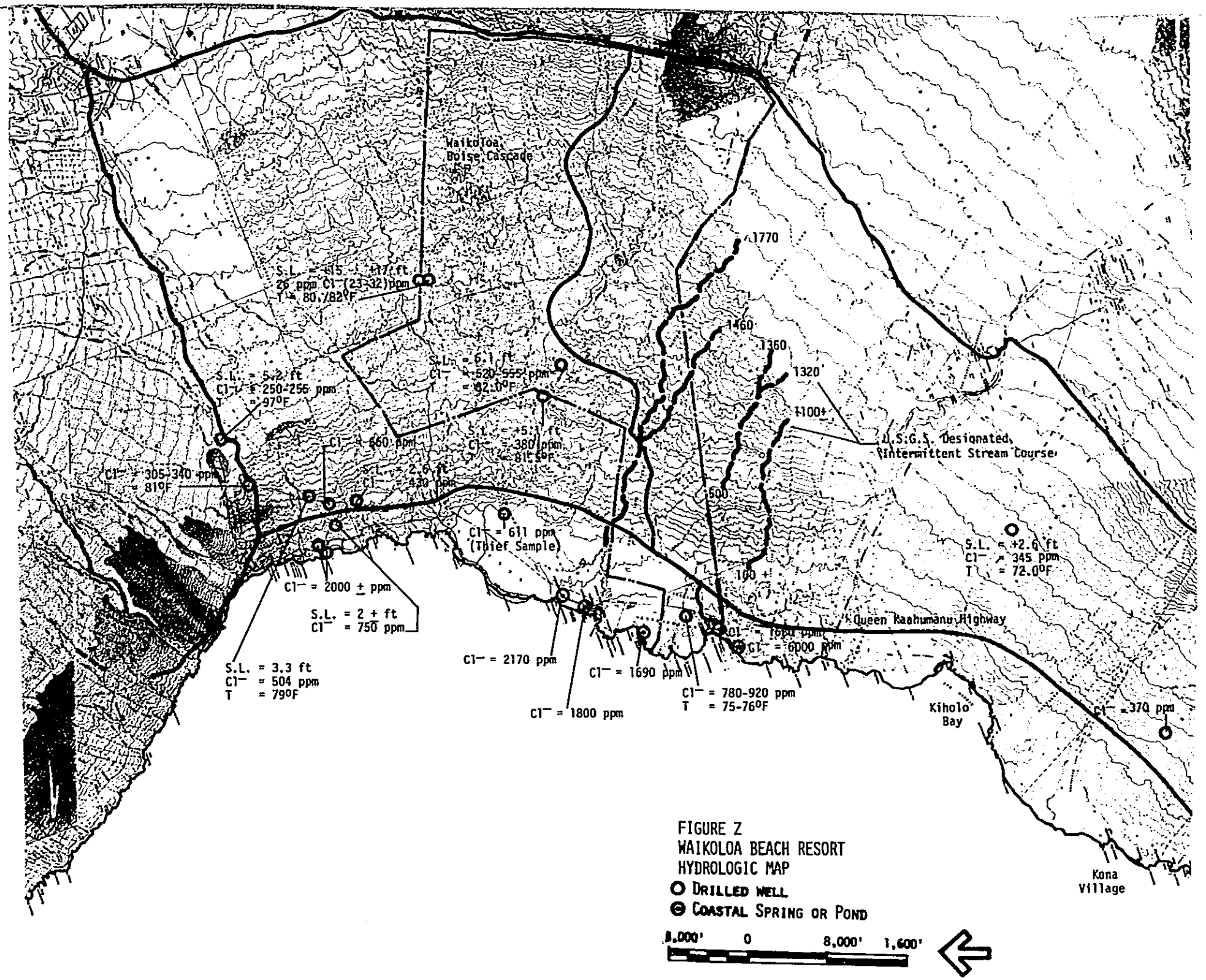

FIGURE Z
WAIKOLOA BEACH RESORT
HYDROLOGIC MAP
O DRILLED WELL
⊖ COASTAL SPRING OR POND

inland from Puako Bay, hit a body of water with very good quality (25 ppm chloride content versus from 250 to 2,000 ppm from other drilled wells in the region) and at a relative high level (16 to 18 feet above sea level versus five to six feet as the highest level for other wells in the region). The good quality and high level cannot be explained on the basis of the gradual increase in basal-lens thickness with distance inland; it is too high for that. Rather, these characteristics are the result of some sort of groundwater barrier. The barrier impedes salt-water encroachment inland, thus preserving the quality of the fresh water, at least in the region below elevation 16 to 18 ft, thus creating a natural reservoir of water at a level higher than the basal lens. This water has come to be known as the Waikoloa aquifer.

Boise's high level wells have been tested by the State Division of Water and Land Development (Chuck Ms.), and by consulting hydrologist Stephen Bowles (Ms. a). Harold Stearns, a well known geologist, has also commented on the discovery (Ms.).

The tested safe yield at sustained pumpage from this portion of the high-level water body is on the order of at least 2 mgd and maybe significantly more than that. Testing at higher withdrawal rates than the capacities of the two existing wells will be needed to establish the maximum yield of the aquifer.

The discovery of the high level aquifer, in addition to providing a potable water source for Boise's developments, has raised a number of questions about the subsurface geologic structure and groundwater flow: what kind of structure retards the flow? What is the aerial extent of the aquifer? From what inland region does the flow come from? What is the relationship between the high level water and the basal lens seaward of it? With the information at hand, both Bowles (Ms. a) and Stearns (Ms.) could only speculate on the answers to these questions. The geophysical prospecting reported in Adams, et al (1969) indicated a strong gravity anomaly in this area, but this is certainly not definitive in itself. Reliable data to answer these questions will come from new wells in the region, most likely to be installed when the need for potable water increases beyond the capacities of the two existing wells.

Basal Water Flowrate to the Coast

Several attempts have been made to approximate the basal flowrate to the shoreline. The first of these was by Cox using a rainfall-to-groundwater recharge approach (Cox et al. 1969: 9-12), and was made prior to the discovery of the Waikoloa aquifer. Considering the entire region delineated by the rift zones of Hualalai, Mauna Loa, and Mauna Kea as possibly tributary to the groundwater discharge along seven miles of coastline between 'Anaeho'omalu and Lalamilo, Cox arrived at a flow of "less than seven million gallons per day per mile" of shoreline. He cautioned that with the difficulty of quantifying evaporation loss, the actual flow is "quite likely much less" than the seven mgd/mile of shoreline. It is important to note that Cox considered the tributary region to be to the southeast in the saddle region and not

from the wetter region of the Kohala Mountains to the north and northeast.

Bowles (Ms. b) has made a more recent estimate using the same basic hydrologic technique but with different ideas on evaporation loss and tributary area. Adding the contribution of Kohakohau and Waikoloa Streams to percolating rainfall within the South Kohala region, he calculated a basal flowrate of 2-1/2 mgd/mile of shoreline. Bowles felt that groundwater underflow from Kohala and/or Mauna Kea adds an unknown amount to this, so he concluded that the total flow is probably between two and four mgd/mile of shoreline.

An alternative approach to calculating the flowrate--also no better than an order of magnitude technique--is based on the configuration and dynamics of the lens structure. The technique is described in Glover (1959); it requires data on the static water level of the lens as a function of distance inland, and a value for the permeability coefficient of the water-bearing lavas. Data on the static level is obtained at each well site; the permeability of the South Kohala lavas can only be grossly estimated.

Table II-B.3 summarizes the calculated basal flowrate for two assumed values of the permeability coefficient. The lower of the coefficient would indicate a very permeable formation, and the higher one an extremely permeable formation. Drawdowns during pump tests of various South Kohala wells indicate in a general, but not quantifiable, way that such values of the coefficient are reasonable for this region. With the gross estimate of permeability, the value of this calculating technique is not in its accuracy but rather in the variation of flow along the shoreline that it demonstrates. As illustrated in Table II-B.2, the South Kohala-North Kona coast shows a decrease in basal flowrate from the north to south (wells are listed from north to south in the table). One possible conclusion from this is that underflow from the Kohala Mountains is more significant than from the saddle area between Mauna Kea and Hualalai.

Conspicuous Basal Water Discharge at the Waikoloa Beach Resort Shoreline

Several investigators have noted that a significant basal discharge point occurs at the head of Waiulua Bay (Cox et al 1969; Fischer et al 1966; Key et al Ms.; Young Ms.). Cox et al (1969) also found depressed surface salinities over extensive portions of 'Anaeho'omalu Bay, and concluded that basal discharge there is more extensive than at Waiulua. The other studies noted above did not detect salinity or temperature anomalies to confirm the Cox finding.

The significance of a concentrated basal discharge is two-fold. First, it illustrates local variations of basal flow due to features such as a layer of cinders, or lava tubes, or large shrinkage cracks. Second, where such discharges occur into calm coastal waters, the input of nutrients and the lowering of salinity significantly influence the marine biological community. The waters within Waiulua Bay are protected by a rubble barrier across the bay entrance, and the aquatic flora

Table II-B.3: Calculated Basal Flowrate to the Coast Based on the Observed Lens Configuration and Assumed Permeability Coefficients (K)

Well	Static Water Level (ft msl)	Distance Inland (ft)	Basal Flowrate (MGD/Mile) K = 1,000 ft/day	Basal Flowrate (MGD/Mile) K = 3,000 ft/day	Volcanic Formation
State Test Well No. 16	4.62	13,600	1.2	3.7	in Kohala lavas at sea level
State Test Well No. 1	3.27	8,250	1.0	3.1	
State Test Well No. 2	3.3	6,000	1.4	4.3	
Mauna Kea Beach Hotel Irrig. Well	2±	2,500	1.3	3.8	
Hapuna State Park Irrig. Well	2.6	4,500	1.2	3.6	in Mauna Kea lavas
Boise Cascade Test Well at 600 ft elev.	5.13	18,000	1.2	3.5	
Boise Cascade Irrig. Well at 800 ft elev.	6.14	22,000	1.4	4.1	
Boise Cascade Irrig. Wells at WBR	1.55	3,500	0.9	2.6	Mauna Kea or Mauna Loa lavas
State Test Well at Kiholo	2.6	16,000	0.3	1.0	in Hualalai lavas
Kona Village Well	1.8	12,800	0.2	0.6	
Palani Well	1.7	10,500	0.2	0.6	
State Test Well at Kolaoa	3.2	16,000	0.6	1.5	

and fauna there are an example of this phenomenon. A subsequent section on biological resources will describe this in some detail.

It might also be noted that no conspicuous basal discharges have been located along the WBR coastline except in the two protected bays. Though this may be a true indication of the discharge pattern, it is more likely due to the rapid mixing of basal water with seawater that occurs with waves and turbulence.

Groundwater Quality

Table II-B.4 characterizes the quality of the high-level Waikoloa aquifer and the basal lens seaward of it. Since the table is a summary of testing done over a period of years by various laboratories, some chemical constituent values are given as ranges. Also as a basis of comparison, typical open ocean surface quality is listed in the last column of the table.

Two of the chemical constituents listed in the table will be discussed as indicators of the various physical and chemical processes influencing South Kohala groundwater quality. First, the chloride ion (Cl^-) content is a sensitive indicator of the extent of seawater intrusion. Its concentration in the ocean is approximately 19,000 mg/l. In rainwater, it is only three mg/l (Visher and Mink, 1964), and as surface water in mauka, South Kohala streams, it is only about five mg/l (Burbank et al 1967; U.S. Geological Survey 1974). This ion does not readily enter into chemical reaction with other constituents, nor is it subject to appreciable ion exchange, nor are there known sources of chloride within the lavas. This makes the Cl^- concentration of any groundwater sample a good indication of the extent that seawater has mixed into "fresh" water. In this regard, note that the 25+ mg/l concentration in the Waikoloa aquifer indicates very little seawater intrusion. In fact, just 0.1 per cent seawater mixed into rainwater would yield the same Cl^- concentration. Apparently the barrier which gives rise to the high water level in the aquifer effectively prevents seawater from moving into the water body.

The chloride concentration in basal groundwater, as expected, shows progressively greater amounts of seawater intrusion for samples nearer the shoreline. The samples from Boise's mauka irrigation wells are about 2.8 per cent seawater; the ones from the irrigation wells within the WBR site are approximately 4.3 per cent seawater; and the Ku'uali'i Fishpond samples are between 10 and 20 per cent seawater.

Relatively high concentratons of nitrogen, particularly in the nitrate (NO_3^-) form, are usually reliable indications of areas where groundwater quality is affected by other than natural causes. In the sparsely populated and vegetated southern half of South Kohala District, it would be expected that the natural nitrate concentration would be low. Surface waters from Waimea town (Kohakohau and Waikoloa Streams) are between 0.0 and 0.1 mg/l NO_3^--N (Burbank et al 1967; U.S. Geological Survey 1974), and the groundwater would be expected to be only slightly higher than this, if at all. Unexplainably, the natural

Table II-B.4: South Kohala Groundwater Quality (all chemical) constituent values expressed as mg/l unless otherwise specified; blank spaces indicated no measurement available)

Chemical Constituent	Parker Well Nos. 4 & 5 - the Waikoloa Aquifer[1]	Basal Groundwater				Surface of Inner waters of Waiulua Bay[5]	Typical Open Ocean Values[6]
		Boise Cascade Irrig. Well @ Elev 800'[2]	Boise Cascade Test Well @ Elev 600'[3]	Boise Cascade Test Wells within WBR site[1]	Ku'uali'i Fishpond[4]		
Major Cations							
Ca^{++}	7 - 9	28			145		410
Mg^{++}	9 - 11	45			386		1,300
Na^{+}	30 - 35	310-330			3,400		10,550
K^{+}	4 - 5	23			125		380
Major Anions							
Cl^{-}	21 - 30	540-550	520	800-850	1820-3950		19,000±
HCO_3^{-}	98 - 104	142			109		140
SO_4^{-}	15 - 18	95-97			98		2,650
Nutrients							
NH_4 & OrgN as N	0.0 - 0.4	0.01-0.3	0.9	0.0-0.4	.02-0.3		.0017
NO_3 & NO_2 as N	0.9 - 1.5	0.80-1.0	0.4	0.5-0.7	0.4-1.3	0.4	.0018
Total N	0.9 - 1.6	0.8-1.2	1.3	0.6-1.0	0.6-1.3		.0035
Soluable-P	0.06 - 0.08	0.04-0.09	0.03	.05-.11	.04-.08	0.04	.006
Total P	0.06 - 0.11	0.1-0.3	0.15	.05-.15	.06-.08		.008
Total Dissolved Solids	160 - 240	1180-1260	900-1100	1900-2000	4000-1100	10,000	34,900
SiO_2	42 - 80	55-85			36		
pH (in pH units)	6.7 - 8.0	7.5			7.4		8.3

Sources: [1]Professor Reginald Young, Water Resources Research Center - U. Hawai'i (personal communication); Swain (1973)
[2]Fett (Ms. a); Swain (1973); Young (pers. comm.)
[3]Fett (Ms. b); Young (pers. comm.)
[4]Cox et al (1969); Young (pers. comm.)
[5]Key, Guinther, and Miller (Ms.)
[6]Gundersen and Palmer (Ms.); Sverdrup et al (1942)

background level is significantly higher; NO_3-N values range between 0.4 and 1.5 mg/l, with a typical value of about 0.9 mg/l. (By contrast, the natural level of O'ahu basal water is 0.25 mg/l or less (Visher and Mink 1964; Swain 1973).) The relatively high background nitrogen level will figure strongly in subsequent sections of this statement dealing with impacts to water quality and marine life.

One other point about groundwater quality--perhaps the most obvious--should be noted. Potable groundwater as defined by the U.S. Public Health Service must have less than 250 mg/l Cl^- and 500 mg/l total dissolved solids (among other criteria). By this standard, only water in the high level Waikoloa aquifer is potable; all of the basal water wells contain too many sea salts. However, much of the basal water is satisfactory for agricultural and/or landscape irrigation; the bermuda grass to be used on the golf course fairways, for example, is quite salt tolerant, so water from the WBR onsite wells is considered good enough to be used for this purpose.

7. Nearshore Physical Oceanography*

The description of the physical oceanography of 'Anaeho'omalu and Waiulua Bays contained in this section is based on information collected during several scientific investigations of the area. In 1968 and 1969 Herbert Mann, an oceanographic consultant, studied the general oceanographic characteristics and the sand reclamation possibilities of the near shore ocean area. In 1971 and 1972, additional studies of the area were undertaken by oceanographers from the University of Hawai'i to determine the feasibility of improving the 'Anaeho'omalu beach swimming area, constructing a small boat harbor at Waiulua Bay, and improving the circulation in the fishponds mauka of 'Anaeho'omalu Beach.

The only coastal improvements undertaken since these studies were completed has been the removal of a consolidated beach rock ledge fronting the beach at 'Anaeho'omalu Bay and dredging of Ku'uali'i and Kahapapa fishponds.

According to Mann: "'Anaeho'omalu lies in a shallow bight which stretches from 'Upolu Point to Ke-ahole Point on the Kona Coast of Hawai'i. Geologically recent, the coastline is generally rough and precipitous, consisting of wave-cut lava cliffs and lava flows which extend out to sea in finger-like formations. Beaches are infrequent and small in extent. . .

"The sea floor within ('Anaeho'omalu) Bay is of uniform depth, but with numerous coral heads, seaward channels and sand patches. The water is generally clear except for a narrow strip in the center of the bay along the shoreline, where poor circulation and small wave action keeps fine material in suspension. . . . Toward the Kapalaoa section the bottom is foul with numerous pinnacles, many awash. Southwesterly swell breaks heavily in this area.

"'Anaeho'omalu Beach is a crescent-shaped mixed coral, shell and black lava sand beach with a well-developed berm along its entire length. It is bounded on both ends by lava outcrops which prevent lateral shifting. . . .

"The section of the shoreline (from 'Anaeho'omalu Bay to Kaauau Point) is exposed to westerly and southerly swell systems and the well-developed steep berm of coral and lava shingle shows evidence of strong wave action. Beaches exist as small pockets of mixed coral and lava sand. Tide pool structures increase in complexity toward Kaauau Point. . . . Northward to Waiulua Bay the shoreline widens to a tidal flat with pebble and cobble floor. There is evidence of a moderate longshore current and a spit has developed at the southern entrance to Waiulua Bay. All along this area the lava and coral berm terminates abruptly on the reverse slope with a sharp boundary between berm and 'a'a lava. Elevations are low behind the berm and there are scattered brackish ponds behind the berm. . . The (Waiulua Bay) inlet is shal-

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*Source: Belt, Collins and Associates, Ltd.

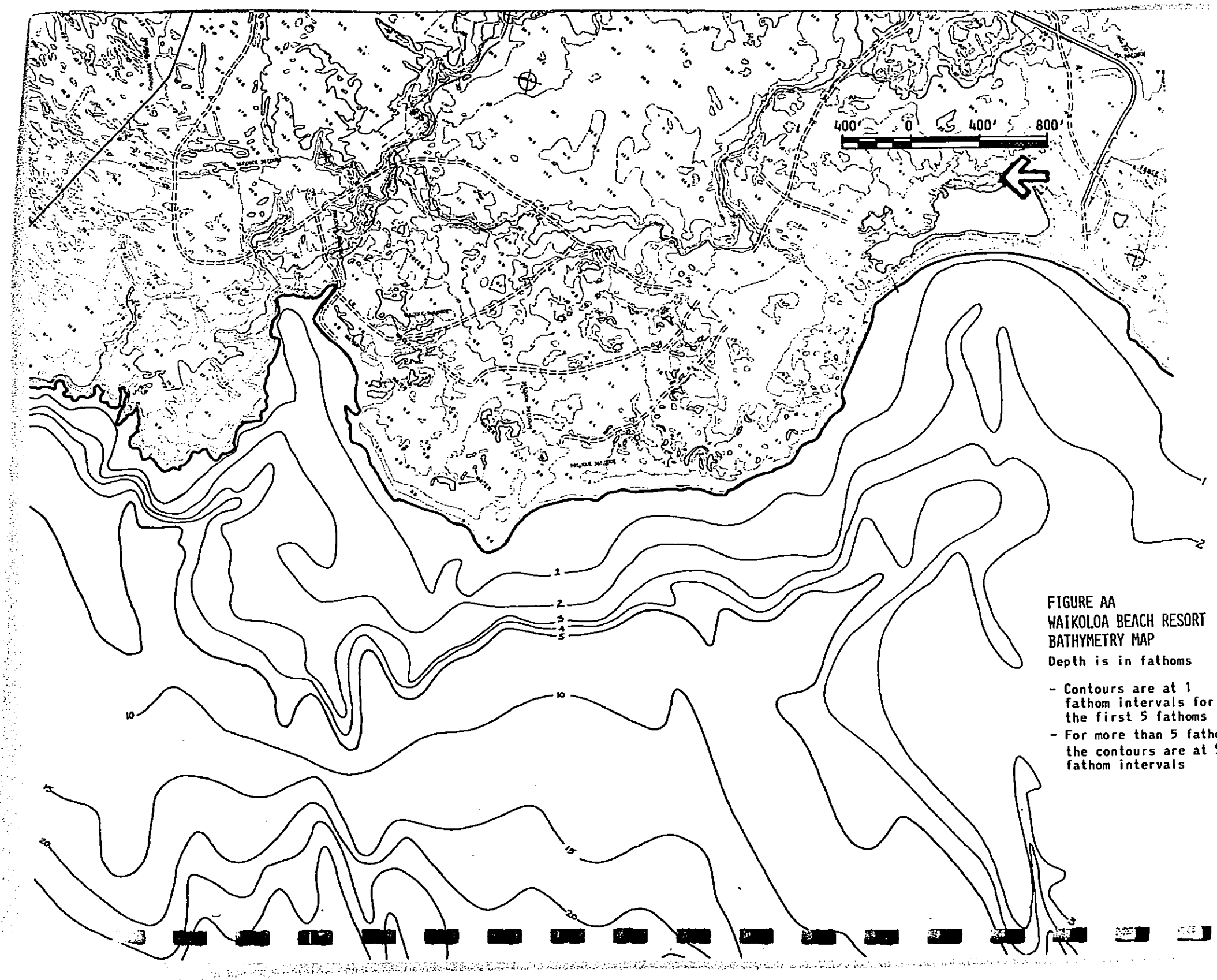

FIGURE AA
WAIKOLOA BEACH RESORT
BATHYMETRY MAP

Depth is in fathoms

- Contours are at 1 fathom intervals for the first 5 fathoms
- For more than 5 fathoms the contours are at 5 fathom intervals

low. . . Fresh water flows into the inlet at the upper end and the water is brackish in this area. The inlet is calm during typical trade-wind sea and swell conditions, but is exposed to westerly swell."*

Bathymetry

A simplified version of the bathymetric map prepared from soundings taken by Herbert Mann in 1968 is shown in Figure AA. There is a fringing coral reef cutting across the front of 'Anaeho'omalu Bay to Kaauau Point. The reef stops at the mouth of Waiulua Bay. North of Waiulua Bay there is no coral reef, since this portion of the coast was covered by the geologically recent Kaniku lava flow. The bottom along this portion of the coast is craggy near the shore but rapidly drops off to sand at most points.

Tides

The range of tides along this coast is small and the fluctuations are usually semidiurnal. The higher of the two daily tides averages 1.2 feet above mean sea level, and the maximum is +2 feet MSL. Generally, the total tidal range in a day is about 2 feet, but there are periods when it is as little as 0.5 feet (Mann Ms.: 2; NOAA 1974: 184). Maximum tidal range is on the order of 3 feet.

Currents

The Hawaiian archipelago lies within the geostrophic east-to-west current coinciding with the northeast tradewind drift. Within the islands, however, particularly near shore, the geostrophic current is weak and inconsistent when it exists at all. Typical velocities are 0.2 to 0.4 knot (Wrytki, Graefe, and Patzert 1969; Patzert 1969).

Along the leeward coast of the Big Island, the current on a rising tide is to the north and tends to move in toward the coast. Nearshore, a representative rising-current velocity is 0.4 knot (Mann Ms.) This current generally produces clockwise eddies in bays along the coast, such as at 'Anaeho'omalu. On a falling tide, the current reverses, weakens (to about 0.1 or 0.2 knot), and tends to produce counter-clockwise eddies in the bays. Because the flood-tide currents are stronger, the resulting net current drift is northward along the coast; in fact, the net drift around the entire island is clockwise (Wrytki, Graefe, Patzert 1969: 17-19).

Leeward of Hawai'i Island, there are offshore current features worthy of note. Eddies of from about 20 to 100 miles in diameter have been observed during all seasons (Patzert 1969). Most of these are cyclonic (counterclockwise), with current flows at the surface on the order of 2 knots, which is significantly higher than other currents in Hawaiian waters. The circular flow patterns are not caused by current flow through the island gaps, but rather by the strong local winds that

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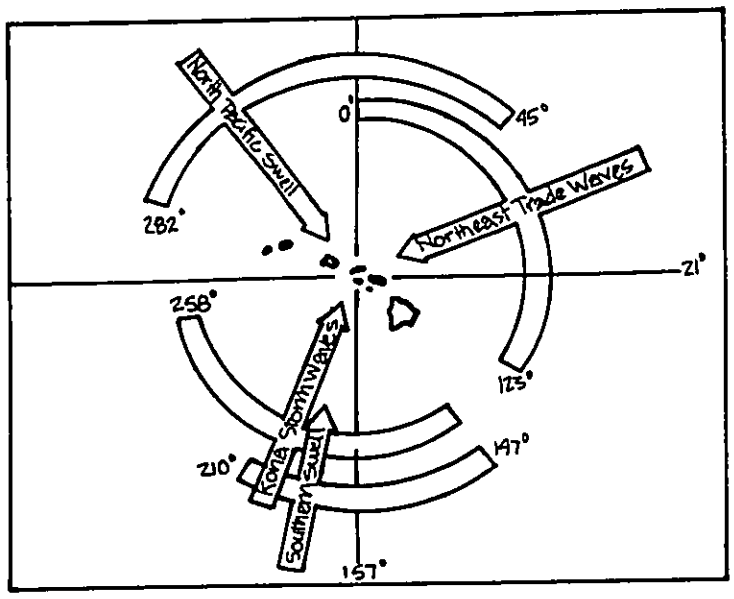
*(Mann Ms.)



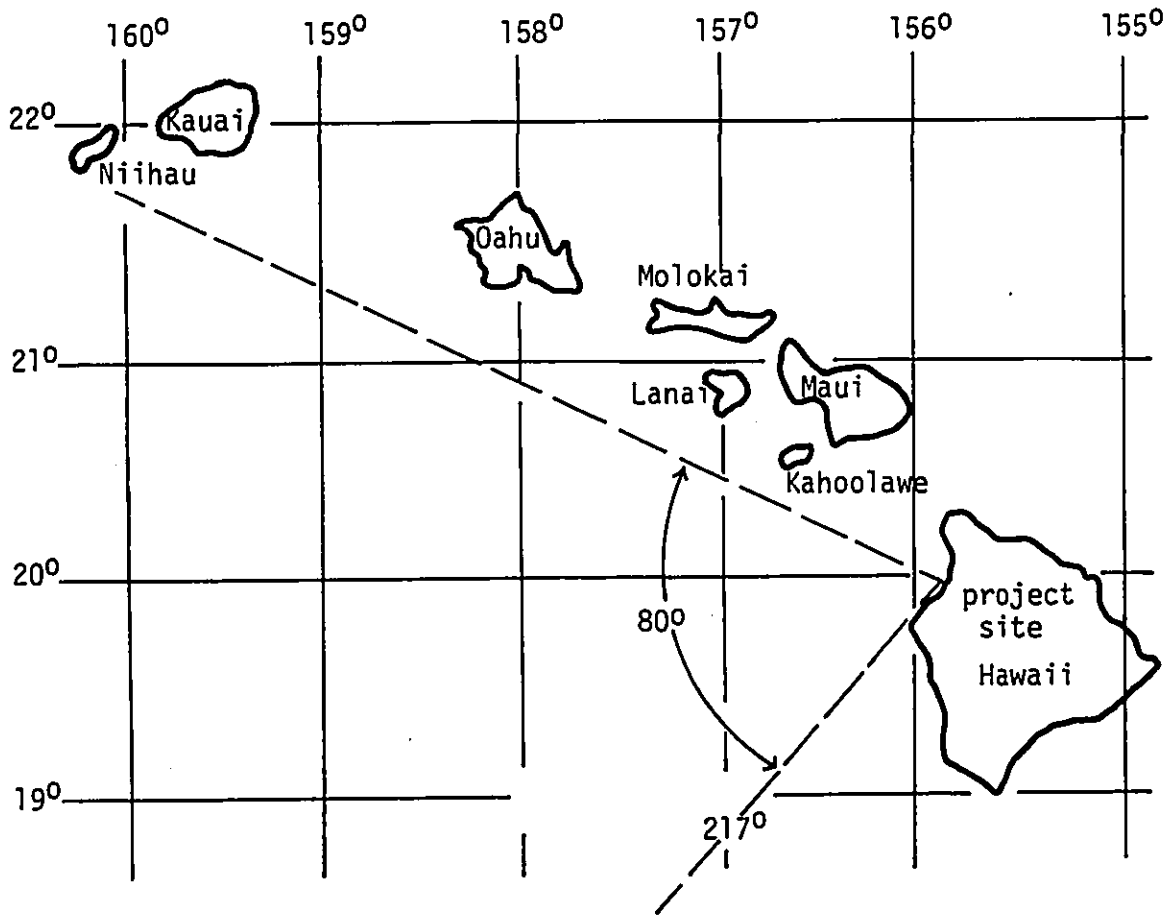


FIGURE AB
WAIKOLOA BEACH RESORT
HAWAIIAN WAVE TYPES

blow through the restricted air space between by the island of Maui and Hawai'i. It was thought that these eddies might create upwelling of the nutrient-rich deep waters, thus creating an area in which biological production would be high and good fishing might be found. However, University of Hawai'i investigators showed that the eddies are shallow features, with upwelling from only about the 150-meter depth. The concentration of nitrates and phosphates at that level is almost as low as at the surface.

Storm Waves

Four major wave types occur in Hawaiian waters (Figure AB). Two of these, the North Pacific and southern swells, are generated by far-off storms; with dispersion and decay over long travel distances, they reach Hawai'i with long periods of 14 to 22 seconds and characteristically low, open-water wave heights of 3 to 6 feet. The third wave type in Hawaiian waters is northeast-tradewind wave; these occur throughout the year and are of intermediate period and height. The fourth wave type--Kona waves generated by relatively nearby storms southwest of the islands--are usually short-period (6 to 12 seconds), steep and 8 to 15 feet high (U.S. Army Engineer District 1963).

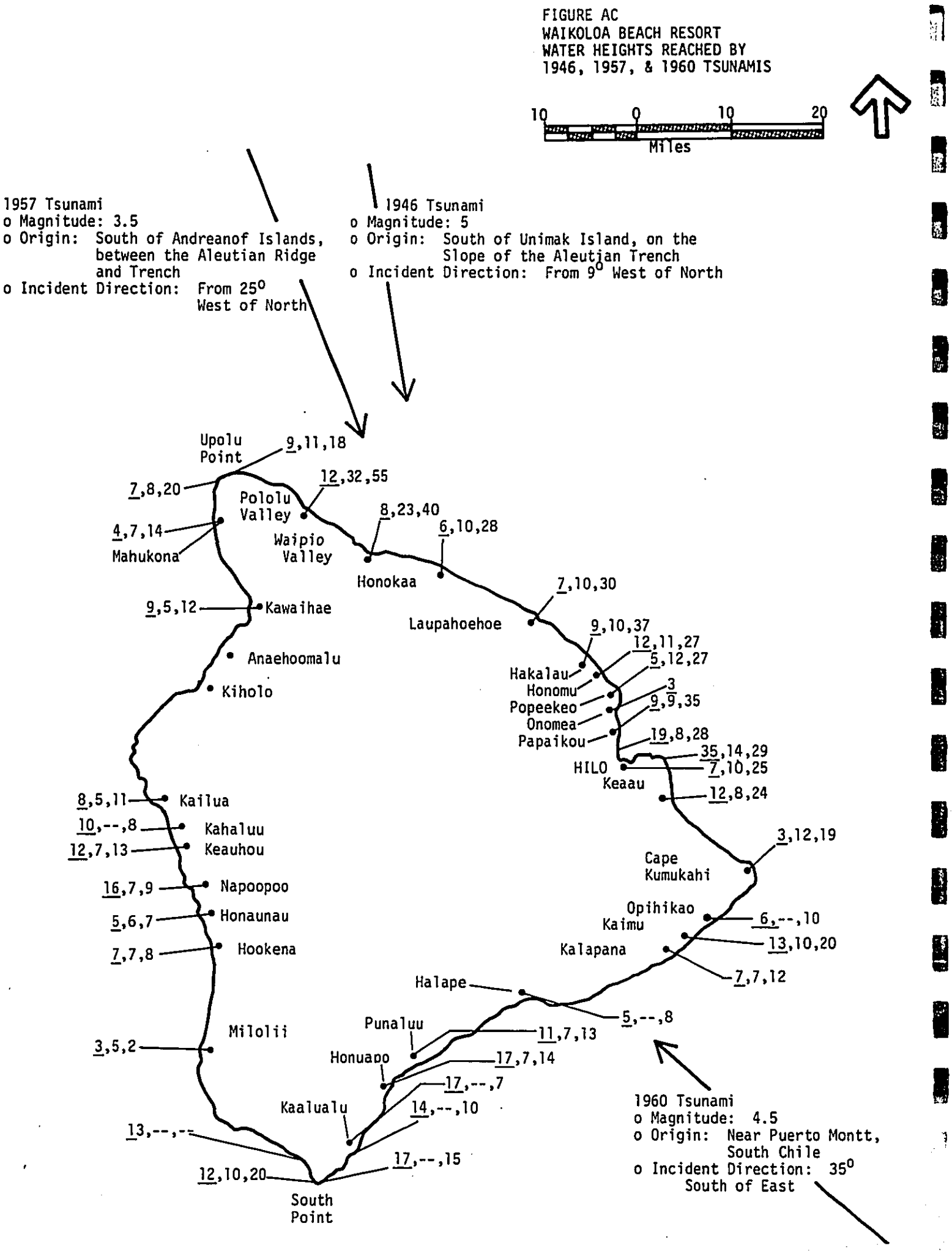
The South Kohala coastline is shielded from direct exposure to the North Pacific swell and northeast-tradewind waves by Maui and North Kohala, respectively. Both wave types undergo extreme refraction to reach the South Kohala coast and so lose most of their energy prior to arriving at the shore. When these waves predominate, the South Kohala coast is characteristically calm.

The waves of the most significance at South Kohala are those arriving from the relatively unprotected southwest sector. Short, steep waves generated by Kona storms occur only intermittently, but their energy results in the notable "disappearing-sand" beaches along the West Hawai'i coastline, the sand in most cases being transported from the beaches to the adjacent sea floor. The effect of long, low southern swells is just the opposite. These swells--most originating in the Southern hemisphere, but some from far off typhoons in the West Pacific--arrive often enough and with sufficient energy to move the sand back from the sea floor up onto the beaches.

Unusually high waves are the basis for planning and design of coastal structures, and Kona storm waves are the most important in this regard. Typically, their heights are 8 to 15 feet with periods of 6 to 12 seconds, but under unusually severe conditions, perhaps once in about 10 years, wave heights may be 25 feet with periods of 15 seconds (Ibid: Table 6). Southern swells have also produced high-breaking waves on occasion; for example, southern-swell breakers of up to 18 feet with periods of about 20 seconds were recorded at Hapuna in 1968. (Gayman and Greenbaum 1968: 10). On January 14, 1969, Herbert Mann observed heavy surf conditions at the 'Anaeho'omalu area caused by a low pressure area west of the state. Swells of 8 to 12 feet were observed arriving from the west.

During his reconnaissance, Mann was able to determine and plot the

FIGURE AC
WAIKOLOA BEACH RESORT
WATER HEIGHTS REACHED BY
1946, 1957, & 1960 TSUNAMIS



"storm wave-run line", the maximum distance inland that large storm waves penetrate. This line is shown on Figure AF as the debris line.

Tsunamis

Historical Runup

Figure AC presents the historical runup data that have been compiled and published for the 1946, 1957 and 1960 tsunamis. On Figure AD these data are generalized and compared. Several points are brought out by this latter drawing:

> Runups along West Hawai'i have generally been less than along other parts of the island's coastline.
>
> Of the three waves, the 1946 wave produced the highest runup at Kawaihae and Kailua, the two locations nearest the WBR parcels for which runup data are available.
>
> Good runup data for a severe tsunami incident from west of the island are not available. There have been several such tsunamis, but all occurred before detailed runup observations were recorded.

Another important point, one not brought out in Figure AD but noted elsewhere (Shepard, MacDonald, and Cox 1950; Fraser, Eaton and Wentworth 1959; Eaton, Richter, and Ault 1961; and Cox and Mink 1963), is that wave "bores" were not formed as these tsunamis inundated low lying areas along the South Kohala coast. This means that the tsunamis did not occur as waves in the popular sense, but rather as very rapid tides. Resulting damage was not from large waves breaking on coastal structures; rather, it resulted from hydraulic uplift pressures generated as the tsunami moved onshore-lifting several beach houses up off their foundations in Puako for example--and then from the returning rush of water as it receded. In no case was there damage in South Kohala approaching that which occurred along the Hilo coast.

Since analytical tsunami forecasting techniques are still unreliable, historical inundations remain the best indicator of future vulnerability. To this end, it is rather fortunate that relatively good data for the 1946 tsunami were gathered. Of the 85 tsunamis that have been observed since 1813, the 1946 wave was the greatest in magnitude. On the logarithmically linear scale oceanographers use to classify tsunami magnitude, the 1946 wave was a 5; no other historical tsunami has been rated as high (Pararas-Carayannis 1969). Also, at the time the tsunami arrived, large storm swells from the North Pacific were hitting the island's shores. The resulting runup, then, was the result of a very extreme seismic event, compounded in severity by the storm surf which moved in over the tsunami swell and broke on temporary inland shorelines. Along the South Kohala coast, the runups recorded during this event define the elevations below which that coastal area might be considered vulnerable to a severe tsunami, and above which the risk is quite minimal. Using Kawaihae data as indicative of this coastal area,

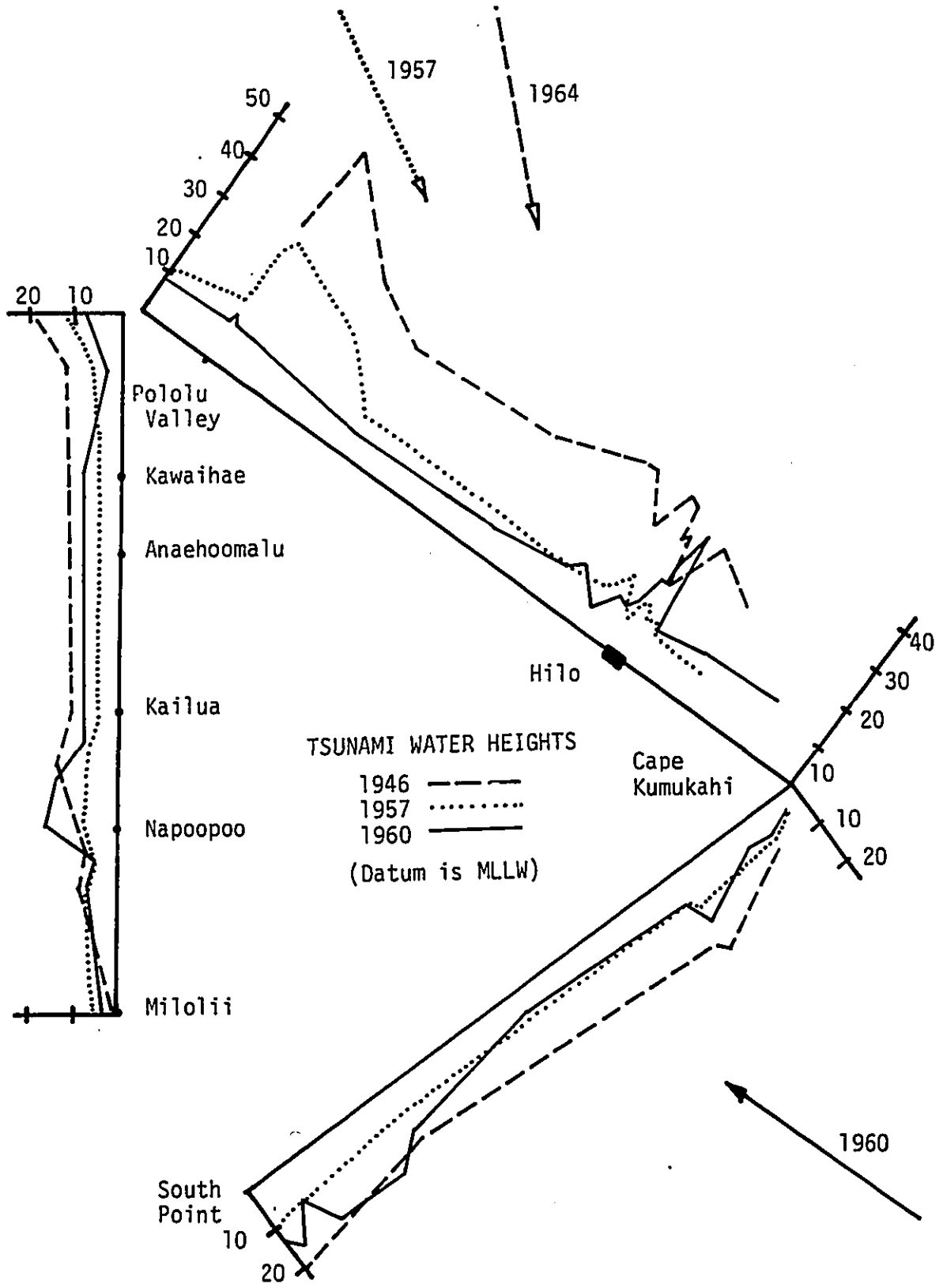


FIGURE AD
WAIKOLOA BEACH RESORT
WATER HEIGHT COMPARISON OF THE
1946, 1957, AND 1960 TSUNAMIS
ADAPTED FROM: FRASER, RICHTER & AULT (1961)

generally, we can assume that 12 feet above mean low, low water (about 11 ft above MSL) is the upper limit of vulnerability defined in this manner.

There is a possible exception to using the 1946 event to define a safe elevation for this coastline. It was noted previously that detailed runup data of a severe tsunami from the west has not been recorded (see Pararas-Carayannis 1969, for a compilation of the available data). Several western tsunamis have been observed since 1813--12 from Japan, two from the latitudes of the Philippine Islands, and several instances of high waves, if not genuine tsunamis, caused by earthquakes centered off the western and southern shores of Hawai'i Island (Ibid.). None of the tsunamis generated far off to the west produced runups in South Kohala comparable to the 1946 wave, though two from Japan (1896 and 1933) did significant damage in Napo'opo'o and Keauhou to the south. The 1968 earthquake southeast of Hawai'i, however, did produce runups in excess of the 1946 wave at Puna and along portions of the South Kona shoreline. Inundations were apparently to the 50 to 60 feet elevations in some places, far exceeding runups recorded for any tsunamis of distant origin. If such an earthquake were to occur west or southwest of Hawai'i, inundations would undoubtedly exceed those of the 1946 wave in South Kohala. The probability of such an event is quite small, of course, but because the possibility does exist it must be considered an exception to the 12-foot safe elevation definition.

Corps of Engineers: Limit of Tsunami Vulnerability

The Pacific Ocean Division of the U.S. Army Corps of Engineers, in association with the State of Hawai'i Department of Land and Natural Resources, published the "Puako - 'Anaeho'omalu Flood Hazard Area Map, September 1973". Based on the maximum observed water surface elevation in the South Kohala coastal area, of about 12 feet for the 1946 tsunami, a 100-year tsunami height at the shoreline was determined to be 15 feet. This height decreases one foot with each 100 feet in land. With this definition, the inundated area at 'Anaeho'omalu would be as shown in Figure AF.

County of Hawai'i General Plan: Definition of Tsunami Inundation

The General Plan - County of Hawai'i (1971) adopted among its standards "Potential Tsunami Inundation Zones" to be delineated by an analytical/empirical forecasting method first published by Cox (1961). The objective of Cox and others at the Tsunami Research Center at the University of Hawai'i was the ". . . .delineation of zones to be evacuated at times of tsunami warning. . . ." (Ibid.:1). As the quotation implies, the upper limits of the zones were to be at least some distance inland from the actual runup so as to provide an adequate margin of safety. In terms of land use near the shore, as in establishing building setbacks and floor elevations for example, differentiating between actual runup and evacuation zones is quite significant.

Without attempting to explain the limitations of the Cox method adopted in the General Plan (most of which are explained by Cox himself) it

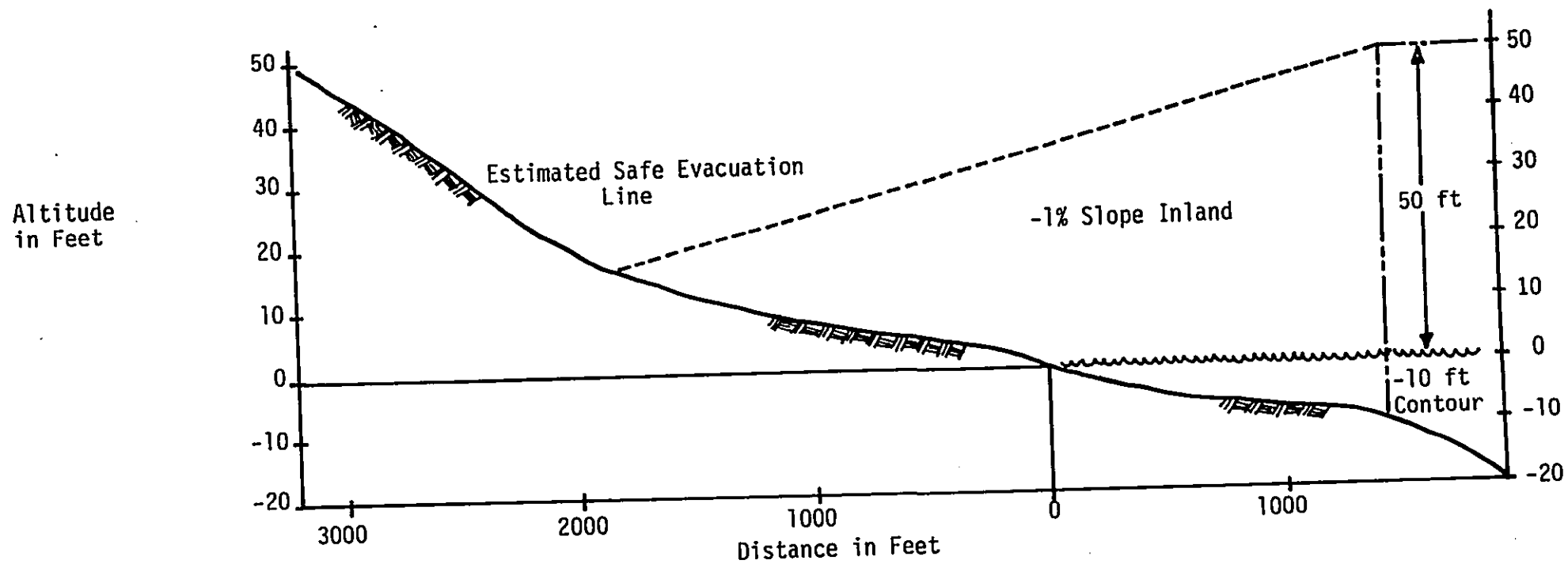


FIGURE AE
WAIKOLOA BEACH RESORT
DOAK COX METHOD OF DEFINING A SAFE
EVACUATION LINE

will simply be presented here as it applies to the WBR parcel. Figure AE illustrates and explains the technique. Figure AF shows the evacuation line as defined by the Cox method.

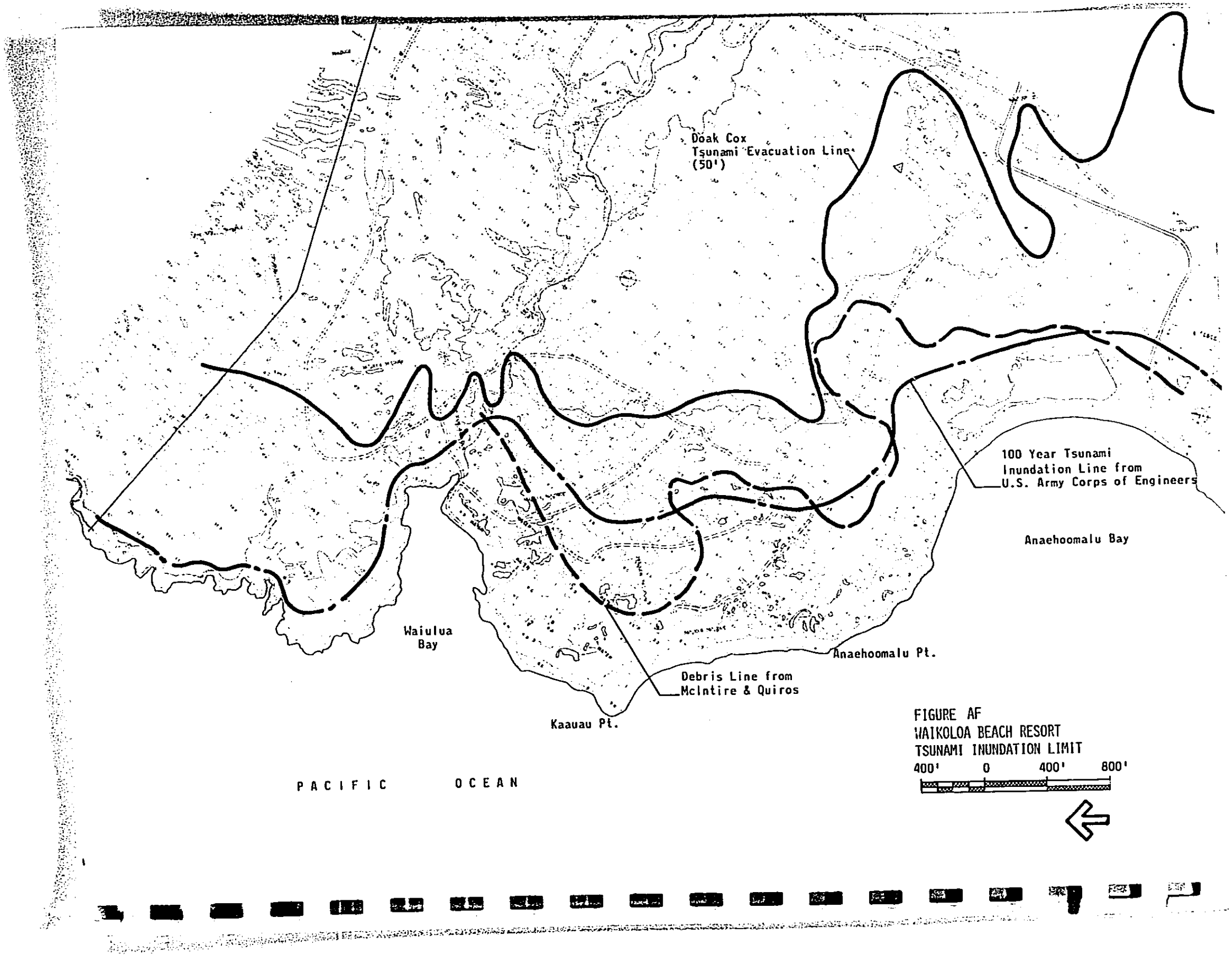


FIGURE AF
WAIKOLOA BEACH RESORT
TSUNAMI INUNDATION LIMIT

8. Nearshore Marine Biology*

This section summarizes the nearshore marine biological resources as they have been described in several studies of 'Anaeho'omalu and Waiulua Bays. (This section does not include the biology of the brackish coastal ponds which are described elsewhere.) The information presented below comes primarily from two sources: the Sea Grant report "Marine Fauna of the Coast of Northern Kona, Hawai'i" (Brock and Brock, 1974), which summarizes the results of a survey done by faculty and students of the University of Hawai'i Department of Zoology in the summer of 1972, and "General Biological Surveys of Waiulua Bay and 'Anaeho'omalu Bay" (Key, Guinther, Miller, 1971), done for Sunn, Low, Tom and Hara (1971) to aid in the applications for the Waiulua Bay small boat harbor and for 'Anaeho'omalu Bay beach improvements.

Brock and Brock

Sixteen stations along the coast were surveyed, with 'Anaeho'omalu Bay one of the most "heavily sampled" (their term) stations. While the survey does give a good qualitative view of the marine fauna, it does not constitute a baseline survey against which the long-term effects of the proposed development might be compared. In the words of the authors:

"All of the sampling stations are unique in one or more ways and this short survey has attempted to indicate this; however, a much more rigorous sampling program is needed in order to assess the marine fauna of the entire Kona, Hawai'i coastline." (Ibid.: 10).

Survey results presented by Brock and Brock (1974) covered three zones:

> Intertidal - the shoreline between high and low tide levels, where flushing by tide and surf provides a ready food and oxygen supply for the biota.
>
> Subtidal A - the portion of the marine environment where brackish water discharged from the basal lens may or may not be present, depending on seasonal conditions.
>
> Subtidal B - the deeper water to a depth of about 30 feet where normal marine conditions prevail (i.e., below the influence of basal discharges).

Fish and invertebrate species were recorded on plastic slates by swimmers attempting to sample the range of habitats in the area. The authors concede that only the most conspicuous diurnal organisms could be recorded in this manner, and that small, nocturnal species were missed. The macro-invertebrate species for Waiulua Bay and 'Anaeho'omalu Bay and fish species for 'Anaeho'omalu Bay are sum-

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*Source: Belt, Collins and Associates, Ltd.

marized in Appendix 3. The discussion and conclusions drawn by Brock and Brock that specifically deal with the 'Anaeho'omalu and Waiulua Bays are:

Waiulua Bay: "Waiulua Bay is small and well protected, bordered by a high 'a'a flow (Kaniku lava flow) to the north and to the south by a coral and lava rock beach. Intertidal invertebrate sampling was conducted at this station. The coastal ponds of this area proved to be very diverse biologically, hence, most effort was put into the sampling of these. Reported here are the invertebrates collected from both the higher salinity ponds and the adjoining bay to three feet (1 m) in depth." (Ibid.: 16) (The fishes of the ponds and general conclusions regarding the ponds are covered by Maciolek and Brock, 1974; summarized above in Section II-B-5, Surface Water.)

'Anaeho'omalu Bay: "The bay (Station D), beachrock bench (Station C), Ku'uali'i and Kahapapa fishponds (Station B) as well as the small tidepools north of the fishponds (Station A) were extensively sampled for both fishes and invertebrates. Sampling depths within the bay extended from the sandy shoreline to over 20 feet (6 m) in depth. The effects of freshwater flushing out from the fishpond system via a *makaha* is evident south of the outlet. The substratum in this area is principally sand and rubble. The coral is sparse relative to other stations and is present as large heads. The invertebrate and fish fauna is not particularly rich; this may be due to the high turbidity and lack of coral cover. To the north of the sandy bay (off 'Anaeho'omalu Point) the substratum is chiefly volcanic rock with much coral. This area was not sampled but on a quick inspection appeared biologically rich.

"The invertebrates of the beachrock were extensively sampled as well as those of the fishponds. The beachrock was found to harbor a much more diverse community of invertebrates than was reported by Key *et al.* (1971a, 1971b)." (Ibid.: 16, 17).

"The abundance and diversity of the marine organisms present at a collecting site reflect the degree of human activity or its absence. Stations in close proximity to human activities ('Anaeho'omalu) clearly show a decrease in species diversity (as well as a noticeable wariness on the part of the fishes towards man) relative to those that are remote. During the summer there was action by landowners to remove the beachrock in 'Anaeho'omalu Bay, a private beach (Station C), for the convenience of swimmers. Due to a much more intensive sampling effort than time permitted at other stations, a diverse invertebrate fauna (44 species) was collected here which significantly added to the findings by Key *et al.* (1971a, 1971b). . . In Station D, 27 species of invertebrates and 36 species of fishes were recorded. The invertebrate sampling was not as intensive as that for fish and the abundance of any one species was low. Probably not only fishing pressure but also the effect of freshwater runoff from the fishponds and the poor clarity of the water have influenced the biota." (Ibid.: 9).

"The invertebrate surveys at Stations B ('Anaeho'omalu fishponds) and (Kaloko) in the mixohaline ponds showed that Kaloko Pond is more diverse than the 'Anaeho'omalu ponds, probably because of a

more direct connection to the sea at Kaloko." (Ibid.: 10).

Key, Guinther and Miller:

The two studies done by Key, Guinther and Miller in 1971 were specifically geared to examining the environmental impacts of the construction of a small boat harbor in Waiulua Bay, the removal of a rock ledge from the edge of 'Anaeho'omalu Bay and modifications to the circulation system and the cleaning of Ku'uali'i and Kahapapa fishponds.

Waiulua Bay: The report is divided into four parts, three of which are summarized below. The fourth part, Water Chemistry, is referenced in the Water Quality section of this EIS.

Fish Census: Seven transect lines were established for Waiulua Bay: the inner four cover the rather homogeneous benthic communities present in the inner bay, the outer three lines cover the heterogeneous benthic communities of the outer bay. In addition, the tidal pools adjacent to Waiulua Bay were surveyed visually. (Ibid.).

"A total of 44 species of fish were observed. Of these, four species were considered common to the area, seven species had patchy distributions, and the remaining species were low in abundance. (Ibid.)

"There is an apparent gradation of number, diversity and density of fishes in the bay. In general, these values are lowest in the innermost portions and increase toward the mouth of the Bay (toward more open-ocean conditions). If the number of species present is taken as an estimate of the diversity of an area, it is apparent that the outer portion of the Bay supports a richer fish fauna than does the inner portion. . . .

"Shrimp (Leander sp.), milkfish (Chanos chanos), rock skipper (Istiblennius zebra), moray eels (Gymnothorax sp.), barracuda (Sphyraena sp.), and several of the fish species present in the bay were observed in the basin tidal pools. All observed species are among the most common inter- and supratidal species that occur in the Hawaiian Islands. In general, these are species which are able to tolerate wide ranges of salinity, temperature, etc., and they are more or less ubiquitous in ares where these conditions prevail." (Ibid.)

"Coral Survey: The hermatypic coral survey was done in two stages. The first stage consisted of a visual survey of general coral types and distribution. The second stage was an estimation of bottom coverage using transects.

"Thirteen species of hermatypic (reef-building) corals were found within the bay, but most were restricted in their distributions to the outer portion of the bay fronting the basalt reef which runs across the middle of the bay. A list of the coral species encountered is presented in Appendix 4.

"Porites lobata and Pocillopora meandrina were the two most abundant species of corals found in the bay. In general, the abundance of P. meandrina is greatest along the outer edges of the bay and directly in

front of the central basalt reef. P. lobata is most abundant in deeper water at the mouth of the bay.

"Within the inner portion of the bay, behind the emergent basalt reef, coral abundance and diversity is greatly reduced. . . .

"The greatest diversity and abundance of living coral colonies occurs in front of the bay at depths greater than four meters. Bottom coverage increases with depth. . . . Nearly half of the bottom within the inner part of the bay is sand substrate, unsuitable for coral settlement. The remaining bottom area consists mainly of large basalt shelves, but coral covers less than one per cent of the basalt surface area. (Ibid.)

"Mollusks: Three transects were chosen to represent the major intertidal habitats in the bay. Two are inside the 'barrier' and one outside and, hence, also represent the inner and outer bay. In addition, where unusual habitats existed or large populations were observed in the vicinity of the transect lines, these were either estimated or counted. . .

"Numbers of individuals for the three or four more abundant species of mollusks along the three transects reveal two types of distributions: animals occurring in all transects but varying in mean density, and animals absent from at least one transect. Species found in the two categories are: Type 1--Nerita (2 spp.), Littorina (2 spp.), and Type 2--Peasiella tantilla, Planaxis sp., and Theodoxus neglectus. The latter are most likely underestimated in such transect studies, as the data suggest a patchy (discontinuous) distribution. . . .

"The data show that the intertidal zone of the east edge of the bay supports a rather dense population of small mollusks. However, none of these species is rare or endangered.

"In addition to the intertidal transects described above, a general survey of the Waiulua Bay invertebrate fauna was carried out. . . .

"The outer portion of Waiulua Bay appears typical of coral communities found on open coasts throughout the Hawaiian Islands. Several species of sea urchins, notably Heterocentrotus mammillatus, Echinometra mathaei, E. oblonga, Tripneustes gratilla, Echonothrix sp. cf. diadema, and Diadema paucispinum were all found on various parts of this reef. The only conspicuous mollusks seen were several species of the genus Conus, but this is not unusual since most coral-reef inhabiting snails are secretive by day.

"Over much of the front of the basalt reef which divides the inner and outer portions of the bay, were found colonies of the soft corals, Palythoa tuberculosa and Zoanthus sp.. Here, the urchins H. mammillatus (slate-pencil urchin) and Echonothrix were common. . . .

"North of the basalt reef, in the existing channel and along the shallows adjacent to it, the bottom is covered with basalt cobble. Under each stone is a rich fauna of small crabs, sponds, polychaetes, and mollusks. The dominant organisms found here included Echinometra, Echinothrix Diadema, and the bivalve mollusk, Isognomon perna.

Tripneustes gratilla was found in the existing channel.

"Behind the basalt reef, within the inner portion of the bay, the fauna becomes notably sparser, increasing again at the extreme head of the bay. Two substrates predominate in the inner bay: smooth basalt (pahoehoe) formations and expanses of sand in the deeper pockets between the basalt formations. Very few invertebrates were found on the basalt formations, although vermetid (tube-forming) mollusks, barnacles, and the bivalve, Isognomon californicum were sometimes abundant in the shallower areas near the shores. . . . The bivalve I. californicum was very abundant in crevices on rough basalt ('a'a) in the intertidal and shallow areas toward the head of the bay. This species is indicative of brackish water, while its congener, I. perna, found closeby but at greater depths, is less tolerant of fresh water influx. The observed positions of these two species, i.e., one above the other, indicates that the conditions of vertical stratification with respect to salinity as recorded during the survey are probably persistent.

"The fauna of the sand bottom areas inside the bay was also found to be sparse, with the exceptions of a dense population (estimated at 360 individuals/m^2) of the acorn worm, Ptychondera flava and the ubiquitous snail, Theodoxus neglectus. Both of these species were most common in shallow water at the head of the bay. P. flava was rare in the deeper sand pockets in which also occurred the snails Terebra spp., and Natica marochiensis.

"The numerous ponds and channels of the tidal basin behind the bay were found to contain water of very low salinity. The fauna here was largely distinct from that of the bay proper. Three invertebrates were common: a shrimp (Leander sp.), a crab (Metapograpsus thukuhar), and a neritid snail (Thedoxus vespertina). All are typical Hawaiian representatives of a brackish water fauna. (Ibid.)

Conclusion of Key, Guinther and Miller - Waiulua Bay Report:

"The inner portion of Waiulua Bay is at present a stressed ecosystem. We infer this from the following biological and physico-chemical considerations: 1) the low density and diversity of corals, and 2) the presence of relatively 'hardy' fish species. This (inner) portion of the bay is probably stressed by: the relatively large input of warm, fresh water resulting in both thermal and osmotic stresses; the apparent lack of circulation due to the emergent basalt reef which divides the bay; and, the input of nutrients (P and N) from presumably terrigenous origins. Dissolved inorganic nitrate- and nitrite- nitrogen and dissolved inorganic phosphate-phosphorus are exceedingly high in the inner portion of the bay, exceeding in their natural conditions the State of Hawai'i standards of both total nitrogen and total phosphorus.

"In direct contrast to the above, the outer bay and the intertidal flats adjacent to the bay support a dense and diverse community of corals and fish, and mollusks, respectively.

"None of the species of animals were observed in Waiulua Bay and sur-

rounding aquatic environs (mainly tide pools) is rare or endangered. Furthermore, it is our opinion (Key, Guinther and Miller) that additional species in this category would not be disclosed with additional observations."

'Anaeho'omalu Bay: "Preliminary surveys showed 'Anaeho'omalu Bay to be a low salinity-low diversity environment--more so than Waiulua Bay. . . In general, few animals were observed near the beach--with only a substantial population of sea urchins attached to rocks near the beach. The more offshore waters of 'Anaeho'omalu Bay were surveyed for fish in October, 1970 (State of Hawai'i Marine Preserve Study) and found to contain less than average number and diversity of fishes than four other nearby bays along the Kona coast."

9. Terrestrial Biology

The existing flora and fauna on the WBR site are limited to the coastal areas around the tide pools and fishponds located in the southwest corner of the property. The entire northern portion of the WBR is covered by the geologically recent Kaniku 'a'a lava flow, and the southern part inland of the ponds and tide pools is a slightly weathered pahoehoe lava flow. Both are devoid of soil and plant life.

Plant Life

A variety of vegetation is associated with the pools and ponds along the southern shoreline, where there is an available underground brackish-water flow. The trees in this area are the native milo (Thespesia populnea), kiawe (prospois pallida) and coconut (cocos nucifera) planted by the Parker Ranch. Shrubs include beach heliotrope (messerschmidia argentea) and naupaka kahakai (scaevola frutescens 'sericea').

Groundcover species present are beach morning glory (ipomoca pes-caprae), pickleweed (batis maritima), heliotrope (helistropium sp.), and salt bush (atriplex sp.). Grasses in the area include marsh cyperus (cyperus javinicus), fountaingrass (pennisetum setaceum), and a variety of bermudagrass (cynodon sp.).

Animal Life

The shoreline and brackish ponds of the WBR property do not provide the wet-lands suitable for nesting of rare native birds such as are found at Kiholo and Kaloko to the south. Birds seen during excursions through the site are more common species--mynah, golden plover, dove, sparrow, lark, and pigeon. The golden plover (kolea) is a migratory bird, dividing its time between Hawai'i and Alaska; it generally stays on the rocks offshore and along the shoreline, going inland to feed during the day and feeding at night along the shore. Doves congregate around the ponds and are numerous. Pigeons are limited in number, generally nesting inland in lava tube caves. The mynahs and sparrows are ubiquitous, and larks are seen only occasionally. Brown, duck-like waterbirds have been seen leaving one of the larger inland ponds on two different occasions, but no positive identification has been made.

Larger animals seen are mongooses and feral goats. The latter have been spotted in groups of three to ten. They apparently roam over most of the inland portion of the property, including the barren and rugged 'a'a flows.

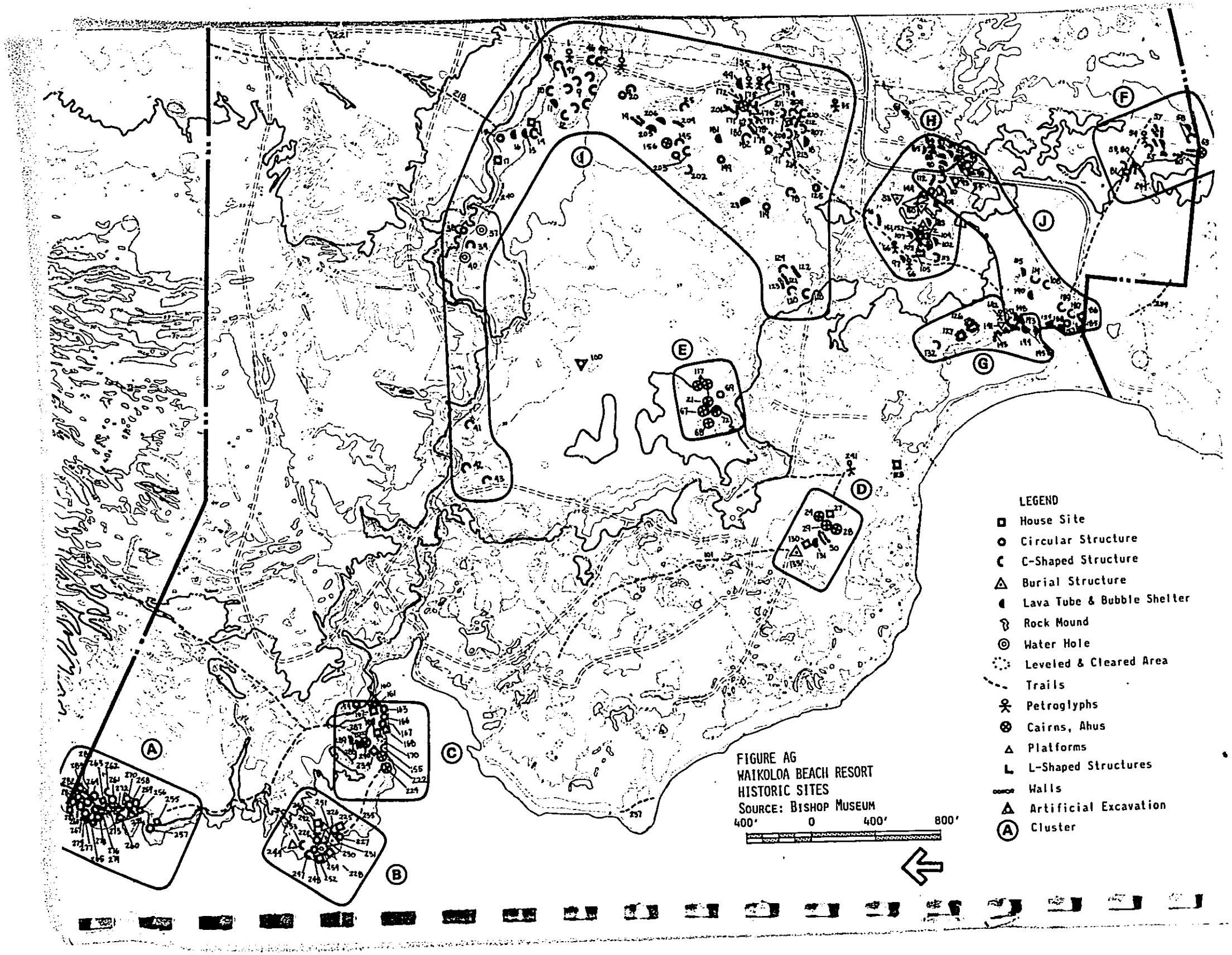

FIGURE AG
WAIKOLOA BEACH RESORT
HISTORIC SITES
SOURCE: BISHOP MUSEUM

C. HISTORIC SETTING

1. Pre-Contact Period: William Barrera, Jr., of the Bishop Museum, author of "'Anaeho'omalu: A Hawaiian Oasis, preliminary report of salvage research in South Kohala, Hawai'i", Number 15 in the Pacific Anthropological Record Series, June 1971, concluded his research work with a hypothetical settlement history of the 'Anaeho'omalu area. His hypotheses are based on the results of 110 age determinations made on datable material from 'Anaeho'omalu. The methods used were Hydration-Rind dating of basaltic glass and radiocarbon dating. Figure AG shows the location of the historic sites identified by the Barrera study.

A tentative prehistory of 'Anaeho'omalu:

"Late 800s or early 900s - The first inhabitants arrived and settled at site-297 at the south end of Ku'uali'i Fishpond. This group was probably composed of just one or two nuclear families; if there had been more, I (Barrera) would have expected at least one other site to have been occupied at that time.

"Late 1000s or early 1100s - Two more sites were occupied, site-148 just behind the fishponds and site-103A, only a short distance from the ponds. Of course, whether the groups occupying those sites were new arrivals or descendants of the original inhabitants of site-297 cannot be definitely ascertained, but the population increase was not too large to be accounted for by normal increase in population of the original groups.

"Middle 1200s - With the occupation of site-24 in the 'Anaeho'omalu Point Cluster during this period, we see the first possible habitation of a group of sites. Given the assumed population growth during the previous three centuries, it would be expected that more than one new site should become occupied by this time.

"Early 1300s - The first site on the Kaniku Lava Flow was occupied--site-277 in the Kaniku Settlement. This is perhaps an indication of population pressure pushing people out into what was previously considered to be an undesirable area.

"Late 1300s to early 1400s - Population continued to increase and four new sites were occupied. Two of these were rather small (sites-103B and -298); one was on the Kaniku Lava Flow at the Nawahine Rock Settlement (site-225), and one was immediately behind Ku'uali'i Fishpond (site-126). The trend toward inhabiting less desirable sites, first noted in the early 1300s, seems to have increased. It is apparent that by this time the population had increased to the point that community-oriented structures, site-126 and -127, were built.

"1500s - Three new sites became occupied; two (site -2C and -133) were rather small, and one (-197/A) was large. The occupation of -197/A during this period seems strange in view of the tendency for occupation of the better areas observed through the sequence thus far. This fairly large site was located near Ku'uali'i Fishpond, and I would have expected it to have been occupied before either sites -225 or -277.

Perhaps a local concept of territoriality had developed, and the group claiming - 197/A had no need of it before this time but had prevented others from moving into it.

"1600s - Three new sites--site-2 in the lava blisters and stacks, site-228 at the Nawahine Rock Settlement, and site-68 at the Ridge Settlement--were occupied. During this same period, however, six sites were abandoned. Five of these were in areas that appear to have been the most desirable places for habitation--site-297 near the fishponds, sites-2C, -103A, and -103B in the area of lava blisters and stacks, and site-24 in the 'Anaeho'omalu Point Cluster. Only one site on the supposedly undesirable Kaniku Lava Flow was abandoned during this period, site-225 at the Nawahine Rock Settlement.

"1700s - This period saw new occupation in only four sites; -143 on the edge of Ku'uali'i Fishpond, -8 and -106 in the lava blisters and stacks, and -117 at the Ridge Settlement. These sites were also abandoned during this same period, however, as well as the following seven: -197/A, -298 and -126 around Ku'uali'i Fishpond; -2 in the lava blisters and stacks; -68 in the Ridge Settlement, and -277 and -228 in the Kaniku Settlement and Nawahine Rock Settlement respectively.

"1800s - Only two sites were still occupied at the beginning of the 19th century, -148 and -133, and both were abandoned by the middle of the 19th century."

Barrera's tentative explanation of the abandonment of 'Anaeho'omalu:

"During the 17th century the ruling powers began to take notice of the potential of the fishponds and the marine environment at 'Anaeho'omalu. Perhaps pressure was put on the people to increase the collection of seafood for the *ali'i*. If more and more of these products were required for tribute, the amount left over for the people themselves would have been less and less. Some would have begun to move away to a place where the demands for tribute were not infringing on the available food supplies needed for daily subsistence. As more people moved away, more surplus would have been available to turn over to the *ali'i*, which in turn may have been impetus for the *ali'i* to demand even more tribute, thus forcing even more people away. It seems reasonable to postulate that at some point in this spiral the *'ili* of 'Anaeho'omalu was converted into an *'ili kupono*, that is an *'ili* that paid tribute directly to the king. This would account for the fact that *konohiki* fishery rights, under which the landholding chief held rights one mile out to sea, went to Kamehameha III during the Mahele from Kamakau. . . .

"Insofar as the *'ili* of 'Anaeho'omalu is concerned, then, the great changes wrought on Hawaiian culture by the introduction of European values do not appear to have been as much of a factor as in the other areas. The onslaught of Western civilization apprently did no more than administer the *coup de grace* to a population that was already on the verge of dying out. It seems ironic that the very factor that made it possible for people to inhabit 'Anaeho'omalu--the presence of fishponds and shallow inshore fishing grounds--might also have been the

cause of the abandonment of the area.

For further interpretation and explanation of the prehistoric aspects of 'Anaeho'omalu see Barrera, 1971.

2. Post Contact Period: A reconstruction of the history of 'Anaeho'omalu since the 1700's by Dorothy B. Barrere is contained in Barrera (1971) as Appendix A.

In summary, she said:

"Only a few recorded incidents of Hawaiian prehistory mention 'Anaeho'omalu. One of these--which appears in the story of Lonoikamakahiki, a 16th century ruling chief on Hawai'i island--attributes the erection of the boundary marker called Ahu-a-Lono between the districts of North Kona and South Kohala to this chief.

"1780 - 1830: Historical references are sufficient to indicate that 'Anaeho'omalu was permanently inhabited in prehistoric--that is, pre-Cook--times. In his 1779 description of the shoreline of Hawai'i, Lieutenant King of Captain Cook's expedition noted fishing villages in the area...

"Most, if not all, of the trails into and within 'Anaeho'omalu were surely marked out by the prehistoric inhabitants of the land. They led to clusters of houses and to water pools within the area, and to the inland coastal trail that led to the uplands of Waimea, from whence came poi and whatever other necessities or 'luxuries' gift-exchanges of fish might bring. Foot travelers making the trek between Kohala and Kona on this inland trail no doubt frequently used the branch trails into 'Anaeho'omalu. Those who by chance or design spent the night there may well have used the same means to protect themselves against the winds as did Ellis and his party in a similar situation in Ka'u. He said, '...we spread our mats on the small pieces of lava, and lay down to rest under the canopy of heaven. A pile of blocks of scoriae and lava, part of which we had built up ourselves, screened our heads from the winds'. The Hilo missionary Titus Coan also described the making of lava windbreaks: '...our bed was hard and rough lava, but raising a low wall of lava blocks, as protection against the piercing night winds, we endured (the) cold...' These descriptions well suit many of the shelter walls found in 'Anaeho'omalu. Perhaps some of them remain from the days of the chief Lonoikamakahiki mentioned earlier, when a group of rebels encamped there.

"1830 - 1860: In early 1848, Kamehameha III began the division, or *mahele*, of all the islands of the kingdom for the purpose of allowing the land holders to establish fee-simple ownership rights to them, a process that lasted for some years. In this *mahele*, Kamehameha III kept the *ahupua'a* of Waimea, Kohala, as a Crown Land, indicating that Kamehameha I had not given it away, but that it was among his personal lands inherited by his sons. Within the *Ahupua'a* were two *'ili 'aina* (subdivisions within the larger *ahupua'a* divisions of land) of 'Anaeho'omalu and Kalahuipua'a. Kamehameha III died in December of 1854, and by his will (Probate 2410) these two *'ili* were given to his queen, Kalama Kapakuhaili Hakaleleponi.

"With the *'ili* of 'Anaeho'omalu went *konohiki* fishery rights, under which the landholding chief held rights one mile out to sea (or to an offshore reef where there was one) for the full length of the *'ili* or *ahupua'a* in which he reserved either one species of fish or one-third of each seasonal catch as his own, and made the rest free to the dwellers of the land.

"In the days of the Kamehamehas, there may have been periodic visits to 'Anaeho'omalu for the express purpose of collecting, and perhaps drying, quantities of fish to be sent to the households of these kings. Since the land was too harsh to support a permanent population in sufficient numbers to carry on large-scale fishing operations, a headman, or *luna*, who would also be the head fisherman (*po'o lawai'a*) for the kings' *ahupua'a* of Waimea, would have been aided, perhaps, by the fishermen of the locality, who would then receive a small share of the catch or catches.

"Under the ancient tax systems 'Anaeho'omalu would have paid its annual *Makahiki* taxes in fish--the only produce of the land. Under the changing economy of the 19th century, however, taxes evolved from payment in labor and in 'kind' (principally mats and *kapa*) to monetary payments. The necessity to earn cash money for the last forced country dwellers to migrate to centers of trade, where most of them remained, to keep up with the steady demand for tax money. It was probably this change from a subsistence to a money economy that led to the abandonment of 'Anaeho'omalu and other seacoast fishing communities throughout the islands. A few 'die-hards' might cling to their old ways and stay on their lands until death, or until natural disaster made even a subsistence living impossible.

"The burial caves in 'Anaeho'omalu attest to the fact that 'Anaeho'omalu was once a 'homeland,' or permanent residence for at least three families in that *'ili*. Such caves were used well into the 20th century as sepulchers for members of the families to whom the caves 'belong,' and corpses of such people were brought from as far away as other islands to be interred in their ancestral homelands. The fact that there were at least three burial caves in 'Anaeho'omalu, and not one large one, argues for their being 'family' caves, rather than 'village' caves such as Ellis mentioned: 'Sometimes the inhabitants of a village deposited their dead in one large cavern, but in general each family had a distinct sepulchral cave'.

"The inference from testimony given in 1873 on the boundaries of 'Anaeho'omalu and Kalahuipua'a is that the last of the permanent inhabitants of 'Anaeho'omalu had died or moved away well before that last quarter of the century.

"1860 - 1900: Queen Kalama, owner of 'Anaeho'omalu died intestate in 1870. In the inventory of her estate ... the *'ili* 'Anaeho'omalu was appraised at $300 for its 869 acres,...or at about 35¢ an acre.

"Charles Kana'ina, father of King Lunalilo, was declared Queen Kalama's legal heir in 1871. He apparently gave 'Anaeho'omalu to his son, for the latter is named as owner of these lands, with fishery rights, in one

government listing. Since Lunalilo predeceased his father, however, in 1874, the lands reverted to Kana'ina. Kana'ina died in 1877, also intestate (Probate 2426), and in 1878 the administrators of his estate included 'Anaeho'omalu in a notice of sale of certain of his lands, thus: 'Parcel 25. The Ahupua'a of 'Anaeho'omalu (introducing the error of calling 'Anaeho'omalu an *ahupua'a* rather than an *'ili)* and the *loko* (pool or pond) in South Kohala, Hawai'i'.

"Samuel Parker, a grandson of the John Parker who was the founder of Parker Ranch, bought 'Anaeho'omalu for $1,000, or about $1.14 an acre. . .

"1900 - 1970: 'Anaeho'omalu, perhaps from the time of its original purchase by Samuel Parker in 1878, appears to have served as a recreation and fishing area for Parker Ranch employees and as a supply of pond fish for ranch luaus. A caretaker of the fishponds lived there continuously, perhaps from well before that time. The 'hut' shown on the Government Survey Map of 1880 was probably the first residence of the caretaker (s) of Ku'uali'i and Kahapapa ponds. Marion Kelly, while investigating Kaloko Fishpond in Kona (January 1970), was told by her informant Keanaaiana that he and his father used to go to 'Anaeho'omalu in the later 1930s and early 1940s to get fry from the 'Anaeho'omalu ponds with which to restock Kaloko pond."

When Boise acquired the property, the ponds were as far from their proper condition as could be possible. The growth of scum and algae on the bottom, floating accumulations of algae and vegetable debris on the surface and thick deposits of muck and sand represented what would have been an intolerable condition to anyone wishing to use the ponds for fish cultivation. Boise, after obtaining the necessary permits from the Department of Land and Natural Resources and the Corps of Engineers, restored the ponds to a natural appearance.

3. Completed Archaeological Inventory and Salvage Operations

In 1969, during Boise's initial plan development period, a contract was established with the Bishop Museum to conduct archaeological investigations of 'Anaeho'omalu Bay area. The work was conducted in a four phase program culminating in the report "'Anaeho'omalu: A Hawaiian Oasis; Preliminary Report of Salvage Research in South Kohala, Hawai'i," by the anthropologist in charge of the project, William Barrera, Jr.

Phase I consisted of a reconnaissance survey of the 502 acre initial resort tract adjacent to 'Anaeho'omalu Bay, one of two State designated urban tracts on the Boise Waikoloa properties. This reconnaissance identified 301 historic sites and made recommendations on salvage and preservation of individual sites.

Phase II was the investigation and salvage of sites identified in Phase I that was endangered by the proposed resort construction.

Phase III was a site survey of the second urban designated area in what is now upland Wailoloa Village area. No sites were found in this area.

Phase IV consisted of the following additional work:
a. Further excavations at the resort area at 'Anaeho'omalu.
b. A historical study of 'Anaeho'omalu by Mrs. Dorothy Barrere.
c. A study of the osteological remains by a physical anthropologist, Dr. Michael Pietrusewsky (his findings are in Bishop Museum Anthropology Department, Report 71-7, October 1971.
d. Further recording of petroglyphs by David Cox.
e. Analysis and write-up of the archaeological materials.
f. Publication of the report "'Anaeho'omalu: A Hawaiian Oasis Preliminary Report of Salvage Research in South Kohala, Hawai'i", Number 15 in the Pacific Anthropological Records (PAR) series, June 1971.

Present Status of Important Sites

The initial recommendations that were later implemented by the existing zoning plan and the later phases of the Bishop Museum contract appear in Appendix 5. Those sites that do not appear in the Appendix or below are not considered to be of archaeological value and are not considered further in this EIS.

The initial salvage work recommended was completed during Phases II and IV of the archaelogical contract with the Bishop Museum, resulting in the publication of a detailed report on the entire area and on nearly 2,500 artifacts (currently stored at the Bishop Museum in Honolulu, but still the property of the landowner).

A brief description and the present status of each of the important site clusters is listed below. This includes the recommendations of the Bishop Museum on both preservation and interpretation or additional salvage work. All of the listed sites have been tested under Phases II and IV of the Bishop Museum contract.

Kaniku Settlement Group A: This cluster of features is situated along the north shore of Waiulua Bay on the Kaniku lava flow. The features were all quite crudely constructed, resembling the C-shaped structures found elsewhere at 'Anaeho'omalu. The predominant method of construction was to remove loose rocks from the surface of the 'a'a flow until a relatively level surface had been attained. This level area was then modified by compacting the bottom with small 'a'a rocks to provide a fairly comfortable working or living surface. As often as not the larger rocks removed in this operation were then placed on one or more sides of the excavation to form a wall.

Nawahine Rock Settlement Group B: This cluster of sites consists of a number of fairly substantial structures and some smaller features located on the point formed by the Kaniku lava flow near Nawahine rock. The larger structures are quite well constructed; the other features are crudely built. The coast at this point is quite rocky; the only safe access to the water is over a water-washed cobble beach just west of the main part of the settlement. The coastal trail, -235 connects this settlement with the Waiulua Bay Settlement and the Kaniku Point Settlement. The specific sites identified for preservation are:

Site-225 - a substantially built C-shaped house.

Site-226 - an open-ended rectangular feature that may have been a canoe shed.

Kaniku Settlement Group C: This cluster, similar to the Nawahine rock settlement, is located north of the Nawahine Rock Settlement on the edge of the Kaniku lava flow. The features are separated from the water by a sharp, wave-cut escarpment behind the shoreline.

The group has some of the more substantial types of structures as well as some of the crudely built, apparently more temporary types. It differed, however, in that there were many small storage facilities scattered about, none of which contained any midden. These are of two types. One is merely a hole dug into the 'a'a with the opening exposed above; often a low wall, rarely attaining a height of two courses, is built around the opening. The second type of storage pit is a bit more substantial, and much better protected. It is apparently constructed either by digging a hole and roofing over the excavation rocks, or by digging laterally into the side of a low mound of 'a'a. The result is that the opening faced out of the side of the feature, thus subjecting the contents to less exposure than in the first type of pit. Both types were found virtually everywhere in the settlement. Specific sites identified for preservation are:

Site-257 - an area of small storage holes around a large, well-made, dome-shaped structure.

Site-265 - is a well-built C-shaped structure with storage holes and midden.

Site-281 - a rectangular structure overlooking the ocean. Some of this group is also within the 40-foot shoreline setback. The remainder will be preserved when the adjacent area is developed into multi-family housing in the future.

The three groups listed above are considered an important group. The Bishop Museum has completed a plane table map of the area and conducted excavations and test pitting at certain sites. The Museum recommendation is that a number of sites in the area are suitable for preservation to the public in a Museum atmosphere.

'Anaeho'omalu Point Cluster Group D: These sites are a cluster of features on high ground overlooking the tidal flats on Kaauau and 'Anaeho'omalu Points. They consist of a burial cave, several habitation caves, walls, cairns, and a possible storage cave. The sites specifically identified for further salvage are:

Site-133 - a burial cave and a small, partially exposed rock shelter. This group contains a valuable burial cave and habitation cave that should be salvaged. Test pits show that midden deposits reach a depth of one-half meter indicating the possibility of a long habitation period. Some of this area has already been graded during the initial development period. The burials have been removed by the Bishop Museum.

Site-24 - a small shelter containing a substantial midden deposit. Tested by Barrera.

Ridge Cluster Group E: These sites are a group of habitation caves located at the top of a steep escarpment. A clear view in all directions is available from these sites because of the elevation of this ridge. At the bottom of the scarp to the south is a small, brackish-water pond, the center of which has been dug out to form a deep spot from which water could easily be obtained. No specific sites from this cluster have been identified for preservation, but some test excavations were done; further full scale excavations are not required in all of these sites.

Ahu-o-Lono Area Group F: This area is not a formalized cluster, however, one site No. 60 was selected for preservation.

Site-60 is a complex of paved features in the extreme southeast corner of the study area. It consists of a number of contiguous "rooms" constructed by removing rocks from the surface of the rough pahoehoe and piling them into crude walls between the cleared areas.

Ku'uali'i Fishpond Area Group G: The sites identified for preservation in this area are:

Site-126 - a feature made up of three platforms in an enclosure.

Site-127 - a square walled area about 9.6 by 7.2 meters.

It is apparent that these two structures, due to their difference from other sites at 'Anaeho'omalu, have a special function. It is hypothesized that 126 is a *mua* (men's eating house) and 127 is a *hale noa* (sleeping house). An area of open midden between the two structures should be salvaged.

The Camel Area Group H: This complex consisted of a burial cave and several habitation caves in the lava blisters and stacks area of the site named "Camel". Specific sites designated for preservation in this area are:

Site-2 - a burial cave system covering an area 32 by 50 meters.

Site-103 - two caves and a small shelter with a connecting pathway.

Site-106 - a habitation cave just north of the "Camel."

Complete salvage is recommended for the burial cave, a shelter cave with deep midden deposit and other shelter caves. An alternative to complete salvage is to seal each cave, or to place paving stones over the midden areas to preserve them from disturbance.

The Golf Course Area Group I: This is not a defined settlement group, but a scattering of sites that covers the central portion of the site. The specific site identified for preservation in this group is Site-135.

Site-135 is a petroglyph field. This petroglyph field is outside the zoned area just makai of the King's Trail.

The majority of the other sites in this group which were not recommended for preservation, have been graded over during the initial development period.

The Old Jeep Road Area Group J: The Bishop Museum recommended site-148 near the fishpond be salvaged or sealed with rubble.

Site-148 is a collapsed lava bubble cave with a large midden deposit. Twenty-five per cent of the recovered artifacts from the entire area came from a partial excavation of this cave during the initial Bishop Museum study.

Non-Grouped Sites: Several individual sites should be preserved including the extensive burial cave No. 100. This is a complex of burials located in the cavern-and-catacomb complex in the smooth pahoehoe near the edge of the Kaniku Lava Flow. Seventeen burial clusters were found within the cave, which was entered by climbing down through a collapsed lava bubble. The caverns are an impressive network of hugh bubbles and tubes; the ceiling is five to six meters high at some points. The cave is of geologic interest also. This site is of such importance that a walk-in museum open to the public is recommended. The King's Trail and the 'Anaeho'omalu Bay petroglyph field although outside the survey area were also strongly recommended for preservation.

Other non-grouped sites recommended for preservation include Site-241, a small petroglyph field.

The Existing Zoning Plan: The specific sites finally designated for preservation or special treatment by the land owner as a result of the recommendations of the Bishop Museum, and the County Planning Department are reflected in the existing zoning map and are identified on Figure C.

4. The National and State of Hawai'i Register of Historic Places

The State Historic Preservation Office, a division of the State Department of Land and Natural resources is in the process of nominating seven of the groups listed above to the State Register and four of the seven to the National Register.

Nominated to the State Register of Historic Places are:

Waiulua Bay Settlement Group C, State No. 864 - designated reserve.
Nawahine Rock Settlement Group B, State No. 865 - designated reserve.
Kaniku Settlement Group A, State No. 866 - designated reserve.

Nominated to the State and National Register of Historic Places are:

'Anaeho'omalu Point Cluster Group D, State No. 4715 - designated

high value.
Ku'ualii Fishpond Group G, State No. 4717 - designated high value.
Ridge Cluster Group E, State No. 4718 - designated high value.
Camel Area Group H, State No. 4719 - designated high value.

When the Historic Preservation Office has finished the application forms they will be evaluated by the State Hawai'i Historic Places Review Board. The Review Board will make the final determination of whether the site will be placed on the Hawai'i Register. Sites nominated to the National Register are placed on the State Register. A detailed explanation of the procedures of the Hawai'i Historic Places Review Board can be found in Chapter VII of the State of Hawai'i Interim Historic Preservation Plan, Part I.

The projection afforded to a historic site on the National Register is primarily on the Federal level. Any Federal agency funds or licensees required by the project will be issured only after a review for impact on National Register Sites, (Section 106, Public Law 89-665).

Privately-owned historic sites on the State Register may be disturbed only after the Department of Land and Natural Resources receives and acts upon a notice of intention from the developer. After the expiration of a three month period from the time of notification, the department shall either commence condemnation proceeding for the purchase of the site or remains, permit the owner to proceed with his alteration, or undertake or permit the recording and salvaging of any historical information deemed necessary to preserve Hawaiian history, by any qualified agency. (Hawai'i Revised Statues Section 6-12).

Conversations with Farley Watanabe of the State Historic Preservation Office have revealed that the intention of nominating the sites listed above is to insure the complete archaeological reclamation of the rich midden materials located by the Bishop Museum in their 1970 survey of the area. Therefore, once the retrieval work is completed the sites will have lost the need for protection.

5. <u>The County of Hawai'i</u>

The Hawai'i County Planning Department in addition to the formulation of the existing zoning scheme (whose archaeological aspects will not be changed by the zoning shift that this EIS is concerned with), is considering the development of a regional historic preservation plan for the Kohala region. The intention of this plan will be to show the regional land use pattern of the prehistoric (Pre-Captain Cook) Hawaiian culture. This will allow the best representative sites of each aspect of the culture to be preserved in a coordinated way, without the duplication that will result from a developer by developer effort. It will also allow a centralized display and coordination center to be established to direct visitors to each of the important areas. It is Boise's intention to cooperate with the County in this effort.

Later thinking by the County is beginning to favor an islandwide historic preservation plan. However, this will not be implemented for at least one year.

D. SOCIO-ECONOMIC SETTING*

This section summarizes background data with which the economic and social impacts that the WBR will have on the region can be assessed. Broader descriptions of the regional economic and social settings can be found in the Community Development Plan for Kohala now in preparation, and the Comprehensive Report of the Kohala Task Force (1975).

Most of the data are presented for the two Kohala Districts. Comparisons with the characteristics of the County as a whole are added where appropriate. South Kohala (Census Tract 217) is the principal focus, because it is the district in which the WBR is located. North Kohala (Census Tract 218) is included because, with the closing of sugar operations there are the difficulties of creating stable agricultural ventures to provide replacement jobs, the WBR is a likely employer of job-displaced individuals in that district. Data for North Kona District (Census Tract 215) is not included, although some resort employees may come from that area. However, Kona is expected to be much less affected by WBR than Kohala.

1. Population Characteristics

Table II-D.1 presents the resident populations as indicated by census data. These figures show that South Kohala has been an area of significant growth in the last 20 years--Waimea village almost doubled in population in the 1950's decade, and the district-wide population increased by 50 per cent in the 1960's. Primary generators of these increases were the opening of the State's Lalamilo farm lots on the outskirts of Waimea, the establishment of the Mauna Kea Beach Hotel, and more recently, the attractiveness of the area for retirement homes. The population density of the district is still low, however. Based on 1970 data, there were 7.2 persons per square mile, just about half of the 15.7 persons per square mile for Hawai'i County as a whole.

Table II-D.1 RESIDENT POPULATIONS BASED ON CENSUS DATA

Community, District, or County	Year 1950	1960	1970
South Kohala (Census Tract 217)			
Waimea Village	341	657	756
Balance of Census Tract	1,164	881	1,554
TOTAL	1,505	1,538	2,310
North Kohala (Census Tract 218)			
TOTAL	4,456	3,386	3,326
Hawai'i County TOTAL	68,350	61,337	63,468

*Source: Mauna Loa Land, Inc., Environmental Impact Statement for Kalahuipua'a, South Kohala and Hastings, Martin, Hallstrom and Chew, Ltd.

The population of North Kohala and Hawai'i County declined for the 1950-to-1970 period (though the County decline was reversed in the 1960's). This slow decline was similar to other areas in the State where the economy has been based primarily on agriculture. The population density of North Kohala was relatively high--25.2 persons per square mile. It used to be concentrated in the three "camp" communities of Hawi, Kapa'au, and Niuli'i, but is now shifted somewhat; opportunities for home ownership in subdivisions created by the Kohala Sugar Company are largely responsible for the shift.

A list of other selected characteristics of the 1970 census population are presented in Table II-D.2. Those deserving special note with reference to the WBR project are:

Age Distribution - Hawai'i's rural agricultural communities have had a traditional out-migration of young people after high school, and this trend is very evident in the population of North Kohala, where there is a significantly smaller per cent of individuals in the 18-to-65 age group than is found in South Kohala or in the County as a whole. A primary factor in this out-migration is believed to be the lack of job opportunities and career advancement for the post-high school person.

Ethnic Group - there is a relatively high number of Caucasians in South Kohala, and they are the most rapidly growing group. Ethnic distribution in North Kohala still reflects the mix created by imported labor for the sugar plantation, with the relatively high percentage of Filipinos the primary indication.

Education - the over-25 population of South Kohala is slightly more educated than for the county as a whole, and that of North Kohala slightly less so.

Residence - the South Kohala population, in line with the growth pattern noted previously for the district, has been more mobile than the North Kohala and county-wide populations.

Employment - the figures for unemployment have undoubtedly changed significantly since the 1970 census--they are likely higher now, particularly in North Kohala. However, the percentages of the population in other employment categories listed are probably reasonably representative of current conditions. The male labor participation rate in both census tracts in 1970 was essentially identical to the rates in 1960; the female participation rate, however, increased rather dramatically in those ten years. In South Kohala, it rose from 39.9 to 46.3 per cent, and in North Kohala, from 21.7 to 47.8 per cent. Almost all of the increase in female labor participation is attributed to jobs created at the Mauna Kea Beach Hotel complex, and clearly the effect was greater in North than in South Kohala. Smith (1972) and Cottington (ms.) have discussed the impacts that changing work roles of women, larger family incomes, and less parental supervision have had on family structure and stability in North Kohala. Family income level shifts from low- to middle-class

Table II-D.2 POPULATION CHARACTERISTICS BASED ON 1970 CENSUS DATA*

Population Characteristic	South Kohala CT 217		North Kohala CT 218		Hawai'i County	
	No.	%	No.	%	No.	%
Total number of persons						
Male	1,205	52.2	1,746	52.5	32,898	51.8
Female	1,105	47.8	1,580	47.5	30,570	48.3
Age distribution						
Under 5 yr olds	215	9.3	333	10.0	5,446	8.6
Under 18 yr old	868	37.6	1,312	39.4	23,102	36.4
Between 18 and 65 yr old	1,080	46.8	1,366	41.1	29,082	45.8
65 yr old and older	147	6.4	315	9.5	5,383	9.2
Median age	28.1	-	27.3	-	28.9	-
Household						
Number	650	-	879	-	17,260	-
Persons/household	3.51	-	3.75	-	3.61	-
Ethnic group						
Caucasion	906	39.2	851	25.6	18,298	28.8
Japanese	564	24.4	793	23.8	23,817	37.5
Chinese	30	1.3	142	4.3	1,841	2.9
Filipino	152	6.6	972	29.2	10,454	16.5
Hawaiian	611	26.5	510	15.3	7,809	12.3
Other	47	2.0	58	1.7	1,249	2.0
Education of persons 25+ yr old						
8 yr or less	297	24.1	784	44.2	12,820	37.2
Completed high school	422	34.2	531	30.0	10,903	31.6
4 yr or more of college	161	13.1	105	5.9	2,601	7.5
Median school yr	12.2	-	10.2	-	11.4	-
Residence in 1965 (of population 5 yr or older)						
Same house	927	45.6	1,525	49.9	36,242	62.5
Different house, same county	382	18.8	1,023	33.5	12,243	21.1
Different county, same state	321	15.8	78	2.6	3,215	5.5
Different state	310	15.3	172	5.6	2,900	5.0
Employment of persons 16+ yr old						
Civilian labor force, male	624	84.4	856	71.6	16,466	73.7
Civilian labor force, female	327	46.3	499	47.8	9,423	45.4
Armed forces	0	0	25	1.1	187	0.4
Employed	912	95.9	1,330	98.2	25,180	97.3
Unemployed	39	4.1	25	1.8	709	2.7
Professional & technical	99	10.9	164	12.3	2,864	11.4
Managerial & administrative	94	10.3	29	2.2	1,829	7.3
Laborers & farm workers	198	21.7	240	18.0	3,357	13.3
Income						
Median for family	$9,182	-	$9,421	-	$9,750	-
Median for unrelated individuals	2,882	-	4,051	-	2,541	-
Families below poverty level	63	11.2	78	10.3	1,430	9.7
Families below $10,000	317	56.4	412	54.4	7,588	51.6
Families above $25,000	25	4.4	27	3.6	754	5.1

*Census data complied in "Community Profiles for Hawai'i" (DPED 1972)

are viewed by Smith as possible positive impacts. Increased rates of divorce and juvenile delinquency are viewed by Cottington as indications of possible negative effects.

Income - the census figures for income are obviously outdated by five years of inflation since 1970, but the relative levels are probably still valid. Incomes in both census tracts were less than the county-wide average in 1970 and probably still are today. In North Kohala, the relative level may have declined still further because cutbacks in sugar employment have not been equally matched by jobs in Task Force-supported ventures; many older plantation workers have accepted early retirement instead.

2. Economic Characteristics

The economic structure of the region is here described in two ways. First, there is a general discussion of four geographical areas within the Kohalas in which distinctly differently economic activities take place.

Following this, there will be a more specific listing of those businesses that comprise the basic sector of the regional economy--i.e., those businesses which bring money into the community from outside and on which the other sectors of the economy depend. A brief discussion of the problems and opportunities for growth of the basic economic sector is included in this second section.

Geographic/Economic Areas

The first geographic area to be discussed is the South Kohala coast between 'Anaeho'omalu Bay and Spencer Park. In 1960, it was identified by the State as one of three primary resort regions on the Island of Hawai'i (Kailua-Kona and Hilo Resort Region were the other two). Subsequently, the County's 1971 General Plan subdivided the resort coast into three segments: 'Anaeho'omalu Bay, the vicinity of Makaiwa Bay, and the area around Kauna'oa Bay. Three major developers control these areas. 'Olohana Corporation built the Mauna Kea Beach Hotel at Kauna'oa Bay in 1965; plans for subsequent development to the north of the hotel are being considered, but no immediate expansion is seen. Boise has obtained zoning for the lands around 'Anaeho'omalu Bay (WBR) and has constructed a water line to the WBR. Completion of the first hotel is hoped to be about the end of 1977. Mauna Loa Land, Inc. plans to develop the area around Makaiwa Bay.

The natural resources of the coast-warm climate, mostly clear days, mostly calm seas, some sand beaches, and good sport fishing offshore--suggested resort development as an appropriate land use. In order to promote tourism to the area, several large government financed projects have been completed to provide the needed infrastructure for resort developments. Such projects include Ke-ahole Airport, Queen Ka'ahumanu Highway, Kawaihae Harbor improvements, Kawaihae-Hawi Highway, Hapuna and Spencer Parks, and water-resource development. Table I-C.1 lists these public expenditures. Some $81 million has been invested or committed by government since 1960, most of it by the State.

County investment has been limited principally to Spencer Park and some of the water-system improvements. Further, the Federal government has established in this area the Pu'ukohola Heiau National Historic Site, which is one of only four national park system facilities in the whole State.

Other activities along this part of the coast--primarily the recreational uses of Hapuna State Park and Spencer (County) Park, and residences on the Puako Beach Lots--are not a part of the resort economic activity in the area but will definitely be affected by it.

The development of a major State Park at Hapuna will complement the development of the South Kohala resorts by providing camping and recreational facilities available to Hawai'i residents at low cost. In addition to the park facilities, campers will be able to partake of many of the resort activities, both recreational and cultural, while enjoying the low cost of camping.

The second geographic area to be discussed is the deep-water harbor at Kawaihae. Economic activities include freight transportation and storage (Young Brothers), gasoline storage (Standard Oil and Union 76), charter fishing, and other industrial uses (Brewer Chemical, for one). Doi's storage and service station are the primary retail outlets. Residences in the area have been almost exclusively for people involved with the industrial activity there. Recently, however, the *mauka* land was subdivided into agricultural lots and marketed with a sales pitch aimed more to second-home buyers and speculators than to employees of the industrial area or farmers.

Almost all freight destined for the resort coast--be it construction materials initially or consumable products once the resorts are built--will pass through Kawaihae. Hence, the traffic in the harbor will increase in step with resort development. Service industries in this area--oil products, for example--are likely to grow proportionately also; however, no great increase of businesses that are part of the basic sector of the economy (i.e., those which bring money into the region) is expected. There is simply very little reason for such businesses to locate at Kawaihae.

The third geographic region is centered in Waimea village. Activities of the basic economic sector there include vegetable farming and small-scale ranching in Pu'ukapu, vegetable growing in the Lalamilo Farm Lots, some tourist activity with the Kamuela and Waimea Village Inns,* and the large-scale Parker and Kahua ranches. There are about 30 vegetable farms working just over 800 acres, and more farm lots in both Pu'ukapu (by Hawaiian Homes) and Lalamilo (by the State DLNR) have been planned. Most of the smaller ranches around Waimea are 200 to 300 acres in size, tiny when compared to the two major ranches. Parker Ranch at 370,000 acres and Kahua Ranch at 30,000 acres clear-

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*The Waimea Village Inn, in February 1976, suspended hotel room and restaurant operations.

ly dominate the region's livestock production.

Waimea has the largest collection of supportive commercial businesses of the four geographic areas being discussed--Anderson (1975) reports the number of these at 100. The shopping center built by Parker Ranch is the focal point of these retail outlets. Waimea is also the center for government services in the district.

For more than 100 years, sugarcane has dominated the basic sector of the economy of the fourth geographic region to be discussed, the windward slopes of North Kohala from Niuli'i to Hawi. There used to be five mills in this area in the late 1800's, but by 1937 they had been consolidated into one mill and a single company, Kohala Sugar. During all the years of sugarcane cultivation, the yields had been marginal and inconsistent as a result of inadequate water and strong winds. Then in 1971, Castle and Cooke, the parent company of Kohala Sugar, announced the termination of sugar production by a phased reduction over a period of several years.

Since the area was almost entirely dependent on sugar--about 500 people were employed with Kohala Sugar at that time, comprising 40 per cent of all jobs in the district and 90 per cent of jobs in the basic sector of the North Kohala economy--the late Governor John A. Burns created the Kohala Task Force to seek ways to restructure the economy. The effort of the Task Force to date have included several studies, the most notable one on water-resource management and development (Bowles, 1974), and loans enabling four new companies employing about 130 people to get started. Anderson (1975) discusses the opportunities, problems, and prospects of each of these new ventures, and they have also been the subject of many articles in local newspapers. Most of the new efforts are in agriculture--growing corn for grain and/or forage, building a feed lot, and raising tropical plants to be air-shipped to mainland markets--but there is also a plastic-products manufacturing company. It is too early to predict the eventual success or failure of any of these ventures. Some are getting financial assistance (State and County funds) to help them over short-term cash-flow difficulties, but long-term feasibilities of any of these companies have not yet been established.

Elements of the Basic Sector of the Economy of the Kohalas

Table II-D.3 lists the businesses or groups of businesses that comprise the basic sector of the economy of the Kohalas. This listing should give some indication of the region's economic stability. Businesses in the basic sector bring money into the community from outside of it, and their success or failure is, in turn, mirrored in the secondary or supportive elements of the economy. If the basic sector prospers, it enables a wide range of supportive businesses to thrive also. But if the basic sector falters, it triggers a chain reaction of failures of secondary businesses. There has been a recent and quite visible example of this basic-to-secondary relationship in North Kohala. With the gradual closing of Kohala Sugar (basic sector), many retail shops and service outlets (secondary businesses) in Hawi have closed. As a result, the main street through Hawi seems half abandoned.

Table II-D.3 ELEMENTS OF THE BASIC SECTOR OF THE ECONOMY OF THE KOHALAS

Geographic Area	Business or Activity	Indicators of Extent of Present Activity
South Kohala Coast	Mauna Kea Beach Hotel Complex	310-room luxury hotel with golf course, tennis, and other recreational facilities; a total of 620 employees, about half of them from North Kohala and a quarter more from South Kohala; balance are commuting from outside the area.
	Boise Cascade-Waikoloa	Waikoloa Village golf course, tennis, equestrian and other recreational facilities; 38 condominium units; development and maintenance activity; a total of 89 employees, 5 from N. Kohala, 73 from S. Kohala, of which 24 live at Waikoloa, and 11 from outside the area.
	Puako Beach Resort Apartments	27 condominium units, 3 employees
Kawaihae	All secondary economic activities	
Waimea	Parker Ranch	50,000 head of cattle on 370,000 acres; 122 employees
	Kahua Ranch	30,000 acres; 17 employees
	Other Ranches	53 small ranches with 40 to 60 animals each (Anderson 1975)
	Vegetable farming in Lalamilo	26 farm lots on 560 acres; approximately 85 jobs
	Vegetable farming in Pu'ukapu (Hawaiian Homes)	6 farm lots with about 180 acres in current use, about 15 persons
	Hawai'i Preparatory Academy	Private school, 7th to 12th grades. 320 students, approximately 75 employees
	Kamuela Inn	19 hotel/motel units; 3 employees
North Kohala (following the termination of Kohala Sugar)	Hawai'i Biogenics Kohala Nursery Orchids Pacifica Kohala Plastics	These firms were created by the Kohala Task Force. Early indications were that they would provide some 100 to 150 jobs, but recent indications are that many of the early projections are not being fulfilled.
	Kohala Corporation	6 employees retained from Kohala Sugar to maintain facilities such as the Kohala Ditch
	Coast Guard Station	About 30 men on duty
	Luke's	23 hotel/motel units, 10 employees

It appears that the long-term prospects for the economy of the Kohalas are a decline in agriculture and an increase--perhaps even a dramatic increase if influencing factors beyond the region become favorable--in tourism. The prediction of a decline in agriculture is tied to several regional factors which make new ventures difficult: the availability and economic cost of irrigation water; the cost to air-ship produce to Honolulu and Mainland markets; and strong, gusty winds in both Waimea and North Kohala which make windbreaks necessary and sprinkler irrigation difficult and costly. Livestock production will probably increase when Kohala Sugar lands become pasture for Parker and Kahua ranches. Vegetable farming will increase in Lalamilo and Pu'ukapu. And some of the new ventures in agriculture in North Kohala may be successful. But none of these gains are likely to equal the economic activity lost with the termination of sugarcane production. In contrast to the prospects for agriculture, the availability of water at the South Kohala coast appears to be the only regional factor that might limit growth of tourism. This actually enhances Boise's competitive position since Waikoloa has an adequate on-site water source. Other factors influencing the success of tourism--particularly the state of national and worldwide economies--are controlled by events outside the region.

3. Housing

Table II-D.4 summarizes selected housing characteristics in North and South Kohala. Major differences between the two districts include more homes in "poor" condition in North Kohala, slightly more persons per household in North Kohala, much lower contract rents and median house values in North Kohala. Also, there were a higher percentage of vacant homes in South Kohala. The recent construction of condominiums and "second homes" in the area may have increased the vacancy rate, although it is also possible that recent population increases may have cut the vacancy rate. Housing in Kohala comprises mainly single unit structures, as would be expected in rural areas.

Households consist primarily of family members, as shown in Table II-D.5.

Anderson (1975) reported that data supplied by the County Planning Department showed that in the Summer of 1975, there were 1,041 residential structures in North Kohala, with 87 of them vacant. He also reported that corresponding data for South Kohala showed a total of 2,174 residential structures, with 98 vacancies, which he considered inconsistent with other data and casual observations. He suggested that a more reasonable estimate would be about 1,200 households in South Kohala.

Table II-D.4 SELECTED HOUSING CHARACTERISTICS
North and South Kohala - 1970
County of Hawai'i

Characteristics	South Kohala	North Kohala
Total households	798	941
Owner occupied	40%	62%
Renter occupied	42%	31%
Vacant year-round	18%	6%
Persons per household	3.51	3.72
Age of Housing		
0 to 5 years old	41%	54%
6 to 15 years old	23%	11%
16 to 30 years old	25%	22%
Over 31 years old	12%	13%
Condition of Housing		
Very good condition	32%	21%
Good condition	48%	47%
Poor condition	14%	26%
Dilapidated condition	6%	6%
Density Per Acre	0.9	1.8
Persons Per Room		
1.00 or less	505	659
1.01 to 1.50	92	135
1.51 or more	53	85
Units with all plumbing facilities-1.01 or more	126	191
Lacking Some or All Plumbing Facilities		
All Unit	100	155
Owner occupied	24	40
Renter occupied	46	87
Vacant year-round	30	28
For sale only	0	5
For rent	2	4
Contract Rent		
Specified renter occupied units	314	266
Less than $30	11	87
$30 to $39	7	26
$40 to $59	12	51
$60 to $79	23	30
$80 to $99	22	6
$100 to $149	52	10
$150 to $199	37	1
$200 to $249	22	1
$250 or more	9	1
No cash rent	119	53
Median	$116	$38
Units in Structure		
1	770	883
2	10	18
3 and 4	5	24
5 to 49	8	21
50 or more	0	0
Value		
Specified owner occupied units	266	533
Less than $5,000	2	23
$5,000 to $7,499	8	40
$7,500 to $9,999	9	42
$10,000 to $14,999	22	126
$15,000 to $19,999	33	128
$20,000 to $24,999	32	93
$25,000 to $34,999	40	54
$35,000 to $49,999	59	19
$50,000 or more	61	8
Median	$31,800	$16,100

Source: U.S. Bureau of the Census, Census of Population and Housing, 1970 and County of Hawai'i General Plan, 1971.

Table II-D.5 SELECTED HOUSEHOLD CHARACTERISTICS
North and South Kohala - 1970
County of Hawai'i

Characteristic	South Kohala		North Kohala	
	Number	Per Cent	Number	Per Cent
Head of household	650	28	879	26
Head of family	533	23	741	22
Primary individual	117	5	138	4
Wife of head	480	21	652	20
Other relative of head	1,055	46	1,675	50
Not related to head	94	4	92	3
In households	2,279	99	3,298	99
In group quarters	31	1	28	1
All persons	2,310	100	3,326	100
Persons per household	3.51		3.75	

Source: U.S. Bureau of the Census, Census of Population and Housing, 1970.

E. PUBLIC FACILITIES*

Existing public facilities in North and South Kohala are shown in Figure AH and are discussed under the headings of Schools, Libraries, Protective Services, Health and Sanitation, Recreation, Transportation, Other Government Services and Civic Organizations.

1. Schools

South Kohala

The district of South Kohala is within the Honoka'a High School feeder complex, which consists of a high school located at Honoka'a, in the Hamakua District, an elementary-intermediate school at Waimea in the South Kohala District, and a grade school at Paauilo in the Hamakua District. The current enrollment for the feeder complex totals ap-

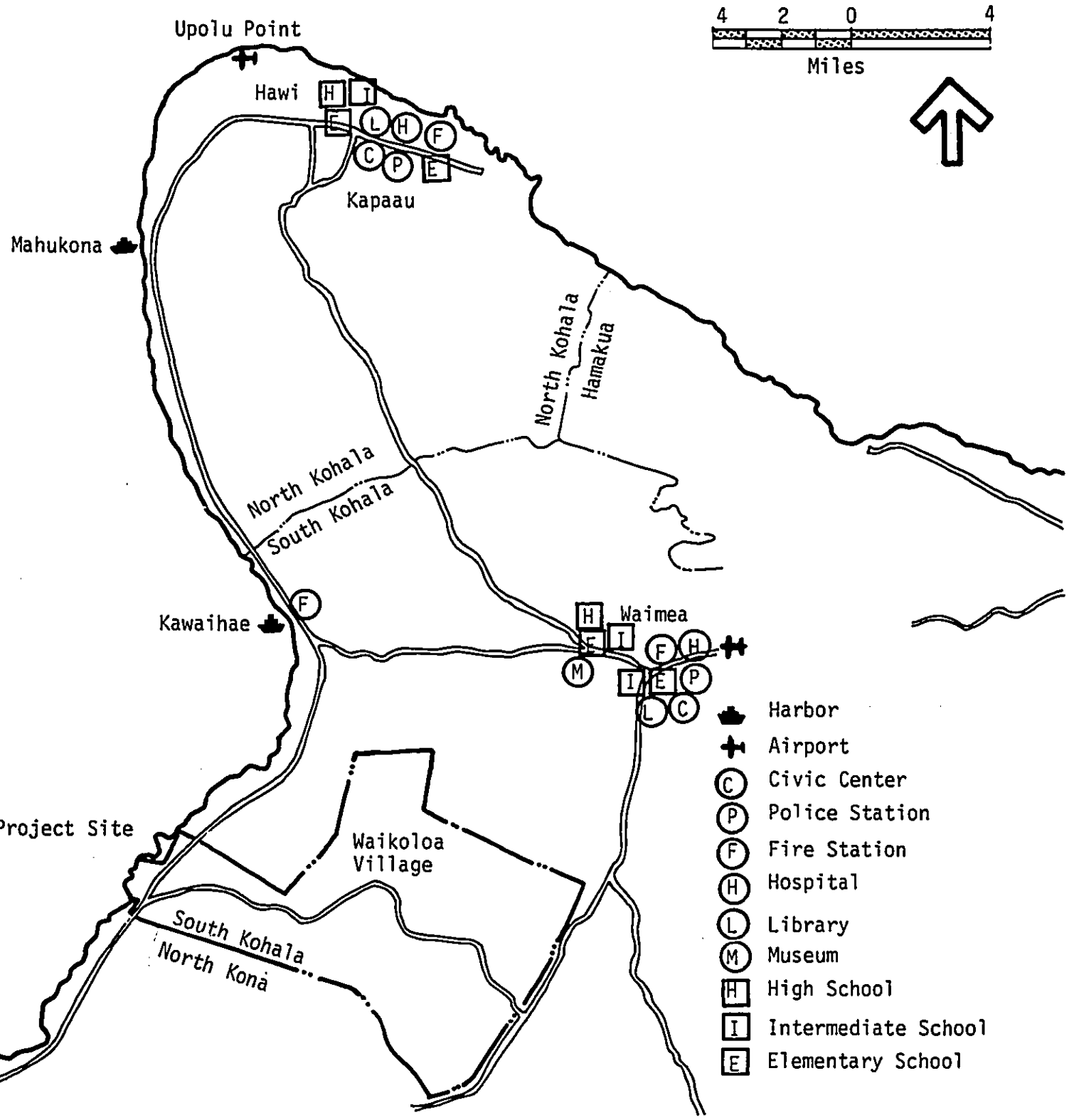
Table II-E.1 PROPOSED SCHOOL SITES SOUTH KOHALA DISTRICT(1)

School Location	Grade	Site Size (ac)	Comments
Waimea	High	25	County General Plan designates the site for school use; site is owned by Richard Smart
Kawaihae	Elementary	10	County General Plan designates the area for ranching; site is owned by Queen's Hospital
Lalamilo	Elementary	10	County General Plan designates area for residential use; site owned by State of Hawai'i
Pu'ukapu	Elementary	10	County General Plan designates area for school site; site in private ownership
Waikoloa	3 Elementary 1 Intermed. 1 High	70	County General Plan shows 5 schools for Waikoloa area but sites not yet dedicated; land is owned by Boise Cascade

(1) Source: Department of Education (1971: 66); Hawai'i County General Plan (1971: 48)

*Source: Primary information obtained from Mauna Loa Land, Inc., EIS.

FIGURE AH
WAIKOLOA BEACH RESORT
PUBLIC FACILITIES
NORTH AND SOUTH KOHALA



proximately 1,940 students. Department of Education (DOE) enrollment projections for 1980 and 1995 are 2,152 and 2,500 students, respectively,[1] based on a regression analysis of past trends.

The Waimea Elementary-Intermediate school, located on a 12-acre site near the shopping center in Waimea town, presently has 27 classrooms with an enrollment of approximately 590 students. High school students from South Kohala are bussed to Honoka'a High, approximately 16 miles from Waimea.

The Honoka'a feeder system was established during a period when most of the population in this area was concentrated along the Hamakua coast. As sugar employment declined in the Hamakua area and tourism and other developments have expanded in South Kohala, however, the population pattern shifted, with an increasing proportion of people settling in South Kohala communities. This shift in turn will increase the need for additional school facilities in the Waimea area. Long-range State DOE plans for reserve school sites in South Kohala, as set forth in the Hawai'i County General Plan, are shown in Table II-E.1. As need arises from area growth, Waimea Elementary and Intermediate School may need to be expanded to house a high school. A new elementary school in Kawaihae is projected in the long-range plan in anticipation of development in that area.

Hawai'i Preparatory Academy, a private intermediate and high school is also located in Waimea, with an enrollment of approximately 300 students from throughout the islands.

North Kohala

The district of North Kohala is served by the Kohala High feeder complex, consisting of Hala'ula Annex Elementary located at Hala'ula Subdivision, and Kohala High, Intermediate and Elementary schools located adjacent to Hawi. Enrollment of the feeder complex was 897 as of September 1974 and the Department of Education enrollment projections are 842 for 1980 and 900 students by 1995. The State Department of Education has noted that "the enrollment of the Kohala complex is not expected to grow significantly. Hala'ula School will be phased out in the next six to ten years due to declining enrollment, old classroom buildings and lack of growth potential in the neighboring area."

2. Libraries

Two libraries exist in the area--one in Waimea in South Kohala and one at Kapa'au in North Kohala. The Thelma Parker Library, located next to the Waimea School, has about 8,000 books for adults and children.[2]

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[1] Phone conversation with Mr. Eddington of the State Department of Education; estimates are based on an update of the "Preliminary Long Range Plan for New School Sites in Hawai'i", January 1971.

[2] Phone conversation with staff of Thelma Parker Library.

The Department of Education has planned a new school-community library building, for completion in the period from 1977-1980, as a part of Waimea Elementary-Intermediate School.[1]

The Bond Memorial Library, with about 10,000 volumes, is located in Kapa'au. Bookmobile service is available to Waimea, Puako, Kawaihae, and the North Kohala area.[2]

The standard for small-population libraries is three volumes per capita (de Chiara and Koppelman 1969: 192); with the combined libraries at 18,000 volumes and the total population of North and South Kohala at 6,000 persons, the criterion is met. It indicates that the library system is adequate for the present population.

3. Protective Services

Protective services are provided primarily by fire and police departments. In South Kohala, a 24-hour, four-truck fire facility is located at Waimea, an eight-hour, one-man, one-truck facility is located in Kawaihae, and a truck is stationed at Puako to be used by volunteers.[3] Fire protection in the Kawaihae and coastal area is of limited effectiveness due to the distances involved, the low density of the population, and the lack of a suitable volunteer force. The limitations complicate the inherent problems of the dry, grassland environment, which is highly susceptible to fires during the summer and fall seasons.

Waikoloa has just completed constructing a private, one-truck fire facility adjacent to the Waikoloa Village Store for added protection. The Mauna Kea Beach Hotel also has a private fire truck for protection of their resort facility and related houselots.

The Hawai'i County Police Department is located at stations in Waimea and Kapa'au. The facility at Waimea consists of a modern station and jail structure which serves as a headquarters for a 13-man, full-time police force. The Kapa'au Police Station is housed in a building that adjoins the court building. In addition, Waikoloa has a full-time, six-man security staff.

Increased public fire and police protection will be required for the WBR, as these private services have neither the ability nor the obligation to provide adequate protection.

4. Health and Sanitation

In South Kohala, health services are presently provided by a dispensary in Waimea and a 40-bed hospital in Honoka'a. A modern, 26-bed hospital facility and a public-health center are located in Kapa'au. The

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(1) Phone conversation with Mr. Eddington of the State Department of Education.
(2) Phone conversation with staff of the Bond Memorial Library.
(3) Phone conversation with Hawai'i County Fire Department.

Kohala Sugar Company also operates a dispensary in Kapa'au; however, service will stop when the sugar operation is shut down.[1]

Ground has been broken for a private, non-profit emergency care medical facility in Waimea. It will have space for five doctors and a dentist, as well as X-ray, laboratory and emergency treatment facilities. Long range State of Hawai'i plans call for a hospital in Waimea, at which time the Kohala Hospital may be converted to emergency treatment and used for a nursing care facility.

Public cemetaries are located in Paulama and Waimea in South Kohala, and at Kahei and A'amakoa, North Kohala.

Refuse disposal in South Kohala is at open dump sites in Waimea and in Puako. A sanitary landfill operation, with rubbish brought to it from several transfer-station sites, is planned for the district. A transfer station has just been installed at the Puako dump site and another is planned at the Waimea dump site. The regional sanitary landfill will be installed at Ahualoa in Hamakua and it will by 1976 serve both North and South Kohala. The initial site will be 35 acres with a reserve of an additional 35 acres. The landfill will be in no more than two eight-foot lifts, giving a total capacity of about 1.8 million cubic yards, sufficient to support a city of 30,000 for eight years.[2]

Waikoloa has a solid waste disposal site on the North Kona-South Kohala border of the project which has been in use for the past two years.

Refuse in North Kohala is presently dumped into an old quarry in Kaahuhu, but this practice will be discontinued when a transfer station is installed--the present projected date is 1979.

5. Recreation

Existing recreational sites in North and South Kohala emphasize camping, hiking, golf, tennis, volleyball, baseball, and picnicking at the inland facilities, and swimming, surfing, boating, and fishing at beach facilities. A few indoor recreation areas are also available, with such sports as basketball and ping-pong as well as more passive activities like cards, chess, and checkers.

Table II-E.2 summarizes existing major recreation sites in North and South Kohala, as recorded in the 1973 County of Hawai'i Recreation Plan. Their locations are shown in Figure I.

There are also three named hiking trails in the area--the Kawaihae-Pu'u Hue Trail, the Kohala Ditch Trail, and the King's Trail from Kiholo to Puako.

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(1) Phone conversation with staff of State and County hospitals.
(2) Phone conversation with staff of Hawai'i County, Sewers and Sanitation Department.

Recreation facilities currently in Waikoloa Village include an 18-hole Robert Trent Jones golf course and clubhouse, restaurant, swimming pool, tennis courts and equestrian facilities. In addition to the publicly-accessible white sand beach at 'Anaeho'omalu Bay, a 10,000 acre open recreation reserve has been set aside in Waikoloa for hunting, riding, hiking, camping and other outdoor recreational activities.

The principal existing beach parks are the County's Samuel Spencer Park, located just south of Kawaihae Harbor, and the State's Hapuna Beach, situated midway between Kawaihae and Puako. Both parks contain excellent white sand beaches and provide parking, picnicking, and restroom facilities. Other beach parks are located at Kapa'a, Kokea and Mahukona. While facilities are quite adequate at these parks, the beaches' quality does not match either Spencer or Hapuna Beach Parks.

Extensive additional recreational facilities are proposed for both North and South Kohala in the County Recreation Plan. The more important of these are: beach and shoreline parks and recreation areas at Kapanaia Bay, 'Upolu Point, Niuli'i, and Hapuu in North Kohala, and at Waialaula, Kukui Point, Wailea Bay, Puako Bay, 'Anaeho'omalu Bay, (within the WBR), Makaiwa Bay, Pauoa Bay, Mauumae Beach, and Kaluhiikanu Beach in South Kohala.

The Kohala area is rich in its abundance of historical sites. For the most part, many sites have been well preserved and are considered valuable from the local community's standpoint, and have statewide significance and archaeological importance.

Several on-going and proposed projects will preserve, restore, develop and provide access to these important historic sites. These projects include: Lapahaki State Historical Park (increment I completed), a main part of the Kohala Historic Park plans; the Kohala Historic Park itself, proposals to develop other important sites affiliated with Kamehameha I; Pu'ukohola Heiau National Historic Site; Puako Petroglyps Historic Park, and "Na Ala Hele" Shoreline Trail System (along the North Kona-South Kohala District boundary to Pu'ukohola Heiau National Historic Site). The various projects will not only enhance individual sites, but through markers, signs, etc., attempt to show the overall relationship between the sites, ecological relationships, and village interactions.

Aside from recreational facilities there are a number of big celebrations and special events which help promote the heritage and culture of the area such as The Parker Ranch Fourth of July Rodeo; the County Fair; Anna Perry-Fiske's "Old Hawai'i on Horseback" Pageant; the Hawaiian-Scottish Games; Hawai'i's Kamehameha Day - with colorful parades, races, polo, music and dancing; and the Great Waikoloa Rodeo, Horse-Race, Bike Race and Canoe Race.

The Kohala area also offers passive recreation with its natural beauty.

Table II-E.2 RECREATION FACILITIES EXISTING IN NORTH AND SOUTH KOHALA

Facility	Area	Agency	Activities
North Kohala			
Camp Koapaka (Old Mokapu School)	--	Private	Indoor recreational activities
Hala'ula School Playground	5.0	State	School playground activities
Kahua Ranch Pavilion	--	Private	Picnicking
Kamehameha Park	8.4	County	Picnicking, town-park activities
Kapa'a Beach Park	28.3	County	Skin diving, fishing, picnicking, auto camping
Kohala High School	4.5	State	High school athletics activities
Kokea Beach Park	7.1	County	Limited swimming, fishing, picnicking
Mahukona Beach Park	2.7	County	Swimming, skin diving, fishing, boat launching, picnicking, auto camping
Mormon Gym, Hawi	--	Private	Indoor recreational activities
Pololu-Honokane	--	County	
Pololu Valley Lookout	1.7	County	Picnicking, scenic viewpoint
South Kohala			
Hapuna Beach Park	65.0	State	Swimming, surfing, camping, lodging
Kahilu Hall	--	Private	Indoor recreational activities
Kawaihae Boat Harbor	246.0	State	Marina, boat-launching ramp, fishing
Kohala Forest Reserve	23,800	State	Wilderness, hiking
Mauna Kea Beach Golf Course and Tennis Courts	--	Private (fee)	Golf, tennis
Puako Boat Ramp	0.5	State	Fishing, boat-launching ramp
Samuel Spencer Beach Park	13.4	County	Camping, surfing, swimming
Skeet Range	--	Private	Skeet shooting
Thelma Parker Gym	--	County	Indoor recreational activities
Waikoloa Golf Course	--	Private (fee)	Golf, tennis, swimming
Waikoloa Equestrian Center	--	Private (fee)	Horseback riding, rodeo and polo activities
Waikoloa Open Recreation-Reserve	10,000	Private	Hunting, riding, hiking, camping
Waimea Elementary/Intermediate School	5.0	State	School playground activities
Waimea Park	6.4	County	Athletics, picnicking
Waimea Rodeo and Racetrack	--	Private	Rodeo activities
Waimea Youth Center	--	Private	Indoor recreational activities

6. Transportation

Highways

The regional map (Figure J) shows the road network for South Kohala. Waimea town is linked with the coast by the winding, two-lane Kawaihae-Waimea Road; a new alignment for this road, proposed by the State Department of Transportation, is to the south of the existing one and is now in the preliminary design stage. The only other maukamakai route is the "Waikoloa Road" built by Boise; it connects the inland, Mamalahoa (Belt) Highway with the Queen Ka'ahumanu Highway at the coast. Boise's Waikoloa Village is approximately midway along this route.

Travel along the coast is via the State's new Queen Ka'ahumanu Highway, presently two lanes but designed so that additional ones could be added. When the last section of this highway was recently opened through to Kailua-Kona, the pattern of ground transportation for the region was changed considerably. Previously, to get from Ke-ahole Airport or Kailua to the South Kohala coast, a traveler had to take the indirect, inland route along the Mamalahoa Highway to Waimea, and then drive ten miles down to the coast; the trip would take about an hour and a half. Now, driving directly via the Queen Ka'ahumanu Highway, travel time is about 30 minutes.

Travel between North Kohala and the South Kohala coast is via the State's Mahukona Highway. It takes only about 20 minutes to drive between Hawi and Kawaihae.

The available traffic-count data for these highways show that the vehicle volumes are rather light in relation to the roads' capacities. The most recently published data are for 1971 (Highway Division 1972); average daily traffic then was 1,016 vehicles along the Mahukona Highway, 1,575 vehicles along the portion of Queen Ka'ahumanu Highway then completed (from Kawaihae to Hapuna), and 1,990 vehicles along the Waimea-Kawaihae Road. Only one count has been made by the State since, in July 1972; the Mahukona Highway volume was down to 625, Queen Ka'ahumanu Highway up to 1,972 vehicles, and the Waimea-Kawaihae Road relatively steady at 1,837 (figures obtained from the Highway Planning Branch, Highways Division, State Department of Transportation). These vehicle volume changes may not be too significant, however, since the counts were made for single 24-hour periods only. Vehicle volumes undoubtedly vary significantly by season, and perhaps even daily. The difference between the 1971 and 1972 counts could very easily be explained by these variations, rather than as a trend.

Airports

Direct Mainland-Big Island flights can be made through General Lyman Field in Hilo. These connections are a small percentage of the total air traffic to the island. The Hilo Airport and all the West Hawai'i airports--at Waimea in South Kohala, and Ke-ahole Airport in North Kona--are served by inter-island carriers. (Table II-E.3.)

Table II-E.3 SUMMARY OF DAILY[1] SCHEDULED AIRLINE ARRIVALS
Island of Hawai'i
September 1975

Time and Carrier	Hilo	Kona	Kamuela
Morning: 6 a.m. - 12 noon			
Overseas Carriers	-	-	-
Inter-Island Carriers	6	5	-
Scheduled Charter	1	2	2
Afternoon: 12 noon - 6 p.m.			
Overseas Carriers	2	-	-
Inter-Island Carriers	8	6	1
Scheduled Charter	2	2	2
Evening: 6 p.m. - 12 midnight			
Overseas Carriers	1	-	-
Inter-Island Carriers	2	1	-
Scheduled Charter	-	1	1
Full Day			
Overseas Carriers	3	-	-
Inter-Island Carriers	16	12	1
Scheduled Charter	3	5	5
Total	22	17	6

(1)Occasional extra sections flown by inter-Island carriers. Other overseas carriers have weekly or twice a week flights. Charters into Hilo are not included.

Source: Airline Schedules; Airline Agents; Hastings, Martin, Hallstrom and Chew, Ltd. September 1975.

The Waimea-Kohala Airport has served most of the needs of the one resort hotel along the South Kohala coast, but this has been changed radically with the recent opening of Queen Ka'ahumanu Highway. Hawaiian Air, which recently reduced its service, and a minor carrier, Royal Hawaiian, are currently the only airlines providing service in and out of Waimea. The air traffic has now shifted almost entirely to Ke-ahole, and it is anticipated that this airport will be the transfer point for most of the WBR guests. Travel distance from this airport to the WBR is 16 miles.

Harbors

One of the Big Island's two deep-water ports is at Kawaihae, only eight miles from the WBR (the other port is Hilo). There are two recreational-commercial marinas in the region, one partially constructed next to the Kawaihae deep-water port and the other to the south at Honokohau. In addition, there is a boat-launching facility at Puako. Kawaihae is tentatively scheduled as a terminus for the proposed inter-island ferry.

Surface shipping is important in the development of a tourist industry, since it is necessary to import building materials, furnishings, and equipment needed to create a new resort, and many of the supplies necessary in subsequent operation. For the most part, these goods can be shipped into Kawaihae Harbor and transshipped to the hotel site. (The resorts' interest in harbors is, at present, more focused on small boat harbors. Game fishing is a famous part of the allure of West Hawai'i. As such, the provision and extension of small boat harbors at Honokohau and Kawaihae adds to the recreational excitement of the area to visitors. Additional government investment is planned and has been encouraged by resort developers.)

Ocean transportation of agricultural supplies and production is handled primarily by Young Brothers out of Kawaihae Harbor. Under the direction of the State Public Utilities Commission, the rate structure is established so that agricultural products are shipped at less than actual cost. The agricultural sector also needs frequent and regular shipping. At present they are able to ship only on Mondays and Thursdays.

At Waiulua Bay, in the WBR, Boise hopes to build a small boat harbor to be used for sport fishing, tour boats, recreational boats and as a refuge. However, many permits must be obtained before this can be done.

Public and Private Ground Transportation

The County of Hawai'i recently initiated a public bus system in Hilo and Kona, and has a route from Kona to Hilo that passes the Waikoloa entrance on the Mamalahoa Highway. Most visitors to the Big Island, however, travel in private buses, U-drive vehicles or taxis. The County also provides a bus service for employees of the Mauna Kea Beach Hotel from a common pick-up point in Kohala.

In the past, the Island of Hawai'i has had the highest percentage of visitors in tour groups among all of the islands--about 62 per cent island wide and 75 to 80 per cent at many hotels in Kona. The breakdown of visitor transportation shows this group-tour preference:

81 per cent	transfer-tour bus companies
13 per cent	U-drives
6 per cent	taxis

The Mauna Kea Beach Hotel is an exception to the group-tour pattern. Visitors' stays are for generally longer periods, and an average of only three per cent of the rooms are occupied by tour groups. Some tour groups formerly made lunch stops there, but overnight stays are not common. The ground transportation pattern for Mauna Kea Hotel visitors is given in Table II-E.4. Note that the Mauna Kea transportation pattern to and from the airport is significantly different from all other ground transportation.

Table II-E.4 GROUND TRANSPORTATION FOR MAUNA KEA BEACH HOTEL GUESTS

Mode of Ground Transport	Ground Transport To and From the Airport (%)	All other Ground Transport (%)	Weighted Average of all Ground Travel (%)
Transfer-tour bus and limousine	85	30	45
U-drive	10	70	53
Taxi	5	0	2

(Note: All figures quoted in this section are from a transportation analysis done for Boise by Economics Research Associates in 1970. Though the study was done six years ago, it is believed that the distribution of visitor transportation modes is still approximately the same.)

7. Other Government Services

Postal facilities are available in Waimea, Hala'ula and Hawi and in a recently-opened postal contract station in the Waikoloa Village Store.

The District Court of the Hamakua and Kohala districts, and the Third Circuit Court, convene in courtrooms in North Kohala, at Hala'ula, and in South Kohala, in Waimea.

The State Department of Social Services and Housing has case workers, food stamp and income maintenance workers, social workers and secretarial help, in the Civic Center in North Kohala. The State Em-

ployment Service has offices in Kona and in Hilo, and a field representative of the Employment Service visits South Kohala on a bimonthly basis.

There are State and County highway baseyards in both North and South Kohala. The Department of Hawaiian Home Lands and the College of Tropical Agriculture (Cooperative Extension Service and Hawai'i Agricultural Experiment Station) also maintain staff and offices near Waimea.

8. Civic Organizations

Among the active civic clubs in South Kohala are Jaycees, Rotary and Lions Clubs, the Hawaiian Civic Club, the Civitans, and the Waimea-Kawaihae Community Association.

In North Kohala, civic organizations include the North Kohala Community Development Association, the Hawaiian Civic Club, the Lions Club, Filipino and Okinawan organizations and the Puerto Rican Club.

The following sites are examples of natural beauty in North Kohala district.[J]

Honokane Valley	5-1-01: 4-6	
Island off 'Awini Valley	5-1-01: 13-15	'Awini
Pololu Valley	5-1-02	Pololu
Pololu Valley (overlook)	5-2-01: 1	Pololu
Akoakoa Point	5-2-01: 7	Wai'apuka
Naue Bay	5-2-01: 7, 8	Wai'apuka
Kapanaia Bay	5-2-01: 14	Makapala
	5-2-07	'A'amakoa
Keokea Beach & Kalalae Pt.	5-2-01: 14-16	Makapala
Kauhola Point	5-3-07: 1	Kukuiwaluhia
'Upolu Point	5-5-06: 7	Kokoiki-'Upolu
Old Honoipu Landing	5-6-01: 24	Puakea
Kapa'a Park	5-6-01: 60	Kapa'a
Mahukona Harbor and Park	5-7-03: 3, 4, 14	Mahukona-Hihiu
Keawanui Bay	5-8-01	Puanui
Kai'opae Point	4-9-01: 6	Wai'aka
Waiaka'ilio Bay	5-9-01: 8	Kahualiilii
Kawaihae-Mahukona Highway		
Kohala Mountain Road		

The following sites are examples of natural beauty in the South Kohala District.

Kawaihae area	6-1-03: 14	Kawaihae 1st
	6-1-04: 1, 3, 20	
Mau'umae Bay and Beach	6-2-01: 7	Kawaihae 2nd
Puu Makela (Viewpoint)	6-2-01: 25	Kawaihae 2nd
Kaluhiikanu Beach	6-2-02: 6	Kawaihae 2nd
Kauna'oa Bay (no access for public)	6-2-02: 4	'Ouli
'Ohai'ula Beach (Spencer Park)	6-2-02: 8	Kawaihae 2nd
Upper Waipi'o Lookout	6-3-02: 4	Waipi'o
View of Kohala Mountains	6-5-01: 14	Wai'auia
Hapuna Bay	6-6-01: 8	Lalamilo
Kauna'oa Point	6-6-02: 38	'Ouli
Scenic countryside around "Waikii"	6-7-01: 3	Waikoloa
Puako Bay	6-9-01: 2	Lalamilo
	6-9-01: 3	
Makaiwa Bay and Pond, Keawanui	6-9-01: 3	Kalahuipua'a
Pauoa Bay	6-9-01: 3	Kalahuipua'a
'Anaeho'omalu Bay	6-9-01: 13	'Anaeho'omalu
Wailea Bay	6-9-01: 2	Lalamilo

[J] County of Hawai'i General Plan

F. PUBLIC UTILITIES*

1. Water System

There are three separate water systems in South Kohala. One, owned by the State and operated by the Department of Land and Natural Resources, serves the Lalamilo agricultural lots southwest of Waimea and provides a smaller amount for domestic use in Hamakua. The sources for this system are streams diverted into the upper Hamakua Ditch; principal storage is in a 60-mg. reservoir west of Waimea; the water is not treated prior to distribution. The entire system has been described in earlier publications (Division of Water and Land Development 1963 and 1965 among others).

The second water system in South Kohala is owned and operated by the County Department of Water Supply. It serves all of the Waimea-Kamuela area, including the Hawaiian Homes in Pu'ukapu, and the South Kohala coastal area from Kawaihae to Puako. The present average daily consumption approximately is 1.1 mgd. The source feeding the Waimea portion is the Waikoloa stream and the Kohakohau stream. The Kawaihae and Puako areas are supplemented by two deep wells. The basic elements of this system are described in the Water Master Plan (Dept. of Water Supply, Co. of Hawaii 1971) and the annual reports of that department. Since these systems will not be a factor in water consideration for the WBR, they will not be discussed further.

The third system is the Waikoloa Water Company, a private water utility company, owned by Boise. The entire system is within the Waikoloa development. The water source is from the Waikoloa Aquifer. There are currently two deep wells located at the 1,200' elevation, a one million gallon reservoir and a distribution system installed throughout the Waikoloa Village. In addition, there is a water main running to the WBR.

In 1972, the Hawai'i Board of Water Supply, the State Division of Water and Land Development, and Harold T. Stearns, consulting geologist and Stephen P. Bowles, consulting hydrologist-geologist conducted an extensive test of the Waikoloa Aquifer.

Pumping began on August 22, 1972 between 11:10 and 11:15 a.m. and ran continuously until 10:30 a.m. on October 25, 1972. Total pumpage was 121.8 million gallons at an average rate of 666 gpm from Parker 5 and 656 gpm from Parker 4 or a combined rate of 1,322 gpm, approximately 78 gpm less than the nameplate rating of 1,400 gpm.

During the test, periodic water samples were collected and analyzed. The water quality is excellent. Chlorides average 25 ppm and no treatment is required. As a result of the testing, Stearns (Ms) and

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*Sources: Mauna Loa Land Inc., EIS; Harold Stearns (Ms); Stephen P. Bowles (Msa).

Bowles (Msa) concluded that a major aquifer had been discovered. Bowles (Msa) indicated that flow through the aquifer in the vicinity of the Waikoloa well field is on the order of 3 mgd to 5 mgd; and ground storage in the Waikoloa aquifer is estimated at approximately 100,000 million gallons at a minimum. Stearns (Ms) indicated that in his opinion, the groundwater reservoir is large enough so that no need exists to buy water from the State's proposed surface water dam at Kohakohau in the Kohala Mountains unless purchase is more economical than pumping from the wells. (For further information reference is made to "The Potential of Fresh Ground Water Resources At Waikoloa, South Kohala, Hawai'i," Stephen P. Bowles, December 1971 (Msa) and "Groundwater Supplies at Waikoloa, South Kohala, Hawai'i" Harold T. Stearns, December 1972 (Ms).)

2. Sewage Collection, Treatment, and Disposal*

There are two privately operated sewerage systems in South Kohala--one at the Mauna Kea Beach Hotel complex and the other just makai of Waikoloa Village. Both of these systems feature secondary (biological) sewage treatment and waste-water-effluent disposal by percolation to the basal lens; the effluents are not now reused for irrigation. At Waikoloa Village, collector and interceptor sewer lines and a treatment plant have been completed to serve the commercial and multi-family zoned parcels.

Everywhere else in the district, sewage is disposed of in cesspools or septic tanks without being treated.

Recognizing that eventually South Kohala resort developments would create the need for sewerage systems, the County retained the firm of Sunn, Low, Tom & Hara, Inc. to make recommendations and preliminary plans. Their first report presented alternative schemes for a coastal system between Kawaihae and Puako (Sunn, Low, Tom and Hara, 1967). The proposed collection line went only as far south as the Puako Beach Lots and was not sized to handle any flow from developments farther south. The second study (Ibid. 1970) included potential developments from Kawaihae all the way to 'Anaeho'omalu Bay. Though major land ownership and development plans have changed since this second study, two of its major recommendations are equally valid today:

1) Because the arid South Kohala coast is water-deficient, treated effluent should be reused for irrigation.

2) There should be several separate systems along the coast, each best located in the vicinity of both sewage sources and areas of reuse.

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*Source: Mauna Loa Land, Inc. EIS.

3. Electric Power

Hawai'i Electric Light Company, Ltd. (HELCO) serves the South Kohala region with a generating plant on the outskirts of the town of Waimea. Overhead 69- and 12-kv lines run along the Waimea-Kawaihae Road to a Kawaihae substation. A 12-kv line runs along Queen Ka'ahumanu Highway only as far as the turnoff to Hapuna Park; it continues down Puako Beach Road to serve the homes there.

HELCO has been negotiating acquisition of a new generating-plant site just north of Kawaihae Harbor and along the Kawaihae-Mahukona Highway.

Electrical energy is supplied to the Waikoloa Village Area via 69 K.V. overhead lines beginning at the Ke'amuku Wye Station on the Mamalahoa Highway. 70' poles carry aluminum conductors from the Ke'amuku station to the Village substation just south and east of the Village Commercial Area. A 5,000 KVA transformer reduces voltage for consumer use. Easement width is 75 feet.

Distribution is taken from overhead lines paralleling the east Village property line on an electrical easement of 50 feet. Subdivision distribution is installed in U/G direct burial trenches except for road crossings. In Commercial and Multi-family areas, and road crossings, all cables are installed in 4" and 5" concrete encased ducts.

4. Telephone

Overhead telephone lines extend along the Queen Ka'ahumanu Highway to Hapuna and then down Puako Beach Road. A telephone switching station in this area, completed several years ago, is located along the Queen Ka'ahumanu Highway, midway between the Kawaihae intersection and the Mauna Kea Beach Hotel. Telephone service is supplied to the Waikoloa Village by Hawaiian Telephone Co. utilizing HELCO poles and the same U/G direct burial trenches and concrete encased ducts.

A. LAND USE PLANS*

1. The State General Plan

In 1959 the newly established State government adopted a policy of dispersing the tourism growth to the Neighbor Islands. The purpose of this policy was to revitalize Neighbor Island economies and to reverse the out-migration pattern developing as a result of the gradual decline of agriculture.

The policy led to an extensive study on comprehensive tourism development within the State by a group of consultants. The basic direction of the study was that the best means of dispersing the tourist industry to the Neighbor Islands was to develop natural assets of the State other than in the Waikiki area of O'ahu. The study developed a state-wide inventory of natural tourist assets and projected future accommodation requirements. From this, the consultants then selected key resort areas on each island and developed a capital improvement program for carrying out the policy.

Following the adoption of the 1960 study, the State established a General Plan setting forth the general pattern for land use development, transportation, and public facilities throughout the State, and incorporating the recommendations of the 1960 study with respect to resort regions on Hawai'i and the other principal islands. The Kawaihae-Puako area was designated in this State Land Use Plan as one of the three primary resort regions on the island of Hawai'i.

A series of development studies, capital improvement projects and private developments have been completed since the initial adoption of the tourism development policy. The capital improvements and other private developments are discussed in Section I. The series of development studies most current offering is the "Hawai'i Tourism Impact Plan Vol. 2: West Hawai'i", published by the DPED in 1972. An analysis of these documents shows that the State's policy of disp
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Relationship of the Proposed Development Plan to the State General Plan

The comprehensive community development plan for Waikoloa (of which the Waikoloa Beach Resort area is a part) is in strict conformance to the State General Plan. The initial development concept for the area

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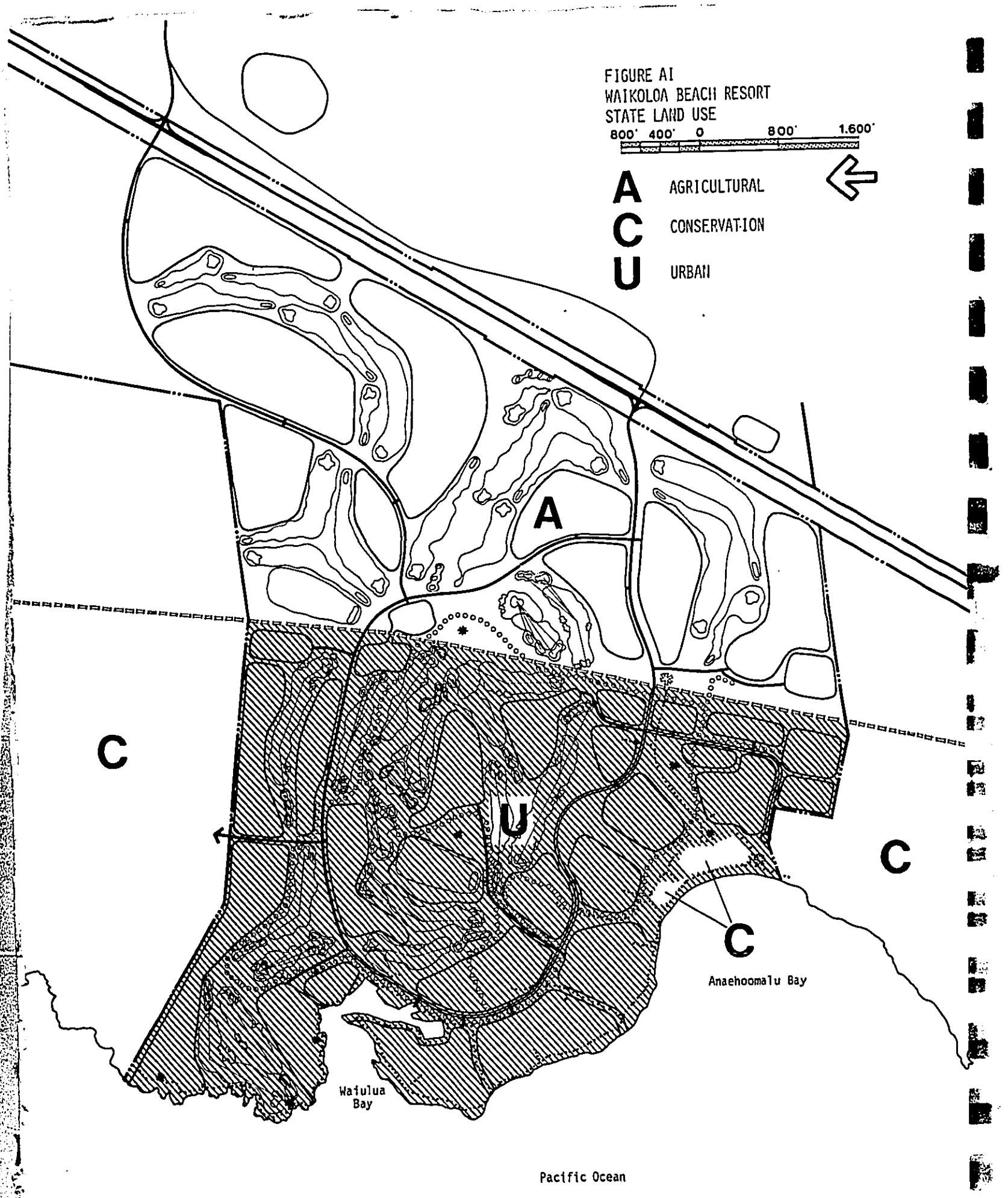


FIGURE AI
WAIKOLOA BEACH RESORT
STATE LAND USE
800' 400' 0 800' 1,600'
A AGRICULTURAL
C CONSERVATION
U URBAN
A
C
U
C
C
Anaehoomalu Bay
Waiulua Bay
Pacific Ocean

was in direct response to the area's need for tourism development as identified by the State General Plan.

2. State Land Use Districts

The State Land Use Law, adopted in 1961 as a means of implementing the General Plan, called for the classification of all lands in the State and authorized the adoption of rules for land use within the various land use districts. It further established a State Land Use Commission to carry out the authority of the law.

Under the law, all lands within the State were placed into one of four classifications or districts--urban, rural, agriculture, or conservation.

> Urban districts are generally defined as lands in urban or other intensive development use, with sufficient reserve areas to accommodate foreseeable growth.
>
> Rural districts are lands composed primarily of small farms mixed with low density residential lots having a minimum lot size of one-half acre.
>
> Agricultural districts include lands with a high capacity for intensive cultivation.
>
> Conservation districts are composed primarily of lands in existing forest and water reserve zones.

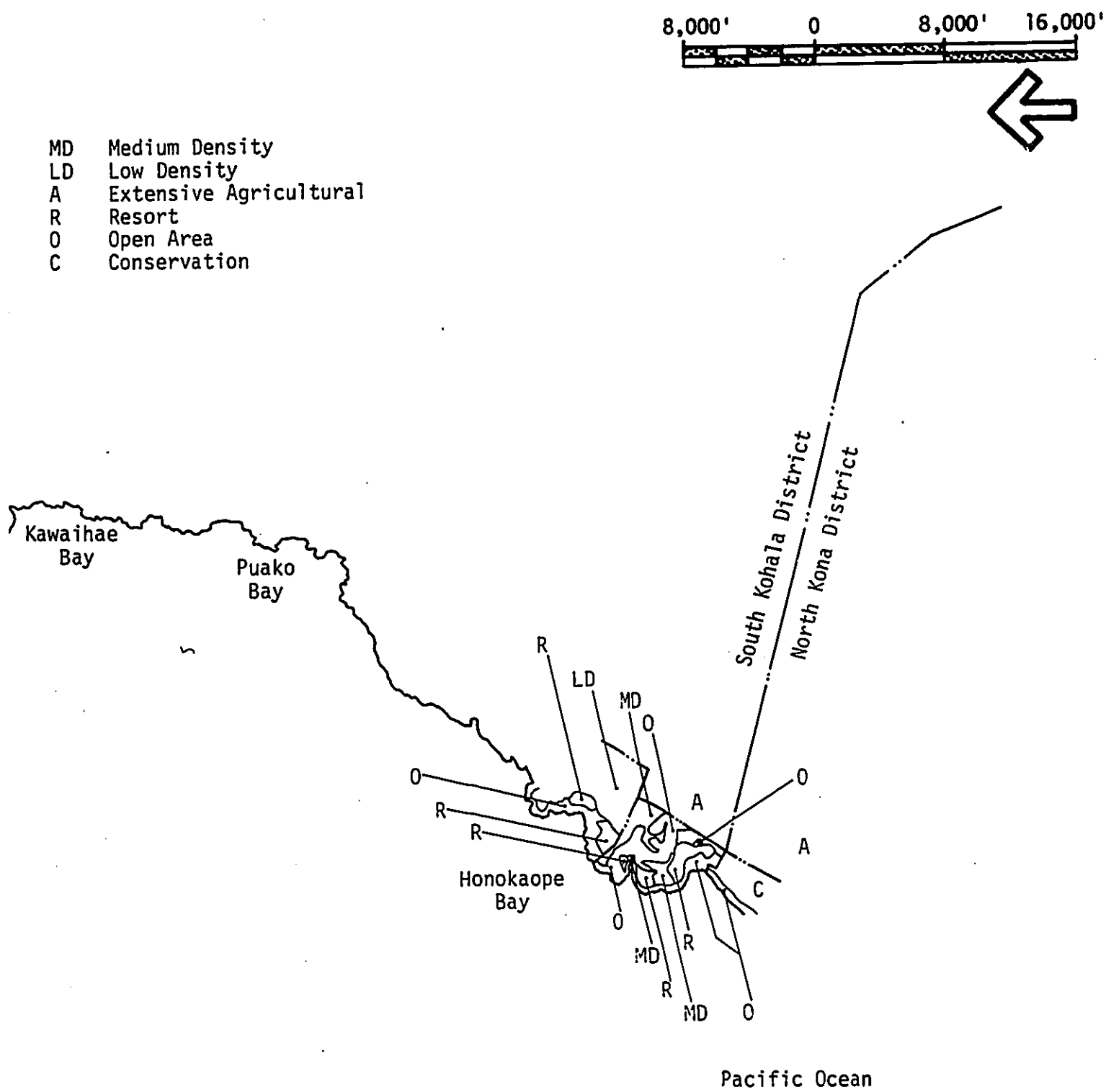
With respect to land use administration, land uses within urban districts are controlled solely by the counties. In the agricultural and rural districts, land uses are administered jointly by the counties and the State Land Use Commission. In the conservation districts, land uses are administered by the State Department of Land and Natural Resources.

As shown in Figure AI, the State Land Use classification for the 502 acre WBR area makai of the King's Trail is designated urban (in conformance with the State General Plan Policy). The two fishponds, Ku'uali'i and Kahapapa, are designated conservation. The Boise lands mauka of the King's Trail to the Waikoloa Village area are designated agricultural. The State Land Use Commission took action in 1968 to establish both the 'Anaeho'omalu area and the Waikoloa Village area as urban areas. This provided the necessary lands to start the two portions of development of the Waikoloa Planned Community--the Waikoloa Beach Resort area at 'Anaeho'omalu and the support community at Waikoloa Village.

The Relationship of the Proposed Action to the State Land Use Districts

Increments One and Two of the WBR generally conform to the existing urban designated area. The only exception is that the mauka edge of the development conforms to the mauka County zoning boundary between resort uses and unplanned. The County boundary follows the Ahupua'a

FIGURE AJ
WAIKOLOA BEACH RESORT
HAWAII COUNTY GENERAL PLAN
LAND USE ALLOCATION MAP
ORDINANCE NO. 439
(DECEMBER 22, 1971)



of 'Anaeho'omalu boundary while the State urban designation boundary follows the nearby King's Trail.

Increment Three will require an amendment to the State Land Use designation to change the area between the King's Trail and the newly completed Queen Ka'ahumanu Highway from agricultural to urban. This change of land use designation will be initiated some time during the Increment One development period. The exact timing will be a function of the need generated for an additional 18-hole golf course to service the development resort area. It is not strictly necessary to change the State Land Use designation to build a golf course, but Boise is reluctant to undertake such a large expenditure for landscaping, utilities and access without prior assurance that the land adjoining the golf course is saleable or otherwise developable.

3. The County of Hawai'i General Plan

The Hawai'i County Charter, adopted in 1968, mandated the County Council to adopt a General Plan setting forth the County's long-range comprehensive physical development policy. The plan published in 1971 addresses tourism in two sections. A stated goal in the Economic Section is "The County of Hawai'i shall encourage the development of a visitor industry which is consistent with the social, physical, and economic goals of the residents of the County." The Land Use Section designated three major resort areas on the Kohala coast, all within the State defined Kawaihae-'Anaeho'omalu Primary Resort Region. These areas are: The 'Anaeho'omalu area, the site of the Waikoloa Beach Resort; the Kawaihae-Hapuna area, the site of the Mauna Kea Beach Hotel complex; and the Puako-Honokaope Bay area, the site of Mauna Loa Land's proposed resort complex.

A "major" resort is defined as ". . .a self-contained resort destination area which provides basic and support facilities for the needs of the entire development. Such facilities shall include sewer, water, roads, employee housing and recreational facilities, etc.:

> Maximum visitor units: 3,000 rooms
> Resort acreage: 90 acres
> Active and passive recreation areas: 50 acres
>
> Accessory uses within hotel or resort zoned area shall be based on 50 square feet of floor area per hotel room.
>
> A maximum of 640 acres for residential use when other zoned lands are not available in close proximity for support use.
>
> Employee housing shall be provided at a maximum ratio of one employee unit to every two hotel units built. The required ratio shall be determined by an analysis of housing needs of each district or related area."*

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*Hawai'i County General Plan, pg. 95.

Figure AJ shows the General Plan Land Use Allocation Map. The map is patterned after the County zoning map that was applicable at the time of publication of the plan. It basically reflects the existing zoning configuration of the WBR. The area from the ocean to the Ahupua'a boundary is divided into medium density, resort and open land uses.

The Relationship of the Proposed Development Plan to the County General Plan and Land Use Allocation Map

Increments One and Two of the WBR development combined with Waikoloa Village conform to the requirement that the resort area be self contained. All required support facilities are either in the planning stage or are already constructed; employee housing is the only exception to this. For this housing, two alternatives are open: (1) Waikoloa is willing to sell at current market value developed house lots to prospective resort employees; (2) Waikoloa is also willing to donate up to 500 acres of unzoned land to provide sites for low cost housing. However, Boise does not believe that there will be a significant demand for employee housing at Waikoloa until 1985.*

Boise stands ready to donate up to 500 acres of unzoned land adjacent to the village and to the existing offsite utilities, roads, etc., as required, to achieve the following objectives:

1) Provide low cost rental units if needed.
2) Provide affordable fee simple units as needed.
3) Avoid concentration of employee units in one area to prevent the creation of a "worker's ghetto."

It is reasonable to assume that private developers will purchase portions of the developed multi-family zoned area of the village for relatively low cost rental housing when a market is developed by the establishment of an employment center at WBR.

Other general plan requirements are met by the WBR project. The limit of 3,000 hotel rooms has been incorporated into the plan. Passive and active recreation areas are in the order of 200 acres for Step 1A of Increment One alone. The accessory uses within Waikoloa Princess Hotel are estimated at 118 square feet per room, well in excess of the required 50 square feet. The area of land zoned for residential use adjacent to the resort area is 172 acres for Increments One and Two, well below the maximum of 640.

The Step 1A portion of the WBR development will conform to the existing County Land Use Allocation Map with two exceptions. The golf course will be configured differently, and there is no special open space designated between the resort parcel and the ocean except around the big fishponds. However, if the open space on the County Map is meant to be the State-required 40 feet setback of development from the shoreline, this is followed in the development plan. It is not neces-

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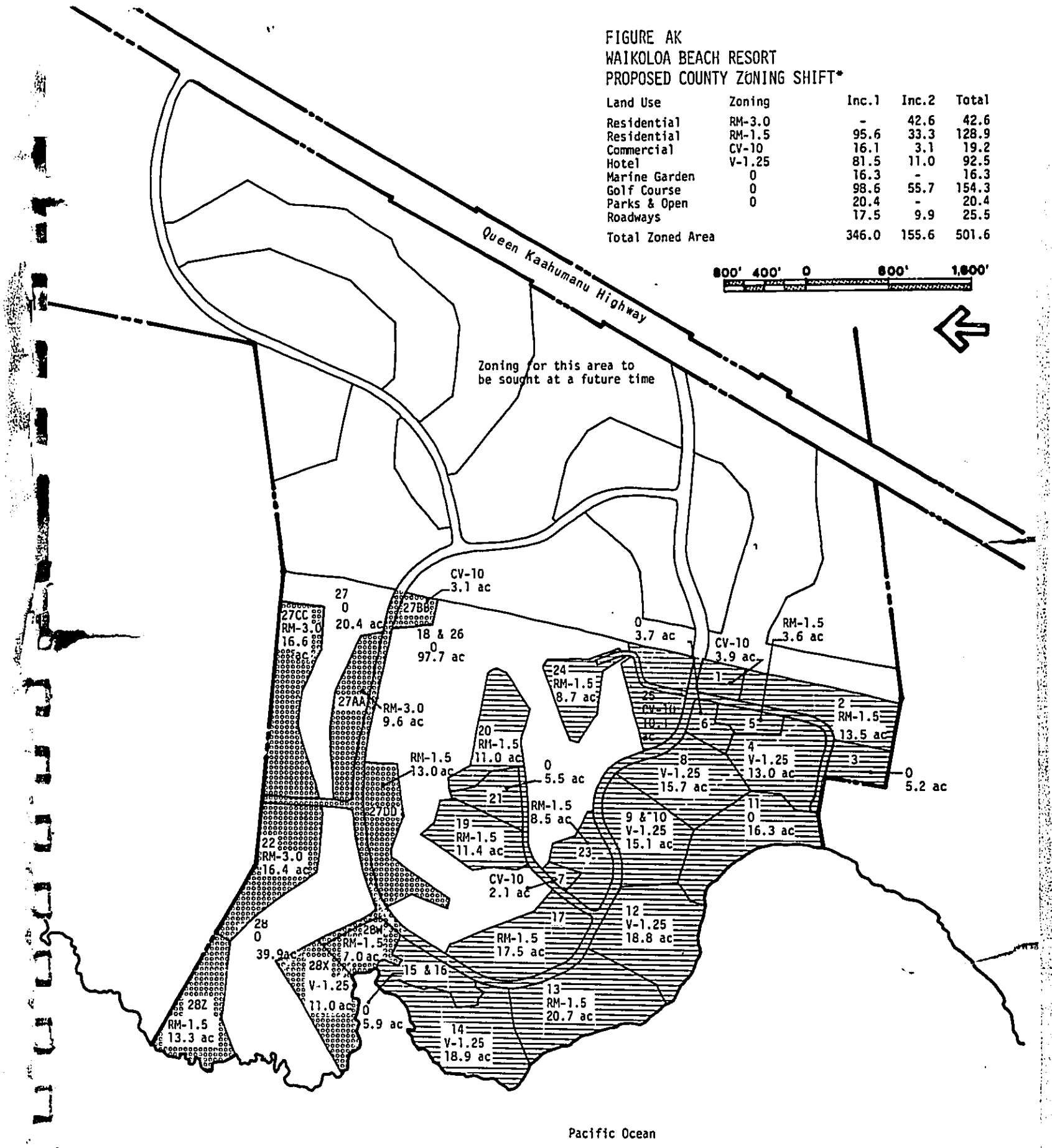
*See Section IV-H-6, New Housing Demand.

FIGURE AK
WAIKOLOA BEACH RESORT
PROPOSED COUNTY ZONING SHIFT*

Land Use	Zoning	Inc.1	Inc.2	Total
Residential	RM-3.0	-	42.6	42.6
Residential	RM-1.5	95.6	33.3	128.9
Commercial	CV-10	16.1	3.1	19.2
Hotel	V-1.25	81.5	11.0	92.5
Marine Garden	0	16.3	-	16.3
Golf Course	0	98.6	55.7	154.3
Parks & Open	0	20.4	-	20.4
Roadways		17.5	9.9	25.5
Total Zoned Area		346.0	155.6	501.6



* The detailed Revised Zoning Map prepared by William Hee & Associates, Inc. in response to this map, differs slightly in the total acreage in roadways (less) and open (more) but otherwise is essentially the same.

sary to shift the land use allocation plan to accommodate the shifted golf course.

Increments One and Two will require some adjustments to the County land use plan. Reconfiguring of the golf course will require that certain multi-family (medium density) areas be moved around a bit. This will not effect the acreages involved, but will simply require a shift of the existing uses.

Increment Three, if it receives State Land Use designation of urban, will require redesignation of the extensive agricultural area mauka of the King's Trail to open and medium density; this change will only be sought after the State redesignates the area.

4. Hawai'i County Zoning

In 1957, the Territorial Legislature enacted a comprehensive forest and water reserve zoning law. This Act granted general powers of zoning to County Boards of Supervisors for areas of their counties that were not included in the forest and water reserves.

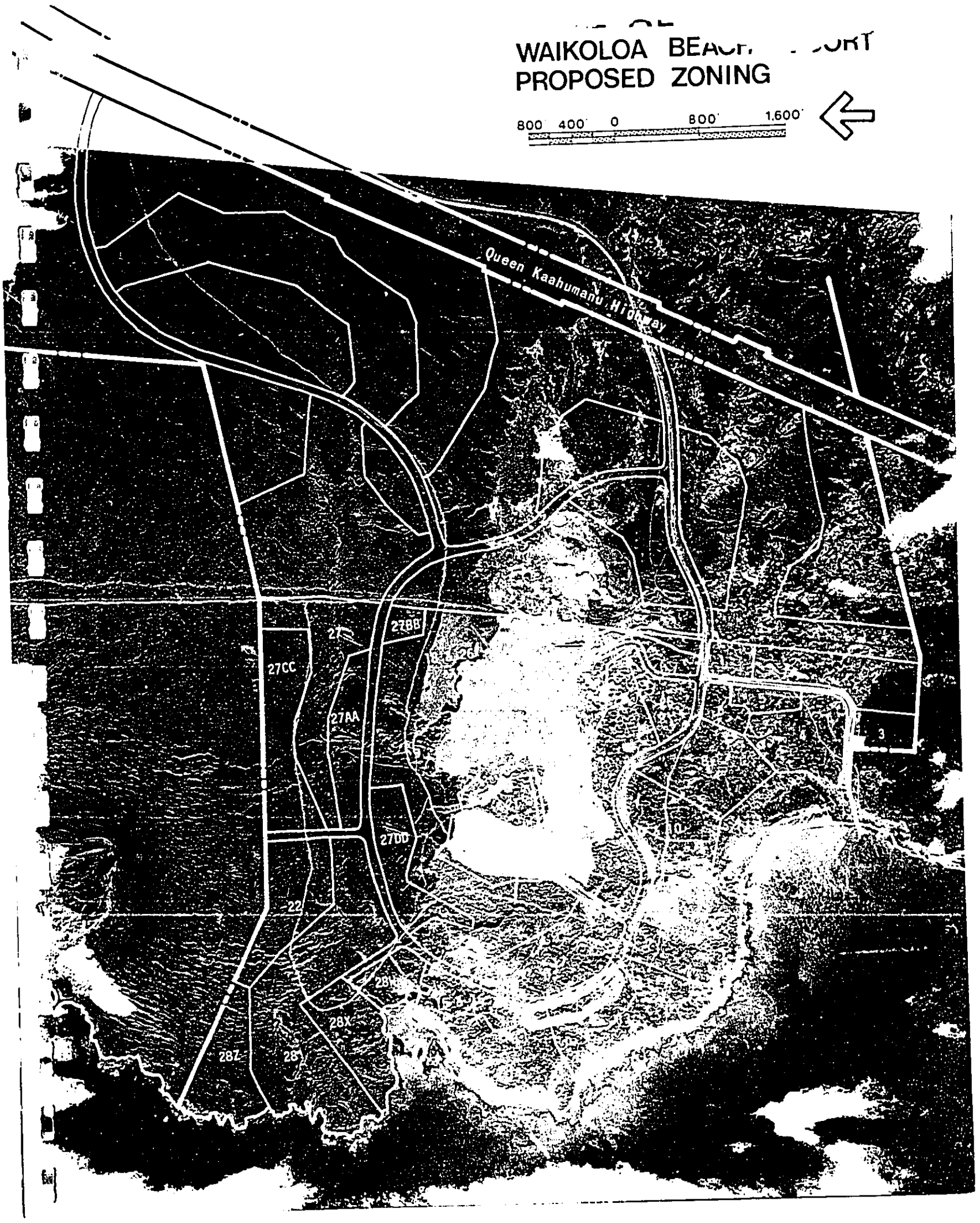
The Increments One and Two areas of the WBR were rezoned by the County in 1971 from open to suitable resort uses in conformance with the original development plan. The existing zoning is shown in Figure C and is tabulated in Section II-A, Location. The area mauka of the King's Trail is designated unplanned.

The Relationship of the Proposed Action to the Existing County Zoning

The initial Step 1A development of the resort area will not require rezoning for the establishment of the hotel, beach park or access road, but it will require a zoning shift of certain multi-family zoned areas to accomplish an improved realignment of the golf course. The golf course can be placed in the new alignment without a zoning shift, as golf course is an acceptable use in all the zoned areas. However, the multi-family areas cannot be equally interchanged. Therefore, it will be necessary to shift the zoning as shown in Figure AK.

Increments One and Two will follow the recommended zoning as shown in Figures AK and AL. Table III-A.1 shows how each individual parcel acreage will change and how the total acreage in each zoning designation will remain the same as in the original resort zoning.

Increment Three will require rezoning. This will be sought some time during the development of Increment One and only if the State redesignates the area urban. The exact configuration is not known at this time but it will probably consist of at least 160 acres of additional open to accommodate an additional 18-hole golf course. Experience in other resort areas has shown that one 18-hole golf course will not be sufficient. This will be abutted by additional multi-family zoning which when added to the 171.5 acres in Increments One and Two will not exceed the maximum of 640 acres allowed by the County General Plan.


WAIKOLOA BEACH RESORT
PROPOSED ZONING
800' 400' 0 800' 1,600'
Queen Kaahumanu Highway
27BB
27CC
27AA
27DD
28X
28Z

5. The Kohala Community Development Plan

The County of Hawai'i General Plan, adopted in 1971, mandated the development of detailed plans for the various sub-area of the County of Hawai'i. Such a plan is now being made for the Kohala region, of which WBR is a part. This plan, called the Kohala Community Development Plan, is being developed in conjunction with the County Planning Department and a group of consultants headed by Environmental Communications, Inc. The report has not yet been finished, and no part of it has been adopted by the County. Boise's staff is carefully following the public development of the community development plan and will attempt to resolve issues as they arise.

Table III-A.1: Existing and Proposed Zoning for Increments One and Two of the WBR

Development Area Land Use	Parcel #	Zone	Acreage under Existing Zoning	Acreage under Proposed Zoning	Change in Acreage
Hotel	4	V-1.25	13.0	12.8	- .2
	8	V-1.25	15.7	15.7	0
	9 & 10	V-1.25	15.1	15.1	0
	12	V-1.25	18.8	18.8	0
	14	V-1.25	18.9	18.9	0
	28X	V-1.25	11.0	11.0	0
SUB-TOTAL			92.5	92.3	- .2
Multi-family	2	RM-1.5	11.5	13.5	+ 2.0
	5	RM-1.5	3.1	3.2	+ .1
	13	RM-1.5	20.7	20.7	0
	16	RM-1.5	.9	*	- .9
	17	RM-1.5	14.1	17.5	+ 3.4
	19	RM-1.5	8.4	11.4	+ 3.0
	20	RM-1.5	10.6	11.0	+ .4
	23	RM-1.5	5.2	8.5	+ 3.3
	24	RM-1.5	11.8	8.7	- 3.1
	27DD	RM-1.5	22.3	13.0	- 9.3
	28W	RM-1.5	6.1	7.0	+ .9
	28Z	RM-1.5	14.2	13.3	- .9
Sub Sub-Total			128.9	127.8	- 1.1
	22	RM-3.0	1.5	16.4	+14.9
	27AA	RM-3.0	37.1	9.6	-27.5
	27CC	RM-3.0	4.0	16.6	+12.6
Sub Sub-Total			42.6	42.6	- 0 -
SUB-TOTAL			171.5	170.4	- 1.1
Commercial	1	CV-10	3.2	3.3	+ .1
	7	CV-10	1.0	2.1	+ 1.1
Change	25	CV-10	11.9	10.7	- 1.2
	27BB	CV-10	3.1	3.1	0
SUB-TOTAL			19.2	19.2	0
Open Beach	11	0	16.3	16.3	0
Public Parking	3	0	5.2	5.0	- .2
Camel	6	0	1.7	3.4	+ 1.7
Marina	15*	0	5.1	5.9	+ .8
Cave Complex	21	0	2.7	5.5	+ 2.8
Golf Course	18	0	24.1		
	26	0	75.7	158.1	- 1.9
	28	0	21.4		
	27	0	38.8		
Roads	Roads	0	27.4	25.5	- 1.9
SUB-TOTAL			218.4	219.7	+ 1.3
GRAND TOTAL			501.6	501.6	0

*Parcel 16 is incorporated into the small boat harbor Parcel No. 15.

III. The Relationship of the Proposed Action to Land Use Plans, Policies and Controls for the Area

B. POLICIES AND CONTROLS*

1. Water Quality Control

The Federal Water Pollution Control Act, 1972.

The purpose of this Act is to restore and maintain the chemical, physical and biological integrity of the nation's waters. This Act will come into effect when permits to dredge the small boat harbor are sought from the Army Corps of Engineers. Originally the Corps' permit was required under the Rivers and Harbors Act of 1899 which was limited to a narrow interpretation of the navigable waters as "waters of the United States. The FWPCA defines navigable waters as "waters of the United States".

Chapter 37 and 37-A of the Rules and Regulations of the State Department of Health.

Chapter 37 establishes the policy to conserve and improve the waters of the State, except where justifiable as a result of necessary economic or social development.

Chapter 37-A establishes water quality standards for the State. The water area adjacent to WBR are classified "AA" waters. "The uses to be protected in this class of waters are oceanographic research, the support and propagation of shellfish and other marine life, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment".

It is the objective of this class of waters that they remain in as nearly their natural, pristine state as possible with an absolute minimum of pollution from any source. To the extent possible, the wilderness character of such areas shall be protected. No zones of mixing will be permitted in these waters.

"The classification of any water area as Class AA shall not preclude other uses of such waters compatible with these objectives and in conformance with the standards applicable to them."**

A specific analysis of the impact of the WBR on the Class AA waters is shown in Section IV-B, Impact on Water Resources.

Chapter 38 of the Rules and Regulations of the State Department of Health establishes minimum standards regarding sewage treatment and disposal systems. WBR's sewage treatment system, described in Section I-E.3, Sewerage System, conforms to these regulations.

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*Source: Belt, Collins and Associates, Ltd.
**Public Health Regulation Chapter 37-A, Page 2.

2. Air Quality Control

The Federal Clean Air Act of 1970 established two types of standards: national ambient air quality standards and new source performance standards. These standards are enforced by both the State and Federal Government.

Chapters 42 and 43 of the State Department of Health Rules and Regulations coincide with the Federal Standards.

The primary impact on air quality by WBR will be in the form of emissions from internal combustion engines required to operate motor vehicles, and from dust generated by construction activities. This will be dealt with in Section IV-C, Airborne Emissions.

3. Solid Waste Control

Chapter 46 of the State Department of Health Rules and Regulations establishes minimum standards governing the design and operation of solid waste disposal systems.

To date the requirement for waste disposal has been met by a sanitary land fill site at Waikoloa, south of Pu'u Hina'i on the north Kona-South Kohala boundary. As the WBR develops, Boise plans to either construct a new makai solid waste disposal site in a natural depression in the Boise quarry site mauka of Queen Ka'ahumanu Highway, (The operation of the site would conform to the State and County requirements for solid waste disposal) or as an alternative possibly using the Puako dumpsite or the one planned for Waimea. A regional sanitary land fill will also be installed at Ahualoa in Hamakua and it will serve both North and South Kohala.

4. Shoreline Protection

Rules and Regulations Relating to the Interim Coastal Zone Management of the County of Hawai'i.

Act 176 of the Session Laws of the State of Hawai'i 1975 mandated the counties of the State to protect the natural resources of the coastal zone of Hawai'i until a general State coastal zone management program is developed.

On December 1, 1975, the County of Hawai'i put into effect Rule No. 9 "Rules and Regulations Relating to the Interim Coastal Zone Management." At the same time the County designated the extent of the special management area to be administered under the rules and regulations. For the 'Anaeho'omalu area the mauka limit of the special management area is set at Queen Ka'ahumanu Highway. Therefore, the entire WBR development area is within the management area.

Generally, the purpose of the Act is to preserve, protect and where possible to restore the natural resources of the coastal zone of Hawai'i.

In order to measure the proposed development against the Rule 9

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In order to measure the proposed development against the Rule 9

guidelines, each of the general issues will be briefly examined below:

Public Access And Recreation Area.

The white sand beach area of 'Anaeho'omalu Bay is included in an 11-acre open zoned beach park open to the public. Until roads were constructed by Boise, this beach was accessible only by boat or by a rugged hike over very rough terrain. A public beach facility and parking have already been constructed at the developer's cost. A walking trail open to the public is planned for the entire length of the shoreline with public access points at the public beach facility, at Waiulua Bay and from each side of the adjacent coastal parcels within the WBR.

Wildlife Preserves.

The two major fishponds, Ku'uali'i and Kahapapa, have been designated a conservation district by the State and are therefore protected. The remaining small tidal pools that are strung along the coast from the large ponds to the Kaniku lava flow will be dealt with by preserving the ponds in the required 40' set back and in preserving selected concentrations as shown in Section IV-E concerning the biological impacts of the resort development. Some ponds, however, will be lost. It is virtually impossible to build on the resort hotel parcels 12 and 14 and multi-family parcel 13 without covering some of the ponds. Every effort is being made to design the facilities around the ponds. Some of the ponds at the head of Waiulua Bay and Waiulua Bay may be dredged for construction of a small boat harbor.

Provisions for Solid and Liquid Waste Removal.

The entire resort area will be serviced by a sewage treatment system which lifts the untreated sewage to a treatment station mauka of the Queen's Highway and then uses the treated effluent to irrigate the golf course, thereby conserving potable water, a scarce resource in the Kohala area. Solid waste disposal will be to a County approved site as described above. The irrigation system is described in Section I, the irrigation system impact on coastal water quality is examined in detail in Section IV-B, Impact on Water Resources.

Alteration to Existing Land Forms and Vegetation.

Due to the flat topography, minimum rainfall and youth of the lava ground surface, the danger of floods, landslides, erosion or siltation is minimal. A large portion of the lava has already been graded without noticeable effect on the quality of the surrounding water. Ground subsidence or failure in the event of earthquake, however, is something that cannot be avoided. All structures will be designed to current seismic construction standards.

The existing vegetation around the fishponds and along the shoreline will be selectively reinforced with as nearly indigenous plantings as is possible. Other areas now barren lava will be landscaped.

The Cumulative Impact of Individual Developments.

The cumulative effects development Increments One and Two have on water quality will be examined in Section IV-B, Impact on Water Resources. The additional effects of the future third increment of development will be examined at the time of its inception.

Dredging and Filling Water Areas.

As stated above, some small ponds will be lost during the building construction. The small boat harbor will require dredging Waiulua Bay and some adjacent ponds.

Reduction of Public Access to Tidal Lands.

As stated above, public access to tidal lands will be improved.

Interference with Existing Makai Line of Sight from the Queen Ka'ahumanu Highway.

The County height limitation and existing topography will minimize the visual impact of the development from Queen Ka'ahumanu Highway. Section IV-G, Visual Character, examines this issue in detail.

Degradation of Water Quality.

As noted above, the impact on water quality is examined in Section IV-B, Impact on Water Resources.

5. Shoreline Setback

Hawai'i Revised Statutes CA 205, Part II, Shoreline Setbacks, establishes shoreline development setbacks throughout the State at 40 feet inland above the upper reaches of the wash of waves other than storm and tidal waves. The County of Hawai'i requires the shoreline to be located and platted by instrument surveys, and to be confirmed by the Chairman of the Board of Land and Natural Resources. Plans showing the location of a shoreline by a registered land surveyor are required to be based upon actual field surveys conducted within six months prior to filing of the application for any construction relative to lands adjacent to the shoreline.

The County of Hawai'i through ordinance may require that shoreline setback lines be set at more than 40' depending on the nature of the shoreline project.

6. Public Access to Beaches

Four State laws address this issue. The purpose of the laws are to insure public access to public recreational areas.

WBR complies with these laws by designating a public parking area and beach facility and by providing public access to the entire beach area via a system of walkways.

7. Regulation of Shore and Water Activities

Hawai'i Revised Statutes 266-1 through 266-3 designates the State Department of Transportation as manager of all ocean shores below the mean high water mark and all shore waters. The purpose is to promote public safety, health and welfare in shore waters.

8. Historic Preservations

The Historic Preservation Program of the State and County comes from a variety of State and Federal legislation. Its purpose is the preservation and restoration of historical areas, building and sites. Specific measures taken at WBR to conform to this purpose are shown in Section IV-F, Impact on Archaeological Sites.

9. Flood Disaster Protection

The U.S. Flood Disaster Protection Act of 1973 will institute a flood plan management system for all areas subject to flooding from rivers, streams and coastal flooding from unusual storm wave action or tsunami. The flood hazard boundaries are in the process of being updated by the U.S. Corps of Engineers. The flood hazard area map for the Puako-'Anaeho'omalu area, prepared by the Corps of Engineers in 1973, (see "100-year tsunami inundation line" shown in Figure AA) assumes a 100-year tsunami height of 15 feet at the shoreline for the entire area. This height decreases one foot for every 100 feet inland. All inhabitable portions of new construction in areas susceptible to flooding or in coastal high hazard areas must be flood proofed or elevated to a level which places it above the anticipated high water level.

Means of dealing with tsunami inundation will be to develop all inhabitable portions of structures above a tsunami high water line developed in Section II-B.7, Near Shore Physical Oceanography.

IV. Probable Impact of the Proposed Action on the Environment

A. LAND TRANSFORMATION AND CONSTRUCTION*

1. Extent of Developed Area

Step 1A of Increment One of the WBR, including such uses as the access road, certain archaeological sites, temporary construction yard, project nursery and a portion of the first 18-hole golf course in the zoned, unplanned, Increment Three area (approximately 63 acres), will encompass a gross land area of approximately 285 acres. This includes the first hotel, an 18-hole golf course, all required support facilities, additional archaeological sites, the beach area, landscaping and a portion of the offsite improvements serving four additional hotel sites, six multi-family sites and commercial sites.

The remainder of Increment One will add approximately another 167 acres to the development. This will include the possible development on the four additional hotel sites, six multi-family sites and commercial sites mentioned above.

Increment Two will add approximately 282 acres, bringing the total development to 734 acres. Increment Two will include one hotel site and eight multi-family sites and a possible second 18-hole golf course, (160 acres), located in the development area of Increment Three.

Increment Three, approximately 802 acres will be developed from the King's Trail mauka to the Queen Ka'ahumanu Highway. This area will include a possible second 18-hole golf course of approximately 160 acres mentioned above. Since zoning for Increment Three will not be requested until some time after Step 1A, other than the second golf course, it will not be treated further in this EIS. The timing of the application for rezoning for Increment Three will depend on demand for golf play at the resort.

A breakdown of the acreage of each increment is shown in Table IV-A.1. The figures are based on the designs for facilities to be included in Step 1A. However, for later increments, the coverage is based on maximum figures likely to be reached if the areas are designed to the maximum of a total of 3,000 hotel rooms and a maximum overall multi-family density of 20 units per acre.

The acreage breakdown for the development through Increment Two shows the intended character of the resort development. The building and paving coverage will be approximately 25 per cent. If the individual site designers choose to place the parking under the buildings, this would potentially reduce the coverage to 18 per cent. This leaves 75 to 82 per cent of the site open. It is estimated that about three-fourths of this open space will be landscaped.

As a basis of comparison, a well-designed single-family dwelling subdivision is about 30 per cent open space, 40 to 45 per cent in paved

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*Source: Belt, Collins and Associates, Ltd.

areas including major access roads, and 25 to 30 per cent in building; a similar multi-family dwelling development is 50 per cent open, 30 per cent paved, and 20 per cent in biuldings. (These figures are based on existing developments in Mililani Town on O'ahu.)

2. Extent of Earthwork

The task of rough grading for building pads, roadways, and landscaped areas will probably be more difficult on pahoehoe lava than on 'a'a. Although the surface of pahoehoe is generally smoother, reshaping it poses several problems.

In some places the lava may be too tough to be bladed or ripped by bulldozer or graders, there are many bulbous upheavals and depressions and there are a number of lava tubes, some that have already collapsed but undoubtedly many more that will collapse under the weight of earth-moving equipment.

In contrast, the 'a'a surface is extremely jagged and difficult to traverse on foot but is easily shaped by medium-to-heavy bulldozers to at least the depth of the clinker layer. The clinker can be crushed to a smooth, albeit extremely porous, cobble surface.

The source of fill material is the Boise quarry (quarry located on Boise property). Travel distance from the quarry is approximately three miles, of which one mile is on the Queen Ka'ahumanu Highway.

To give some idea of the probable extent of total material that may be brought in from the Boise quarry, it is assumed that an average of six inches of fill will be necessary for buildings and pavement and four to six inches of choker fill for landscaped areas will be necessary.

Using the development areas in Table IV-A.1, the extent of imported material will be shown in Table IV-A.2. About 393,000 cubic yards of fill will be brought down from the Boise quarry.

3. Imported-Soil Requirement

All soils for landscaped areas will have to be imported. A cinder ash mix of 50 per cent cinder and 50 per cent ash is available from the Boise quarry and from the Parker Ranch/Shield Pacific Quarry in the Saddle Road area.

Preliminary planning for the golf course and landscaping areas has been based on using the cinder-ash mix in a 12-inch layer. A total of about 575,000 cubic yards of material will be used for the golf course and landscaped areas.

4. Other Required Construction Materials

Asphalt cement (AC) for roads and cart paths will be obtained from the hot-mix plant at the Boise quarry. The required quantity of asphaltic concrete can be approximated using the areas given in Table IV-A.1 and the assumptions that the AC wearing surface for roads will be two

inches thick and the asphalt cart paths will average four inches in thickness. Based on these assumptions, approximately 6,760 cubic yards of hot mix will be required for Step 1A. A total of approximately 41,170 cubic yards of hot mix will be required to complete Increments One and Two of the development.

It is expected that the construction of the development will be primarily concrete for the hotel buildings and wood frame on a concrete foundation for the residential units. The concrete required for the residential units can be approximated by assuming the equivalent to an eight inch concrete slab covering the entire building ground area. The concrete required for each hotel is approximated using a factor of 24 cubic yards per room. This factor estimates the room at 500 square feet, 200 square feet of circulation and 200 square feet of accessory uses enclosed with eight inches CMU on a six inch slab. The total concrete requirement is 129,000 cubic yards for the project through Increment Two. It will all be obtained from the batch plant at Boise's quarry.

Other construction materials--lumber and steel for example--will probably be brought in on barges to Kawaihae Harbor and then trucked to the site. Estimates of the quantities of these materials have not been made.

Table IV-A.1

LAND TRANSFORMATION

Land Use	Lot #	Gross Area Acres	Max. # Units	Estimated Building Coverage	Estimated Parking Coverage Car	Estimated Parking Coverage Bus	Estimated Road & Misc. Coverage	Estimated Path & Rec. Area Coverage	Total Covered Area Acres	Landscaped Area Acres	Unaltered Open Space Acres
Step IA of Increment I											
Hotel	12	18.8	350	2.60	2.04	.09	.45	1.11	6.29	7.34	5.08
Temp. Clubhouse	7	2.1		.80	.70		.10		1.60	.50	
Golf Course (Initial 18-holes)	18, 26, 27, 28 and Unplanned	175.5						.41	.41	142.70	32.39
Beach and Fishponds	11	16.3						.40	.40	6.00	9.90
Public Parking	3	5.0			.55		.10		.65	1.00	3.35
Camel Area	6	3.4						.01	.01	1.69	1.70
Burial Cave	21	5.5						.20	.20	2.50	2.80
Petroglyph Field	Unplanned	5.0						.20	.20	4.80	
King's Trail	Unplanned	20.0									20.00
Temporary Project Nursery	Unplanned	5.0			.10		.10		.20	4.80	
Temp. Proj. Constr. Yard	Unplanned	7.1			1.00		4.10		5.10	2.00	
Access Road	Unplanned	7.9					1.65		1.65		6.25
Onsite Roads	Roads	13.6					4.34	2.52	6.86	6.74	
Sub Total		285.2		3.40	4.39	.09	10.84	4.85	23.57	180.16	81.47
Remainder of Increment I											
Hotel	12	***	88								
Hotel	4	12.8	420	2.90	1.77	.09	.20	.65	5.61	5.00	2.19
Hotel	8	15.7	510	3.50	2.16	.11	.20	.79	6.76	6.00	2.94
Hotel	9-10	15.1	490	3.40	2.07	.11	.20	.76	6.54	6.00	2.56
Hotel	14	18.9	610	4.20	2.58	.14	.20	.95	8.07	7.00	3.83
Multi-family	13, 17, 20, 24, 2, 5	74.6	1,665	23.00	18.95		2.40	3.79	48.14	20.00	6.46
Commercial	25	10.7	90,000 S.F.	3.00	4.10		.20	.90	8.20	.80	1.70
Commercial	1	3.3	6,000 S.F.	.50	.27		.20	.39	1.36	1.54	.40
Temp. Hotel Employee Parking	(2)	*14.2			*11.30		* .20		*11.50	* 1.00	* 1.70
Onsite Roads	Roads	9.9					3.00	.25	3.25	6.65	
Small Boat Harbor	15 & 16	5.9			.27		.10	.30	.67	.23	5.00
Sub Total		166.9		40.50	32.17	.45	6.70	8.78	88.60	53.22	25.08
Increment II											
Hotel	28X	11.0	360	2.50	1.52	.09	.40	.55	5.06	4.00	1.94
Multi-family	23, 22, 28, 19, 27AA, 28Z, 27DD 26CC	95.8	1,765	24.30	20.10		3.20	2.40	50.00	30.00	15.80
Commercial	25 & 1	14.0	33,000 S.F.	1.02	1.00				2.02	.08	(2.10)
Golf Course (2nd 18-holes)	Unplanned	160 +			1.28		.20	.41	1.89	150 +	8.11
Perm. Clubhouse	27BB	3.1		1.00	.90		.20		2.10	.20	.80
Roads	Roads	2.0					.77	.24	1.01	.99	
Delete Temp. Const. Yard**		(7.1)			(1.00)		(4.10)		(5.10)	(2.00)	
Perm. Hotel Employee Parking	Unplanned	17.0			12.72	2.00	1.00		15.72	1.28	
Sub Total		281.8		28.82	36.52	2.09	1.67	3.60	72.70	184.55	24.55
TOTALS		733.9		72.72	73.08	2.63	19.21	17.23	184.87	417.93	131.10
		100%							25%	56%	19%

All area/coverage figures are in acres.
*Not Included in Totals - Temp. use of Multi-family Lot 2.
**7.1 temp. construction yard becomes part of perm. hotel employee parking.

Table IV-A.2: Material Requirements

	Total Required cu yds	Buildings Depth (ft)	Buildings Volume (cu yds)	Parking & Access Road Paving Depth (ft)	Parking & Access Road Paving Volume (cu yds)	Path Paving Depth (ft)	Path Paving Volume (cu yds)	Landscaping Area Depth (ft)	Landscaping Volume (cu yds)
Step 1 of Increment I									
Fill	118,840	6"	2,860	6"	13,440			4'-6"	102,540
Soil Mix	246,480							12"	246,480
(AC) Asphaltic Concrete	6,760			2"	4,460	4"	2,300		
Concrete	9,000		9,000						
Increment I Remainder									
Fill	116,370	6"	34,440	6"	43,250			4'-6"	38,680
Soil Mix	92,990							12"	92,990
(AC) Asphaltic Concrete	20,240			2"	14,350	4"	5,890		
Concrete	84,400		84,400						
Increment II									
Fill	157,790	6"	23,150	6"	36,280			4'-6"	98,360
Soil Mix	236,430							12"	236,430
(AC) Asphaltic Concrete	14,170			2"	12,050	4"	2,120		
Concrete	36,500		36,500						
Total Project Increments I and II									
Fill	393,000	6"	60,450	6"	92,970			4'-6"	239,580
Soil Mix	575,900							12"	575,900
(AC) Asphaltic Concrete	41,170			2"	30,860	4"	10,310		
Concrete	129,000		129,000						

B. IMPACT ON WATER RESOURCES

1. Domestic Water Supply*

In Section I-E.1, Domestic Water Systems, the total potable water demand for the Waikoloa Village and the WBR Increments One and Two at 100 per cent occupancy in shown at 8.6 MGD and at the estimated occupancy rate, 4.9 MGD.

According to Bowles (MS.a), the ground water storage in the Waikoloa aquifer is greater than 100,000 million gallons and the subterranean flow through the aquifer in the vicinity of the existing wells is on the order of 3 to 5 MGD.

In addition, hydrogeological studies (Bowles MS.a) and well pumpage tests have shown that groundwater flow into the Waikoloa wells could be increased by drawing down the water level. Such draw down would work to the benefit of the Waikoloa aquifer in two ways:

> As the water level in the aquifer is lowered, the "differential head pressure" of the waters flowing from the mountains is increased, thus increasing the flow rate.
>
> As the water level in the aquifer is lowered, the pressure on barriers seaward of the wells is decreased, thus decreasing the loss of water by leaks to the sea through the barrier.

Bowles also concludes that the thickness of the fresh water lens is 600 feet, and that the seaward boundary of the Waikoloa aquifer lies between Parker Well 1 at the 813 foot elevation and Parker Well 4 at the 1,203 foot elevation.

The subterranean flow through the system should be sufficient to handle the estimated average potable water requirements. However, if the demand ever exceeds the flow rate, it could be drawn from the 100,000 million gallon storage. In addition, water from the Waikoloa aquifer at 25 PPM CL could be mixed with water at the 800 foot elevation (Location of Parker 1) with 500 PPM CL. Two parts 25 PPM with one part 500 PPM equals 3 parts of 180 PPM. This means that 4.0 MGD from the Waikoloa aquifer mixed with 2.0 MGD from the basal lens at the 800 foot elevation would yield 6.0 MGD of potable domestic water. If the demand did in fact reach 100 per cent occupancy and mixing was considered, only 2.6 MGD would have to be drawn from the aquifer storage. Assuming it was possible to pump the aquifer dry, at 2.6 MGD there is a 385 year supply.

Contamination of the Waikoloa Aquifer by treated effluent, fertilization, pesticides, herbicides and other polluted water is not visualized because: 1) A hydrologic barrier exists between Parker Well 1 and Well 4 which are respectively, at ground elevations 813 and 1,203 feet;

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*Sources: J. H. K. Tanaka, Inc.; Belt, Collins and Associates, Ltd.

have salinity contents of 500 ppm and 25 ppm; and are located about 3.2 miles and 6.2 miles from the coastline. 2) Contamination, if it is to occur, would be to the brackish water lens along the coastline.

Land uses proposed for Boise land overlying the Waikoloa aquifer are unlikely to produce any significant impact on the ground water resources of the area. Most pesticides, herbicides, fertilizers and septic tank effluent from the improved property would be contained within the top soil. Considering the thickness of the section through which these contaminants must pass before reaching the aquifer, it is fair to say that their impact upon the quality of water in the aquifer will be extremely small.

2. Impact on Basal Groundwater*

Data and calculations in this section will attempt to quantify the impact of resort activities on basal groundwater. It has been pointed out in Section II, Description of Environmental Setting, that the groundwater beneath the site is not potable due to the presence of ocean salts mixed into it. This brackish water must still be considered as a significant natural resource, however, because it is the primary water supply for the two large brackish fishponds at 'Anaeho'omalu Bay and the 80± smaller water holes along the coast to the north. The chloride ion concentration in Ku'uali'i fishpond suggests that its surface waters are just 10 to 20 per cent seawater, the balance being "fresh" groundwater. This figure is probably quite representative of most of the water features within the WBR site. Any significant alterations of the groundwater system may result in changes in the marine communities in the ponds and water holes. The discussion to follow on possible changes to the groundwater is in two parts; the first deals with quantities of basal flow and the second considers potential chemical constituent changes.

Changes in the Quantity of Basal Water Moving to the Shoreline

Resort activities which will significantly influence the basal flowrate are irrigation of the golf courses and irrigation of other landscaped areas. Depending on the design of hotels' central air conditioning systems, i.e., if the basal lens is used as the source of cooling water, these may have a large impact also.** Of lesser effect on the flowrate will be possible leakage losses from water and sewerage lines and changes in onsite rainfall recharge due to the creation of impervious surfaces. Only the significant impacts will be considered here.

Golf Course Irrigation:

Plans call for an 18-hole golf course having 143 landscaped acres in the Step 1A development, and a second 18-hole, 150 landscaped acre course in Increment Two. A mixture of brackish water from shallow, onsite wells and potable water from the domestic distribution system will provide the irrigation water initially. Then, as effluent from the resort's sewage treatment plant becomes available, it will be used for irrigation, allowing the use of potable and brackish water to be correspondingly reduced. The rates of irrigation use of the three different water sources were discussed in Section I-E.2, Golf Course and Landscape Irrigation System, they are summarized in Table IV-B.1.

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*Source: Belt, Collins and Associates, Ltd.

**The hotel for Lot 12 specifies a recirculating system using cooling towers. Therefore, the impact on the basal water from air conditioning will be minimal.

Table IV-B.1 GOLF COURSE IRRIGATION SOURCES AND RATES OF USAGE

Development Stage	Treated Sewage Effluent (MGD)	Brackish Well Water (MGD)	Potable (Domestic) Water (MGD)	Total (MGD)
Prior to Step 1A	--	0.485	0.485	0.970
End of Step 1A	0.154	0.552	0.398	1.005
End of Incr. I	1.282*	--	--	1.006
End of Incr. II (full development with two golf courses)	1.706	0.319	--	2.026

*Excess sewage effluent not needed for golf course irrigation will be used for irrigating landscaping of common areas on roadways and of developments adjacent to the golf course.

If it is assumed that about 5 per cent of the irrigation water percolates through the soil layer to the basal lens, then the net impact on basal flowrate due to the maintenance of the golf courses would be as shown in Table IV-B.2. It should be cautioned that the 5 per cent percolation rate is just an order of magnitude estimate. As will be evident on examining the table, however, the increase in flowrate due to percolation is relatively small compared to the decrease in flowrate due to withdrawals from onsite wells. Thus the fact that the estimate of percolation is rather crude is of little significance.

Table IV-B.2 CHANGE IN BASAL FLOWRATE DUE TO GOLF COURSE IRRIGATION

Development Stage	Increase in Flowrate Due to Irrigation Percolate (MGD)	Decrease in Flowrate Due to Well Withdrawals (MGD)	Net Change (MGD)
Prior to Step 1A Hotel occupancy	0.049	0.485	-0.436
End of Step 1A	0.050	0.552	-0.502
End of Incr. I	0.050	--	+0.050
End of Incr. II	0.101	0.319	-0.218

Irrigation in Other Landscaped Areas:

Irrigation requirements for other landscaped areas were presented in

Section I-E-2 (Table IV-B.3). Water for this irrigation will come entirely from the domestic distribution system unless an excess of sewage effluent over golf course needs exists; in that case, the excess effluent may be used instead of potable water. Since no basal water will be used, the basal flowrate will be increased by the amount of percolating irrigation water. Based on the assumed 5 per cent percolation rate, this effect will be of relatively little significance.

Table IV-B.3 INCREASE IN BASAL FLOWRATE FROM PERCOLATING IRRIGATION WATER IN AREAS OUTSIDE OF THE GOLF COURSE

Development Stage	Total Irrigation Water Applied (MGD)	Net Irrigation Water Percolating to the Basal Lens (MGD)
Step 1A	0.187	0.009
Increment I	0.417	0.021
Increment II	0.634	0.032

Air Conditioning Chillers:

Probably most of the hotels will have central air conditioning systems, some of which may utilize basal water for cooling the chillers. A system for a single hotel might use up to 1,000,000 gpd and heat the water about 10°F. before expelling it via an injection well, surface infiltration, or a coastal outfall (figures from Derek Cockle at the Mauna Kea Beach Hotel). With six hotel sites in the WBR, the potential impact on basal flowrate is obviously very great.*

Withdrawals of this magnigude would draw ocean salts into the basal lens. The effect could be localized, however, if the cooling wells supplying the water were located as near to the shoreline as possible and if the pump bowls in the wells were placed relatively deep, say at 40 feet below sea level. The trade-off would be more saline water from the wells in exchange for maintaining the present salinity of the water at the top of the basal lens. These measures would be much more critical where cooling systems will be in close proximity to significant ponds or waterholes, particularly if they are directly inland from these features.

It should be pointed out that it is likely that no brackish water cooling systems will be used. The brackish water of the basal lens is corrosive, and even the best of current designs have not completely surmounted this problem yet. The Mauna Kea Beach Hotel, for example, is in the process of switching from a brackish system to a recirculat-

*The hotel for Lot 12 specifies a recirculating system using cooling towers. Therefore, the impact on the basal water from air conditioning for that hotel will be minimal.

ing one using potable water and a cooling tower. The experience at this hotel will undoubtedly influence designers of the WBR hotels.*

Domestic Water Withdrawals from the Inland Waikoloa Aquifer:

Ultimately, the WBR will consume about 2.5 MGD of potable water, all of it coming from deep wells tapping the inland, high level Waikoloa aquifer. The relationship of such withdrawals to the basal lens flowrate is not known.

Interpretation of the Changes to Basal Flowrate:

The WBR site covers approximately 1.6 miles of the South Kohala coastline. Based on the results of the various methods of approximating the total basal flowrate that were presented in Section II, 2.5 mgd discharge per mile of coastline is a reasonable, order of magnitude estimate of the basal flowrate. This means that approximately 4.0 mgd of basal water discharges along the shoreline between Waiulua and 'Anaeho'omalu Bays.

If air conditioning wells** are located and designed with sensitivity to the various surface water features near the coast, then the primary impact on basal flowrate will come from landscape irrigation. The Step 1A net irrigation withdrawal of about 0.4 to 0.5 mgd (Tables IV-B.1 and IV-B.3) would be 10 to 13 per cent of the total flow, and could conceivably result in marginally higher salinities in some of the shoreline ponds and pools. During the latter part of the Increment One stage of development, the increased availability of treated sewage effluent will result in a very minor net recharge to the basal lens; at the end of Increment One, recharge will be 0.05 mgd, a 1 per cent increase in basal flowrate. With the installation of the second golf course, withdrawals will again exceed recharge; the projected net withdrawal of 0.186 mgd would produce a 5 per cent decrease in basal flowrate.

The pools and ponds on the WBR site have been termed "anchialine" by Maciolek and Brock (1972) to mean that they have waters of measurable salinity and show tidal surface level fluctuations. New species of crustaceans and other unusual aquatic life forms were discovered in the pools, so these water features must be considered a valuable natural resource. (A fuller description of them can be found in Section II). However, the projected basal flowrate changes due to landscape irrigation are not likely to threaten the viability of these anchialine ecosystems. The aquatic species of the anchialine systems are adapted to relatively wide salinity differences occurring from natural causes so they should not be adversely affected by a minor salinity

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*The hotel for Lot 12 specified a recirculating system using cooling towers. Therefore, the impact on the basal water from air conditioning for the hotel will be minimal.

**Air conditioning wells may not be needed if recirculating systems are used.

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*The hotel for Lot 12 specified a recirculating system using cooling towers. Therefore, the impact on the basal water from air conditioning for the hotel will be minimal.

**Air conditioning wells may not be needed if recirculating systems are used.

increase or decrease due to irrigation.

Changes to the Quality of Basal Water Moving to the Shoreline

To project changes to basal water quality, a number of processes must be considered: the rate and types of fertilizing used on landscaped areas and a determination of the fraction of these minerals that will leach from the soil layer down into the basal lens; the use of pesticides and herbicides for landscaped areas and their stability and leaching potential; reuse of treated sewage effluent for irrigation; and possible seepage of raw sewage from collecting mains. Some of the inputs to the basal lens by these processes--most of the dissolved solids, for example--need not be considered because their possible effect on anchialine and marine ecosystems is nil. The classes of constituents that do have a potential impact are: (1) nitrogen and phosphorous, generally the most critical nutrients for promoting aquatic primary productivity (potassium, the other major nutrient, is already relatively abundant in the anchialine and coastal waters); (2) bacteria and viruses; and (3) herbicides and pesticides, particularly chlorinated hydrocarbons.

Possible Nutrient Sources

Table IV-B.4 shows the nutrient requirements for the golf course and other landscaped areas of the WBR. The figures come from several sources: Beard 1973; Land Study Bureau 1965; Claude Jenkins of Waikoloa; Guido Giacommetti and Marshall Inn of Kamehameha Development Corp., and landscape architects of Belt, Collins and Associates, Ltd. The figures are a compromise between rates recommended in turfgrass literature and the generally lower application rates reported for the Waikoloa and Keauhou landscape management programs.

Nutrient requirements for landscaping will be met initially by fertilizing. As the development progresses and a significant amount of sewage effluent becomes available, however, nutrients in the effluent will decrease the amount of fertilizing required. This is demonstrated in Table IV-B.5 with the previous estimates of effluent quantities and the likely nutrient concentrations in this effluent--15 mg/l nitrogen and 10 mg/l phosphorous (Young & Chan 1970; Engineering Science, Inc. 1972; Pound and Crites 1973).

Seepage of raw sewage from buried collecting mains is also a potential source of nutrients entering the basal lens. The rate of seepage can only be guessed at, but a reasonable order of magnitude loss rate from pipe joints might be 0.5 per cent of the total flow in the mains. The amount of seeped sewage that eventually reaches the basal lens will be less than this, however, due to a "clogging" phenomena. In laboratory experiments, clogging of tap water moving through thin cracks has reduced percolation rates to anywhere from 1/100 to 7/8 of the initial rate (see, for example, Wentworth 1944). In organically enriched water such as raw sewage, suspended solids and slimes are produced by microbial activity on the food supply. Inorganics such as ferrous sulfide are also produced. These have been shown to cause even greater retardation of flow (Ishizaki, Burbank and Lau

Table IV-B.4 NUTRIENT REQUIREMENTS FOR THE GOLF COURSE AND OTHER LANDSCAPED AREAS

	Nitrogen as N	Phosphorous	
		as P_2O_5	as P
Application Rates in lbs/ac/year			
Golf Course	280	70	30
Other Landscaping	150	200	90
Total Applied in lbs/year*			
Step 1A			
Golf Course	33,600	8,400	3,600
Other Landscaping	4,950	6,600	2,970
Increment 1			
Golf Course	33,600	8,400	3,600
Other Landscaping	9,000	12,000	5,400
Increment 2			
Golf Course	64,400	16,100	6,900
Other Landscaping	19,500	26,000	11,700

*Based on landscaping acreages given in Table I-E.3.

Table IV-B.5 NITROGEN AND PHOSPHOROUS QUANTITIES IN SEWAGE EFFLUENT IRRIGATION WATER

Development Stage	Applied on Golf Course		
	Sewage Flowrate (MGD)	Nitrogen (lbs/year)	Phosphorous (lbs/year)
Step 1A	0.154	7,020	4,680
Increment I	0.970	44,240	29,500
Increment II	1.706	77,800	51,900

Development Stage	Applied on Other Landscaping		
	Sewage Flowrate (MGD)	Nitrogen (lbs/year)	Phosphorous (lbs/year)
Step 1A	0.000	--	--
Increment I	0.312	14,230	9,500
Increment II	0.000	--	--

1967). For the calculations that follow it will be assumed that such clogging reduced percolation to the basal lens to one-fifth of the potential seepage from pipe joints--i.e., to 0.10 per cent of total sewage flow in the mains.

The nutrient loading on the basal lens of seeped sewage is thus the total sewage flow multiplied by 0.10 per cent and multiplied again by the respective nitrogen and phosphorous concentrations of raw sewage. The latter values will be on the order of 40 and 10 mg/l, respectively (Engineering Science, Inc. 1972; Pound and Crites 1973). Table IV-B.6

presents these calculations.

Table IV-B.6 ESTIMATED NUTRIENT LOAD IN RAW SEWAGE SEEPAGE FROM COLLECTING MAINS

Development Stage	Average Sewage Flow (gal/day)	Raw Sewage Seepage (gal/day)	Total N Loading (lbs/yr)	Total P Loading (lbs/yr)
Step 1A	154,000	154	19	5
Increment I	1,282,000	1,282	156	39
Increment II	1,706,000	1,706	208	52

Nutrients Actually Reaching the Basal Lens

Nutrients will either be applied to landscaped areas (in fertilizers and treated sewage effluent) or be infiltrated directly to the basal lens (in seeped raw sewage). The first possibility will require some discussion before the true impact of the basal lens is evident; the latter possibility will have a direct impact.

Nutrients applied in landscaped areas have several possible fates: to be taken up as plant tissue; to be combined into insoluble forms and held in the soil matrix; to be leached from the soil with percolating irrigation or storm rainfall water; to be lost to the atmosphere by volatilization (a possibility for nitrogen but not phosphorous); or to be mechanically transported toward the coast via soil erosion. Note that only one of these possibilities--leaching from the soil in percolating water--would impact the basal lens.

The extent of nitrogen leaching--essentially all in the oxidized and very soluble nitrate (NO3) form no matter which form of nitrogen is initially applied--varies greatly with vegetation type, soil texture, soil type, and management practices. It is quite likely that the bermudagrass on the golf course and the soil that will be used have opposite effects. Various lysimeter and potted plant studies in Hawai'i (Lau 1974; Ekern 1974; Ayres and Hagiwara 1963) and on the Mainland (summarized in Lance 1975) indicate that grass, particularly bermudagrass, is a relatively effective nitrogen sink that allows less nitrate leaching than most vegetation. However, the coarse texture of the "volcanite" soil (a 50-50 mixture of volcanic ash and volcanic cinders) is relatively prone to nitrate leaching. Based on findings of the studies noted above, on the relatively small percolation rate that is expected for applied irrigation water, and on the infrequency and low intensity of rainstorms which tend to leach fertilizers in "slugs", it will be assumed that just 10 per cent of nitrogen applied on the golf courses will be leached to the basal lens, and that the figure will be 25 per cent in other landscaped areas. The lower rate for the golf courses is attributed to the extent of grass on the courses and on the presumption that watering and fertilizing will be done with greater care and uniformity there. These assumed leaching rates are considered "safe", meaning that it is not likely that actual nitrate leaching

rates will exceed them.

Leaching of phosphorous is easier to estimate. It has been consistently demonstrated both in Hawai'i (Ayres 1955; Visher and Mink 1964; Takasaki and Valenciano 1969; Tennorio et al. 1970; Lau 1974) and on the Mainland (Enfield and Bledsoe 1975) that phosphorous is quite immobile in soil, and thus not leached to any extent. Even though applied in soluble forms, it is readily combined with iron, aluminum, and/or calcium to form insoluble, absorbed combinations. For the purposes of this statement, then, it will be assumed that just 0.2 per cent of the phosphorous applied to landscaped areas is carried to the basal lens with percolating water.

Now all data and assumptions necessary to make an estimate of the total nitrogen and phosphorous that might reach the basal lens have been presented. The resulting estimate is shown in Table IV-B.7, with accompanying explanations as to how each figure was derived. These calculated quantities have little meaning, however, until compared to the amounts already provided from "natural" sources, i.e., the background level carried in the basal flow. In the discussion on groundwater in Section II, data given on flowrate and representative nutrient concentrations were as follows:

Total Nitrogen	= 0.9 mg/l
Total Phosphorous	= 0.1 mg/l
Basal Flowrate	= 2.5 mgd/mile coastline, or 4.0 mgd for the 1.6 mile WBR coastline

With appropriate unit conversions and multiplication, these figures indicate that approximately 10,950 lbs/year of nitrogen and 1,220 lbs/year of phosphorous are discharged naturally into the WBR coastal waters. When these natural rates are compared to the projected additions in Table IV-B.7, it is apparent that the impact of the nitrogen input will be quite significant; conversely, the impact of the phosphorous input will be relatively unimportant.

The amount of nitrogen that will be added to the basal flow by the WBR project is of the same order of magnitude as that already provided from natural sources. If the WBR-supplied nitrogen diffuses into only the top part of the basal flow--say the top half of the lens--by the time these added nutrients reach the anchialine pools and ponds, then nitrogen concentrations would be approximately 1.7, 2.2, and 3.0 mg/l, respectively, for the three development stages as compared to the 0.9 mg/l level now. (If the nitrogen mixes through the entire basal lens, concentrations would be somewhat lower: 1.3, 1.6, and 2.0 mg/l at the end of the three development stages.) Note that both mixing possibilities are used in our discussion--the one assuming mixing through the entire lens when dealing with discharge into coastal waters; the one assuming nitrogen mixing in only the top half of the lens when dealing with influx into the coastal ponds.

Phosphorous inputs to the basal lens will range between 2 and 15 per cent of the background level. If all of this input diffuses into just the top half of the basal lens, then the phosphorous concentration would

Table IV-B.7 Estimated Nitrogen and Phosphorous Input to the Basal Lens (all figures in lbs/year)

Development Stage	Nitrogen				Phosphorous			
	From the Golf Course[1]	From Other Landscaped Areas[2]	Via Direct Infiltration[3]	Total[4]	From the Golf Course[5]	From Other Landscaped Areas[6]	Via Direct Infiltration[3]	Total[7]
Step 1A	3,360	1,240	19	4,619	9	6	5	20
Increment I	4,424	3,560	156	8,140	59	19	39	117
Increment II	7,780	4,875	208	12,863	104	23	52	179

[1]Calculated as 10 per cent of the amounts listed in Table IV-B.4 or Table IV-B.5, whichever is greater.
[2]Calculated as 25 per cent of the amount listed in Table IV-B.4 or Table IV-B.5, whichever is greater.
[3]Calculated as 100 per cent raw sewage seepage (Table IV-B.6).
[4]The sum of the first three columns of the Table.
[5]Calculated as 0.2 per cent of the amount in Table IV-B.4 or Table IV-B.5, whichever is greater.
[6]Calculated as 0.2 per cent of the amount in Table IV-B.4 or Table IV-B.5, whichever is greater.
[7]The sum of the preceding three columns.

be increased from 0.1 mg/l to 0.103, 0.119, and 0.129 mg/l at the end of the three development stages. (Again, if it assumed that the phosphorous is mixed throughout the lens instead in just the upper half, concentrations would be somewhat lower: 0.102, 0.110, and 0.115 mg/l for the three development stages.)

Bacteria and Viruses

Possible sources of bacteria and viruses are treated sewage effluent and raw sewage leaked from collection mains. Effluent from the treatment plant will be chlorinated before it is discharged into holding ponds to await reuse for golf course irrigation. This process can be expected to destroy essentially all bacteria. Viruses will be destroyed in chlorination also, but not as completely as bacteria; some forms are able to resist this sterilization. Tests for total and fecal coliforms will be regularly performed to indicate the effectiveness of bacterial destruction; similar tests are not performed for viruses.

Destruction of bacteria and viruses not removed by chlorination will be aided by the reuse of the effluent for irrigation. The chances of bacterial survival on the turfgrass and in the soil will be decreased by straining removal and retention at the soil surface, by exposure to sunlight and by competition from soil microflora. Absorption will be the primary mechanism of virus removal. (However, the volcanite soil to be used for the golf course will not be as effective as soils with higher clay contents would be. Virus retention by clays results from a high ion exchange capacity and large surface area.)

If viruses (and perhaps some bacteria) are carried through the soil with percolating water, survival of several months in the basal lens should be expected (Gerba et al. 1975). It appears reasonable to conclude, then, that the various chemical and physical processes from treatment plant to basal lens will remove essentially all bacteria, but that at least some viruses will appear in the anchialine ponds and coastal waters. It is believed, however, that a small number of viruses will not constitute a health hazard nor upset the anchialine ecosystems. It should also be pointed out that this effluent disposal plan will meet the applicable State Department of Health standards (Chapter 38, Public Health Regulations) and Federal regulations (as required by PL 92-500, the Water Pollution Control Act, to become effective in 1977).

Possible leakage of raw sewage from the connecting joints of collection mains will probably go undetected and, therefore, uncontrolled. (The only feasible control, in fact, is to insure proper installation of the pipes initially.) In a previous discussion, it was estimated that 0.1 per cent of the total sewage flow in the mains might seep into the basal lens; this would amount to from 120 to 1,270 gallons per day depending on the development stage. The coliform count for this sewage will probably be on the order of 1,000,000 mpn/100 ml (Pounds and Crites 1973; Environmental Science Inc. 1972). Dilution as the sewage mixes into the basal lens will be at the ratio of the quantity of seeped sewage to the 4.0 mgd total basal flow beneath the WBR, i.e., from 1:33,000 to 1:3,150 depending on the development stage. After dilu-

tion, the average basal lens coliform count might increase from about 3± mpn/100 ml for Step 1A development to 300± mpn/100 ml at the end of Increment Two.

Two aspects of the coliform count projection should be stressed. First, it is entirely hypothetical, based solely on the arbitrary assumption that 0.1 per cent of the raw sewage of the project will seep into the basal lens. The seepage rate could be much lower; studies just haven't been made to provide a more definitive figure, and the quality of pipe installation is certainly variable enough to make the transfer of the results of a test pipe to pipes installed in the field suspect anyway. Second, even at the highest projected count--300 mpn/100 ml--State Water Quality standards are not likely to be exceeded. Class AA waters, the classification for the entire WBR coastline, specify that the median coliform count shall not exceed 70 per 100 ml, nor shall any single sample exceed 230 per 100 ml (Chapter 37-A, Public Health Regulations). To meet this, basal water would need to be diluted just four-fold on discharge at the shoreline. It can be safely said then the dilution factor is considerably more than this, even within a few feet of the shoreline. The only point along the entire coast for which such dilution might not hold under all wave and tidal conditions is the inner portion of Waiulua Bay where, on very calm days, the concentrated basal discharge there forms a thin lens over the seawater.

Herbicides and Pesticides

The use of both herbicides and pesticides on the golf course and other landscaped areas is to be expected, either on a regular basis for preventive care or intermittently in isolated locations to correct specific problems. The Keauhou golf course is sprayed regularly, for example, but the Waikoloa and Mauna Kea Beach Hotel courses are not. At Keauhou, herbicide applications average 18 gallons per month over the entire 138 acre course (roughly 14 gallons of Paraquat and 4 gallons of Ansar 170). Pesticides are also applied at an average of about 18 gallons per month, all as chlorinated hydrocarbons (Diazinon and Duraban, used in a 2:1 ratio. All figures are from Guido Giacometti and Marshall Inn of Kamehameha Development Corporation). The regular use of these chemicals at Keauhou is considered to be representative of the maximum rate of use that might occur at the WBR site.

The resilience of herbicides and pesticides in their toxic forms are considerably different, and as such have quite different potential impacts on basal and marine waters. The toxicity of herbicides is considerably shorter--from several weeks to several months depending on the type (Beard 1973). They decompose either chemically or through microorganism activity, and are then lost through volatilization, adsorption and leaching. Though it would be difficult to attach a figure to the leaching loss rate likely for the WBR project (experimental evidence of herbicide leaching loss rates in Hawai'i is generally lacking), evidence obtained during several studies of Hawai'i's coastal waters indicates that herbicides will probably not be at detectable levels in the basal lens or coastal water of the WBR region. Sugarcane plantations have been using herbicides extensively for

years (Land Study Bureau 1965), yet these have not been detected in offshore coastal waters nor in marine sediments (Environmental Science Inc. 1972; Lau 1973). Since use on plantations has been in greater quantities than will be used for WBR landscaping, it seems reasonable to conclude that herbicides in the WBR coastal waters are not likely to reach detectable levels either.

One other aspect of the impact of herbicides on water quality should be noted. In situations where potable water will not be affected--such as at the WBR project--no standards exist to regulate their use. Chapter 37-A of the Public Health Regulations, the only existing State statute specifying the allowable level of contaminants in surface water bodies and adjacent coastal waters, does not contain standards for organic chemicals. It is not justifiable to conclude that herbicides post no threat to aquatic life, however. The health risk from these contaminants in drinking water has only recently been translated into standards (EPA 1975), and it is probable that standards for aquatic life will be enacted sometime in the future also.

Pesticides, and in particular the chlorinated hydrocarbon forms popularly used in Hawai'i, have residual toxicities lasting for years in soils, water, and marine sediments (Beard 1973; Lau 1973; Environmental Science Inc. 1972; Eto et al. 1967). Some forms, DDT in particular, may be ubiquitous in Hawaiian coastal waters and marine sediments, even in areas where they have never been used before. The concentrations are generally extremely low, generally in the several parts per trillion range (Lau 1973); in the sediments of the months of rivers, however, higher concentrations of a few parts per million have been measured (Environmental Science Inc. 1972).

Eto et al. (1967) reports on laboratory tests to define the behavior of selected pesticides (DDT and Lindane) with percolating water in soils. The several conclusions of that study that have implications for the use of pesticides at the WBR site are as follows:

Movement of pesticides into the basal lens is a function of the percolation rate and pesticide solubility. In other words, over-irrigation or intense storms will carry pesticides in greater amounts than under normal conditions. Storms along this coast are rare; over-irrigation (i.e., applying water in greater amounts than the soil's moisture holding capacity) will probably be rare also.

Higher organic content in the soil increases pesticide volatilization and also results in greater retention via adsorption. In other words, a high organic component in the soil would reduce the rate of leaching to the basal lens. The organic content of the "volcanite" soil to be used at the WBR will be very low initially, but will increase over time as landscape plantings become established.

Pesticide retention via adsorption is directly related to soil depth. The 12-inch layer of coarse "volcanite" likely to be used for WBR landscaping must be considered a very thin soil mantle with poor retention capacities.

The rate that pesticides may enter basal water beneath the WBR site cannot be reliably quantified--there are too many unknowns on the behavior of chlorinated hydrocarbons on and within the volcanite soil and there are essentially no data from comparable situations elsewhere. Groundwater quality testing in Hawai'i does not ordinarily include chlorinated hydrocarbons among the constituents analyzed (see Swain 1973, for example). There have been a number of studies on the identification of irrigation water to the basal lens on several of the islands (Visher and Mink, 1964; Takasaki and Valenciano, 1969; Tenorio et al., 1970), but these have not considered pesticides. Nitrates, sulfates, and silica were used as indicator constituents.

The possible significance of unquantified, albeit low, concentrations of chlorinated hydrocarbon pesticides in the basal flow is, quite frankly, unknown. The situation is similar to that of herbicides; levels will be extremely low, but measurements of these concentrations probably won't be made because detection is rather difficult at such levels. It has been assumed in the past, and probably will be for sometime to come, that these low concentrations are not toxic to the aquatic (Anchialine and marine) life in the receiving waters. (More discussion on the impact of pesticides can be found in the subsequent section on coastal water quality.)

3. Impact on Coastal Water Quality*

Water quality along the WBR coastline will be affected by three sources primarily: (1) pollutants carried in the basal flow and discharged at and just below sea level at the shoreline; (2) pollutants carried in surface, storm water runoff; (3) pollutants resulting from recreational use of the nearshore waters. These effects will be mitigated by the mixing and dilution that will occur in the surf zone and by the transport and dispersion of pollutants produced by longshore currents.

Standards for the net effect of these processes are established in Chapter 37-A of the State's Public Health Regulations. It is commonly known, however, that for some locations these standards are unrealistically low, i.e., that they are below the naturally occurring background levels (see, for examples, Lau 1973, Chun et al., 1972, and Dugan Ms.). The meager evidence of the water quality along the WBR coastline is insufficient to determine whether these waters can presently meet the applicable Class AA standards. Data exists only for nutrient levels, and was measured specifically in the WBR nearshore waters on only one occasion--in 1972 (Key et al., Ms.). Nitrogen and phosphorous levels in the inner surface waters of Waiulua Bay were, at that time, found to be higher than the standards: 0.4 mg/l nitrogen compared to the 0.10 mg/l Class AA standard; 0.04 mg/l phosphorous versus the 0.02 mg/l standard. These relatively high levels were due to minimal dilution of the concentrated basal discharge into the calm, inner waters there. But at the entrance of the bay, nutrient concentrations were found to be less than half the Class AA standards. As a basis of comparison, the University of Hawai'i Water Resources Center made one set of measurements for "ocean water" along this coast in February, 1975 (sampling location was somewhere offshore of the coast between Puako and Kiholo but unspecified), and measured 0.16 mg/l nitrogen and 0.012 mg/l phosphorous (Professor R. H. Young, personal communications). This nitrogen value is above the Class AA standard and about four times as high as the sample reported in Key et al. (Ms.) for the Waiulua Bay entrance. The phosphorous value is within the standard but also higher than reported by Key et al. (Ms.) for the bay entrance.

To reliably establish the existing water quality, sampling over an extended period--such as is done by the State Department of Health at a limited number of locations--would be required. The State's nearest sampling station is in Puako Bay, and only coliforms are measured at this location, so their data are not indicative of water quality along the WBR coast. The sum of knowledge of the existing water quality, then, is quite obviously limited. The following assessment of the impacts of the WBR project is made from this perspective.

Basal Discharge into the Coastal Waters

Pollutants that may be carried by groundwater into the coastal waters

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*Source: Belt, Collins and Associates, Ltd.

have been discussed previously. The most significant pollutants can be summarized briefly here:

> Nitrogen inputs will amount to from 4,600 to 12,900 lbs per year as the development progresses from Step 1A through Increment Two. When compared to the naturally occurring input of nitrogen from the basal lens into the coastal waters--about 10,950 pounds per year--it should be readily apparent that the nitrogen input will be significant.
>
> Phosphorous inputs will be less significant, amounting to an increase of between 2 and 15 per cent over the present basal input as the development progresses from Step 1A through Increment Two.
>
> Basal lens coliform counts of from 3 to 300 organisms per 100 ml sample are projected, increasing from the lower value to the higher one as the project grows in size.
>
> Herbicides and pesticides in very low, but not quantifiable, concentrations are expected in the groundwater.

The impact of these pollutants in the marine environment is keyed to the extent of dilution. With just a limited amount of mixing in the surf zone and dispersion by longshore currents, the basal concentrations are reduced significantly in the nearshore waters. This can be illustrated in two ways, the first by a purely hypothetical mixing model and the other based on the sequence of actual measurements at Waiulua Bay in 1971.

A simplified model of the shoreline mixing process can be constructed with the following data and assumptions:

> Mann (Ms.) found that the nearshore current reverses on ebb and flood tides, but that there is a net drift of about 0.2 knots up the coast toward Puako.
>
> Mixing and dilution occurs relatively rapidly within the upper layer of turbulence created by waves; the upper five feet of the nearshore waters will be assumed for this rapidly mixing zone.
>
> Based on the observations of divers and conductivity measurements at locations of concentrated basal discharge (reported in Cox et al., 1969), it will be assumed that all basal discharge occurs within 200 feet of the shoreline.

The net drift in this nearshore, "rapidly mixed" layer is approximately 218,000,000 gallons per day. With the estimated basal discharge of 4,000,000 gallons per day at the resort coastline, dilution would be on the order of 55 to 1 in the mixed layer. For example, if the maximum predicted gross average nitrogen concentration in basal water--2.0 mg/l for mixing through the entire basal lens--were mixed in this ratio with ocean water at 0.16 mg/l-N, the resulting concentration would be 0.19 mg/l-N, a 0.03 mg/l increase above existing

levels. The maximum predicted total coliforms count of 300 organisms per 100 ml would be diluted to only 5 to 6 per 100 ml with mixing at this ratio.

The measurements of nutrients and salinity in Waiulua Bay waters reported in Key et al. (Ms.) provide a more graphic and reliable indication of the extent of nearshore mixing and dilution. Figure AM shows the results of sampling along seven transects in the bay. Transects 1 through 4 are inside of a submerged coral and rubble protective barrier which effectively prevents most wave energy from entering the inner bay; transects 5, 6, and 7 are outside of this barrier. The points to note in Figure AM are:

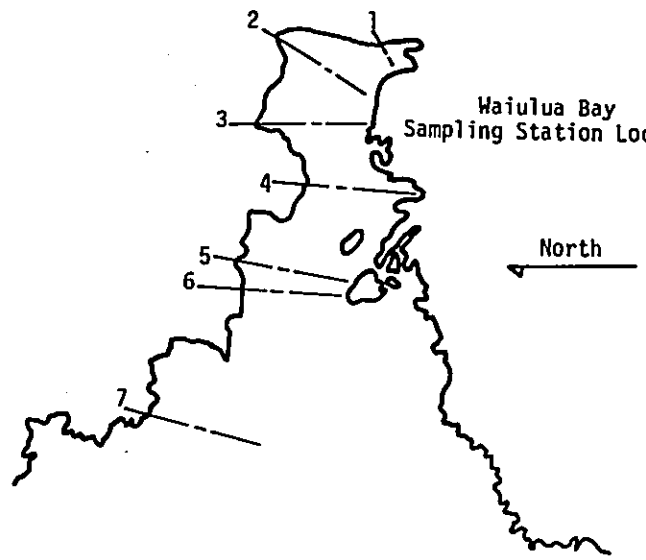
> The inner waters have a strong vertical zonation for both nutrient and salinity levels because there is very little wave energy to bring about vertical mixing there.
>
> Nitrogen levels near the surface of the inner bay were between 0.4 and 0.5 mg/l, approximately half that of the basal lens and indicative of a 1:1 mix of basal water and ocean water. On the other hand, reported salinity at the same points was only 10 per cent - a concentration more suggestive of a 3:1 basal/ocean mix.
>
> Destruction of the vertical zonation and rapid basal dilution are apparent in the outer transect concentrations at 100 feet beyond the protective barrier, nutrient and salinity levels are essentially the same as open ocean values.

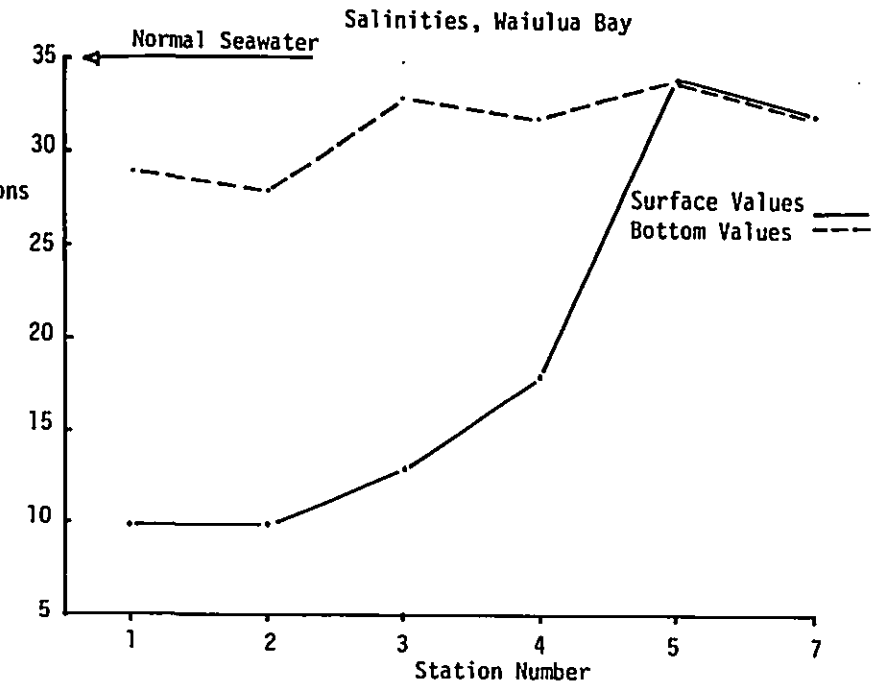
It may be recalled from previous discussions that Waiulua Bay has been identified as a point of conspicuous basal discharge. Sampling at the outer transects of this bay shows how effectively wave energy can dilute such a concentrated flow in the nearshore waters. The data of Key et al. (Ms.) is not complete enough to derive a dilution ratio, but it does appear to be even greater than the calculated ratio used previously in the hypothetical mixing model.

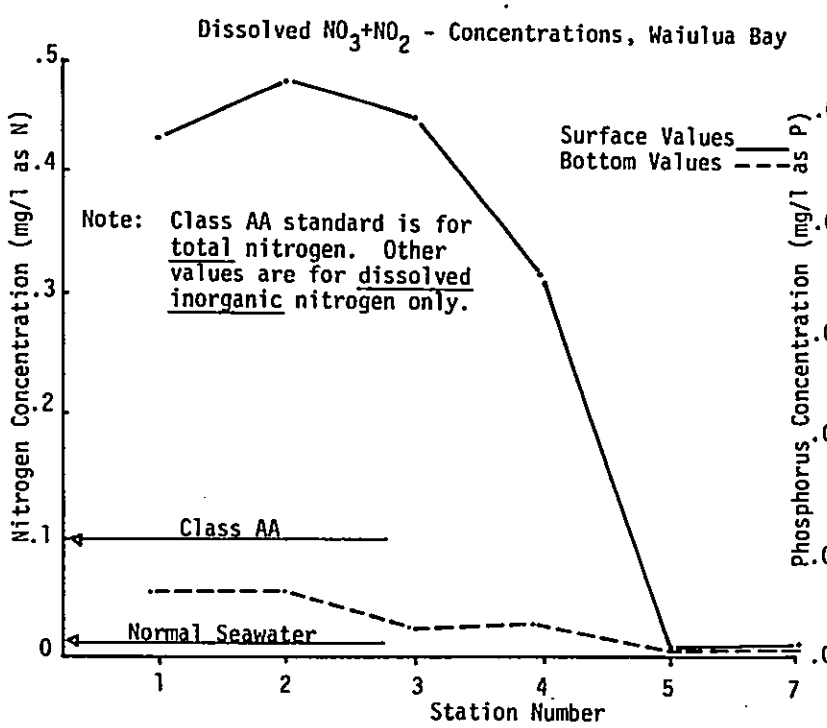
With regard to the impact of pollutants in the basal flow on coastal water quality, then, it is concluded that the extent of dilution will eliminate any significant effect of all of these constituents with the possible exception of nitrogen. The background level of nitrogen in these coastal waters is not well established--it may be anywhere from 0.02 to 0.16 mg/l and quite likely is not constant. The addition of nitrogen from this project through the basal lens may increase the average coastal water concentration by as much as 0.03 mg/l in the nearshore surface waters. In localized areas of significant basal discharge into calm waters, the nitrogen level will be increased by more than this.

Storm Water Runoff into the Coastal Waters

Storm water runoff to the ocean--even during the region's most intense storms--is essentially nil at present because the extremely permeable 'a'a and pahoehoe lavas can infiltrate and percolate rainwater downward more rapidly than it precipitates. But with the im-







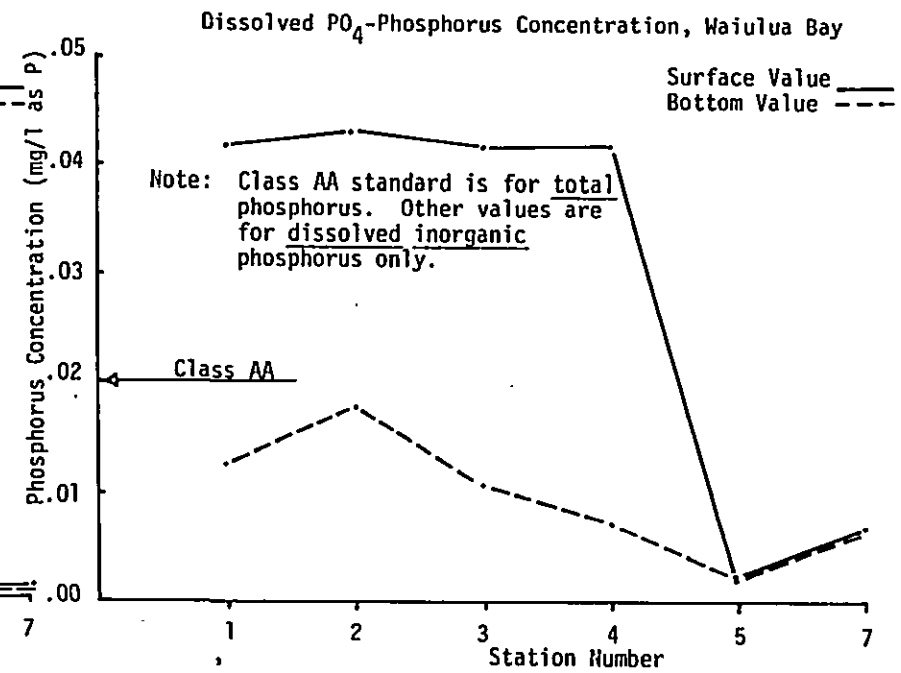


FIGURE AM
WAIKOLOA BEACH RESORT
WATER QUALITY CHARACTERISTICS,
WAIULUA BAY, SOUTH KOHALA, HAWAII

Source: Key, Guinther & Miller (1971)

portation of soils for landscaping and the addition of impervious surfaces associated with roads, buildings, and other pavement, the situation of negligible runoff to the ocean may change.

Assessing the potential impact of runoff on coastal water quality requires data on the rate and frequency of occurrence of runoff and on the levels of contaminants in these surface flows. Such figures can be determined only with orders of magnitude accuracy, and the following assessment should be viewed as such.

Surface Drainage Scheme: At this stage of the project's formulation, drainage planning has been done for the Step 1A roadway system only. All other land uses--golf course and other landscaping, buildings, and pavement, the balance of the road system, and bare (undisturbed) lava--are known at this time only as the likely percentages of the total land area shown in Table IV-B.8.

Table IV-B.8: PROPOSED LAND USE DISTRIBUTION

Development Stage	Total Area (acs)	Portions of Areas in Various Land Uses (%)			
		Buildings, Parking, & Paved Paths	Access Road Pavement	Landscaping	Unaltered
Step 1A	285.0	4	4	64	28
Increment 1	452.0	21	5	51	23
Increment 2	733.9	23	3	56	18

Working with the land use allocations of Table IV-B.8 and general trends of the existing topography, several conclusions about the surface drainage patterns can be made:

Carrying storm water in pipe conduits, except at low points in the road, will not be necessary due to the combination of extensive open space and low intensity expected rainfalls. Swales within the landscaped areas should suffice where carrying concentrated storm flows is necessary.

About 18 per cent of the land area will be undistrubed lava or cobble and sand beaches; no surface runoff is expected from these lands.

About 56 per cent of the total area will be landscaping on the coarse-textured volcanite soil. The permeability of this soil--while never having been actually tested--probably exceeds two inches per hour. (This figure is based on measured rates of comparatively textured soils reported in Sato et al., 1973). The soil's surface will become compacted as it is walked or driven over, so an infiltration rate of about 0.5 to perhaps a little more than 1.0 inches per hour can be expected at the soil surface. Since this rate is almost as great as the expected intensity of a five-year storm (Weather Bureau, 1962), only rain-

fall intensities exceeding the five-year storm will generate significant surface runoff from the landscaped areas.

Of the approximately 26 per cent of the total area in impervious surfaces, most will be as isolated buildings or paving--that is impervious areas surrounded by permeable soils or bare lavas. Most of the runoff from such locations is expected to percolate into the surrounding permeable areas rather than reach the coastline as a surface flow.

These general conclusions indicate that the only significant storm runoff discharge to the coastal waters might occur in the vicinity of the proposed small boat harbor at Waiulua Bay (see Figure L, the master-plan drawing). Adjacent land uses, particularly the multi-family and hotel parcels and the access road, will result in a high percentage of impervious surfaces in close proximity to the shoreline.

Rate and Frequency of Discharge in the Vicinity of the Waiulua Bay Small Boat Harbor:

Data and probability calculations published by the Weather Bureau (1962 and 1965) show the low intensity and frequency of storms along the South Kohala Coast. On an average, only 13 days of the year have more than 0.10 inches of precipitation at gauge no. 95.1 in Puako. Since a day's rainfall of less than this would be unlikely to result in any surface runoff, a figure of 13 days a year is as good an estimate for the frequency of any coastal discharge of surface runoff as can be made. An average of just three days a year have precipitation of at least 0.50 inches at the Puako gauge. In other words, there will be a significant discharge in the vicinity of the small boat harbor for only a few days each year.

An order of magnitude figure for the rate of discharge can be calculated with the following data and assumptions:

Of the average annual rainfall of 10 inches, assume that about two thirds of it--say 6.5 inches per year--occurs in sufficient intensity to create a surface flow into the small boat harbor.

The total area of the adjacent, runoff-contributing multi-family and hotel parcels is approximately 60 acres.

As an order of magnitude approach, assume that all of the rainfall on impervious surface becomes runoff, but that none of the rainfall on landscape or unaltered open space does. Thus, if the impervious surfaces constitute about 30 per cent of the 60 tributary acres, all of the rainfall on 18 acres will become runoff into the harbor.

Based on these assumptions, the total annual runoff from the 18 acres would be on the order of 4,000,000 gallons - roughly equivalent to the average daily discharge of basal flow along the WBR coastline. Purely in terms of annual volume, therefore, surface runoff is minimal. In terms of impact, of course, the yearly average is not nearly as im-

portant as the concentrated runoff associated with specific storm events. Even assuming that half of the four million gallons might be discharged over the space of a few hours, however, there are a number of reasons why it does not appear that the increased runoff volume will reduce salinity in the bay to the extent that it will have a significant effect.

> Because freshwater runoff tends to flow across the surface of the bay waters, the relatively immobile benthic community is at least partially buffered. Free-swimming organisms which do inhabit the surface layers are free to move out into unaffected waters during the short period when salinity levels are depressed.
>
> The development that will produce the increased runoff is predicated upon development of a small boat harbor in Waiulua Bay. Construction of the harbor would, in turn, improve circulation in the inner bay to such a degree that it is unlikely that decreased salinity would be a problem.

While it can be stated with some certainty that the effects of expected salinity changes in nearshore areas will be negligible, it remains to be seen whether the contaminants typically carried by such storm runoff will have an impact more significant than that associated with the intermittent and rather minor changes in surface salinity.

Runoff Water Quality: Pollutant concentrations in storm water are highly variable. Ranges of measured concentrations have been published by the Environmental Protection Agency (Mallory 1973) and are summarized in Table IV-B.9. These ranges are really too broad--more than a thousand-fold for suspended solids, for example--to be useful for the assessment of the WBR site except to show the uncertainty faced in predicting contaminant concentrations.

Table IV-B.9: REPORTED STORM WATER POLLUTANT CONCENTRATIONS

Constituent	Observed Range (in mg/l unless otherwise specified)
Dissolved Solids	30 - 8,000
	154 - 228
Suspended Solids	26 - 36,250
Volatile	38 - 98
Nonvolatile	119 - 292
BOD	6.9 - 625
COD	18 - 3,100
DO	6.4 - 8.0
Total Nitrogen (NO_2, NO_3, Organic)	2.3 - 11.8
Total Phosphate	0.47 - 1,400
Coliform Total/100 ml	40 - 240,000
Fecal Strep/100 ml	median - 20,500
Chlorides	11 - 160

Despite the uncertainty concerning storm water quality, an order of magnitude projection of the impact of runoff pollutants is desirable. A University of Hawai'i study comparing the wet and dry weather water quality of Manoa Stream (Chun et al., 1972) offers what might be the most comparable data available for the situation at the WBR site. (The Manoa Stream basin used for this study includes forest reserve and single-family residences in its upper reaches and more intensive urban areas downstream). The assumption of the study was that differences in quality between wet and dry weather stream flow are attributable to the input of storm runoff; on this basis, pollutant characteristics of the Manoa basin runoff were:

> Total coliforms, fecal coliforms, total bacteria, and fecal streptococcus counts were essentially the same in wet and dry weather. They were also essentially the same in the forest reserve well above human activity as downstream in the intensively used urban area. Counts were on the order of $2x10^4$ organisms per 100 ml sample for total coliforms and 10^3 per 100 ml for fecal coliforms. These levels are approximately one order of magnitude above the applicable State standards for fresh waters (Class 2). These rather surprising results indicate that microorganisms contributed by runoff may not be a significant pollutant problem, but that the bacteriological standards of the State water quality regulations may be unrealistically low, i.e., below naturally occurring levels.
>
> Suspended solids in runoff increased the wet weather stream concentrations about 10-fold over the dry weather level, to a maximum of 200 mg/1. This most visibly obvious pollutant is also reflected in measurements of turbidity; ten-fold increased (in Alpha Tu units) were measured. Such a discharge into Waiulua Bay would definitely make the water exceed Class AA standards until the bay was flushed out.
>
> Total nitrogen concentrations in the runoff doubled the stream flow concentration from 0.2 to 0.4 mg/1. This is surprisingly low in comparison to the ranges published by EPA (Table IV-B.9), and well below the WBR basal groundwater level of 0.9 mg/1. Whether the Manoa results are representative of the runoff from the WBR site will depend entirely on the extent of runoff from landscape areas. If this is kept to a minimum, particularly with a liberal number of sumps in the golf course, then nitrogen levels in the runoff might be as low as measured at Manoa.
>
> The levels of total phosphorous--from 0.2 mg/1 in the dry weather flow from the forest reserve area to 0.6 mg/1 in the wet weather flow downstream in the urban area--is undoubtedly due to erosion of fertilizer-enriched soil. Because the volcanite soil will not be particularly susceptible to water erosion, land slopes will be moderate, rainfall intensities will not have a high erosion potential, and the vegetative cover will probably be well tended, (hence, in good hydrologic condition). It is believed that the level of phosphorous in the WBR runoff will not be as high as

measured at Manoa.

The impact on WBR coastal water quality due to those runoff contaminants considered above can be summarized as follows. Pollutant discharges will be infrequent--about 10 to 15 days each year; the effect will be localized--evident in areas with relatively poor natural flushing such as the inner Waiulua Bay waters, and rapidly diluted by wave mixing in open water; and Class AA standards will probably be exceeded immediately following each storm.

Pollutants which have been neglected to the point in the discussion are chlorinated hydrocarbon pesticides. As with the groundwater discussion previously, it is difficult to assess their potential impact in runoff because very little study has been done on this topic, and almost none of it locally. The level of pesticides in runoff will be in direct proportion to the amount of runoff from landscaped areas, and this is expected to be a small portion of the total flow. But rather than attempt a specific projection of the pesticide concentration, an idea of the possible impact will be presented using coastal water concentrations that have been measured for the Statewide "Quality of Coastal Waters" study (Lau 1973). It should be kept in mind that the results for both of the areas to be quoted here reflect contributions from groundwater as well as surface runoff.

> Kahana Bay on O'ahu, with minimal agricultural and human activity on the adjacent lands, is considered a reasonable indicator of the background (i.e. "natural") level of pesticides in Hawai'i's marine environment. Levels of chlorinated hydrocarbons were found to be in the few parts per trillion range in both the waters and the sediments of this bay.
>
> The Hawai'i Kai coastline, also on O'ahu, is adjacent to rather extensive potential chlorinated hydrocarbons sources, both from use on landscaping and in housing construction (primarily for termite control). The waters along this shoreline had chlorinated hydrocarbons in the same range as at Kahana Bay, but the levels in the sediments were at least one order of magnitude greater. It was concluded by the investigators that this reflected both intensive urban activity and poor sediment circulation caused by the marina configuration.

Because the extent of land activity is greater and the coastal circulation more sluggish at Hawai'i Kai than will be the case at WBR, it is believed that the concentrations measured at Hawai'i Kai represent an upper bound for the levels that might occur along the WBR coastline. However, no actual measurements are available with which to confirm or disprove this assumption. Even if an upper bound of several parts per trillion chlorinated hydrocarbons in the water and an order of magnitude greater in the sediments is an accurate estimate of the level of these pollutants that will result from the proposed development, the absence of any standards against which these levels can be judged makes a determination of their significance very difficult. (See Section IV-E.1, Anticipated Biological Impacts).

Recreational Use of Nearshore Waters

Recreational activities at WBR will introduce three types of pollutants into coastal waters: chemicals (mainly petroleum products from power boats using the small boat harbor) and organic waste and coliform bacteria from swimmers and divers. The first of these will be addressed in the data that must accompany applications for the permits necessary to construct the small boat harbor and will not be discussed here. The others will be touched upon briefly.

It is impossible, of course, to directly measure the amount of nutrients that recreational users of an area contribute to coastal waters. An attempt has been made, however, to determine if an area that has very heavy recreational use (Waikiki Beach) has any water quality characteristics which might be attributable to that use (Lau, 1973). The results of that study suggested that there are not. Smaller scale sampling at specific locations in Waikiki over the space of a single day* indicates that elevated coliform levels do occur in areas with limited circulation while large numbers of people are actually in the water, but that they drop rapidly as use diminishes in the afternoon. Given these facts, and the very much lower intensity of use that is likely to occur at WBR as compared to Waikiki, it seems reasonable to believe that there will be no measurable impacts as the result of increased nutrient input from swimmers, but that some increase in coliforms may be expected for short periods.

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*Personal communication from Dr. James Kumagai, Civil Engineering Refresher Course, University of Hawai'i, 1974.

C. AIRBORNE EMISSIONS*

The generation of certain airborne emission as a direct result of both the construction and the operation of the WBR resort is inevitable. The most significant emissions will be: exhaust gases from construction and transportation equipment driven by internal-combustion engines, dust generated in the filling and grading portions of the construction activities and smoke from cooking activities.

Automotive Emissions

Gasoline and diesel internal-combustion engines are the most important long-term source of airborne emissions at WBR. The estimates for automotive emissions shown in Table IV-C.1 are based on, first the analysis of traffic requirements in Section I-E.6, Road System, and then on the quantification of the total emissions generated by this traffic flow.

Table IV-C.1 TOTAL EMISSIONS

Emission	Total Emissions/day (lb)			
	Initial Construction Period	Step 1A	Incre. I Total	Incres. I and II
Carbon Monoxide	362.5	773.3	6,105.2	8,377.1
Hydrocarbons and Nitrogen Oxides	173.4	420.8	4,037.6	6,093.6

The estimate of emissions is split into gas engines, primarily for automobile transportation, and into diesel engines for trucks and buses. The total emissions are calculated for four different situations: initial construction, operation of Step 1A, operation of completed Increment One and the operation of completed Increments One and Two. The emissions for gasoline-powered vehicles are presented in Table IV-C.2.

The amount of atmospheric emissions to be expected from the various kinds of traffic generated by WBR resort was estimated by applying the 1975 Federal emissions standards to the projected traffic volumes. Over the period of time in question, the 1975 standard will be a fair average of the emissions generated. The reason for this is that emission standards are becoming stricter every year. It is assumed that as time passes, the 1975 standard will represent an average value between uncontrolled cars and the strict emission standards expected for 1980. All computations assume 100 per cent occupancy of all completed facilities and are therefore conservations.

The emissions from diesel engine truck and bus traffic are a bit more difficult to project, since the Federal Standards are in gm/brake hp/hr; it was necessary therefore to make the following assumptions in order to convert this to gm/mile:

*Source: Belt, Collins and Associates.

Table IV-C.2 CALCULATIONS OF EMISSIONS FOR GASOLINE-POWERED VEHICLES

Source of Emissions	Initial Constr. Period	Vehicle Distances (mi/day) Step 1A	Incre. I Total-1988	Incres. I & II
Construction workers	6,000	3,040	3,040	0
Hotel employees	0	8,120	33,780	43,000
Hotel deliveries	0	360	1,800	2,160
Visitor cars		12,000	298,000	533,500
TOTAL	6,000	23,520	336,620	578,660

Emissions	1975 Emission Standard (gm/mile)	Total Daily Emissions* Initial Constr. Period (lb**)	Step 1A (lb)	Incre. I Total (lb)	Incres. I & II (lb)
Carbon Monoxide	3.4	45.0	176.3	2,523.2	4,337.4
Hydrocarbons	0.41	5.4	21.3	304.3	523.0
Nitrogen Oxides	3.1	41.0	160.7	2,300.5	3,954.7

*Based on the above numbers of vehicle miles/day, using 1975 Federal emission standards (E.P.A. Regulation on Control of Air Pollution from New Motor Vehicles, p, 121:1101).
**The number of vehicle miles is multiplied by the gm/mi and then divided by 453.6 to convert that figure into lb.

1. The average 8 cubic yard dump truck is 120 horse power and travels at an average speed of 20 miles per hour.
2. The average transit mix truck is 120 horse power and also travels at an average speed of 20 miles per hour.
3. The average bus is 120 horse power and travels at an average speed of 40 miles per hour.

The Federal Emission Standards set for diesel engines built after 1974 allow 16.0 gm of hydrocarbons and nitrogen oxides and 40.0 gm of carbon monoxide per brake hp/hr. The emissions for diesel engines are presented in Table IV-C.3.

Some of the conclusions that can be drawn from these calculations are:

1. The visitors who stay in the condominium units contribute the largest share of pollution due to their propensity to use cars rather than buses.
2. The effective application of Federal and State vehicle emission standards will mean that, even though the total vehicle miles will increase greatly in the future, the per capita vehicle emissions will greatly decrease.
3. Since the above calculations are based on 100 per cent occupancy of both the hotel and multi-family units, the estimates of emissions represent an extreme situation. The normal situation is about 60 per cent of the above, based on an ex-

Table IV-C.3 CALCULATIONS OF EMISSIONS FROM DIESEL-POWERED VEHICLES

Source of Emission	Vehicle Distance (mi/day)							
	Initial Constr.		Step 1A		Increment I Total		Increments I and II	
	(mi/day)	(hp hr)*	(mi/day)	(hp hr)	(mi/day)	(hp hr)	(mi/day)	(hp hr)
Construction deliveries	597	3,580	129	770	300	1,800	0	0
Employee buses	0		800	2,400	3,440	10,320	4,270	12,810
Visitor buses	0		1,200	3,600	9,500	28,500	11,000	33,000
TOTAL	600	3,600	2,129	6,770	13,240	40,620	15,270	45,810

Emission	Total Daily Emissions (lb)				
	1974 Emission Standards gm/hp hr	Initial Constr. Period (lb)	Step 1A (lb)	Increment I Total (lb)	Increments I and II (lb)
Carbon Monoxide	40.0	317.5	597.0	3,582.0	4,039.7
Hydrocarbons and Nitrogen Oxides**	16.0	127.0	238.8	1,432.8	1,615.9

*Vehicle miles are converted into horse power hours by dividing vehicle miles per day by the average speed of the vehicle and then multiplying this number of the horse power of the vehicle.

**hp hr figures are multiplied by gm/hp hr standards and then divided by 453.6 to change the gm into lb.

expected occupancy of 70 per cent of the hotels and 50 per cent for the multi-family units.

The above analysis does not answer the more cogent questions regarding the quality of the air: What will be the concentrations of the particular pollutants at various points? How do these concentrations compare with the State's Ambient Air Quality Standards? What will be the effect on plant and animal life?

Obtaining the total amount of vehicle emissions was relatively simple, but projecting how pollutants will be dispersed is infinitely more complicated. The vehicles will be traveling at different times of the day to different points on the island. Meteorological conditions vary from place to place. Some of the pollutants are oxidized in air in a short time--CO to CO_2 for example--resulting in relatively innocuous chemical forms. Others will react in sunlight to an unknown degree to produce photo-chemical smog. All of these factors and more must be accounted for in a dispersion modeling technique in order to project the concentration of pollutants. Because all these factors are not known, and because dispersion models for many of the particular pollutants are in only the research stage, such a quantitative accounting would be quite limited in the sort of information it could provide. In light of this, it seems more appropriate to try to assess the impact of the pollutants in a qualitative manner.

Chapter 42 of the State's Public Health Regulations established upper limits on the level of certain pollutants permissible in Hawai'i's air and made the State Department of Health responsible for enforcing those standards. A monitoring system has been established, but its nine sampling stations (as of the most recently published report) have a relatively limited geographic distribution. The system's usefulness is further compromised by the fact that only the station located at the Health Department's main office in downtown Honolulu tests all of the pollutants governed by the State's standards.

As mentioned in our earlier discussion of the wind patterns at WBR, the South Kohala coast is relatively sheltered from the tradewinds that prevail over much of the state. Instead, its atmospheric circulation is characterized by gentle sea breezes during the day and winds that blow from the land towards the ocean at night. Unfortunately, the only air quality sampling station on Hawai'i is located in Hilo on the island's windward coast and does not provide useful information concerning conditions at WBR. In fact, all of the stations in the monitoring network are in areas more or less exposed to the tradewinds.

In short, neither existing air diffusion models nor the records from established sampling stations provide the kind of information required to make a reliable assessment of the affects on air quality of the development of WBR. By the very fact that there will be an increase in the amount of pollutants released into the atmosphere, it is obvious that air quality will be adversely affected, but it is impossible to estimate the extent of the deterioration that will occur.

Perhaps the most that can be said is that, given the small size of WBR

relative to West Hawai'i as a whole, it is extremely unlikely that its development will have a significant effect on regional air quality. Localized areas with particularly intense vehicular activity, e.g., intersections, waiting areas, etc., will be most affected, but even they would be unlikely to reach the point where the concentration of pollutants exceeds the State standards.

Dust and Smoke

Dust generated in the process of grading and filling of roads, the second golf course, and construction sites will be a problem during the construction of the later increments of development. Large quantities of dust are generated when moving both 'a'a and pahoehoe lava. The onshore/offshore wind pattern has the potential for causing large amounts of this dust to become airborne during the grading and landscaping portions of the various development increments unless adequate dust-control measures are instituted. It is difficult to quantify the amount of particulate matter that is likely to be generated in this manner; however, it is possible to discuss the qualitative effects this dust may have on the project and on the surrounding areas.

During the construction of Step 1A, approximately 200 acres of lava will be graded for development into the golf course and into the first hotel. During the daylight construction period this activity will generate large amounts of dust, which will be carried inland (mauka) by the daytime-prevailing onshore wind and will disperse over the mauka lava fields. Fortunately, the nearest area likely to be disturbed by this mauka flow of airborne dust is the Queen Ka'ahumanu Highway, about two miles inland from the construction site. It is believed that two miles is far enough for the majority of the airborne particulate matter to return to the ground, or disperse to the extent that it is not concentrated enough to be bothersome.

During later construction, however, the required grading may cause a disturbance to persons in the already established facilities. The problem, however, will be minimized by the scheduling of site developments in line with the daytime onshore wind pattern, starting with the construction of the shoreline hotel sites and then progressing mauka across the housing sites. This schedule will take advantage of the mauka daytime wind to blow the dust onto undeveloped portions of the site. The disturbance between hotel sites will be minimal due to their positions abreast of each other facing the wind.

During all phases of construction, a dust control program will be in effect. Where necessary, water or oil will be applied to the crushed lava and soil that might be exposed to the relatively strong winds, particularly when the wind pattern reverses, as it does occasionally.

Permanent roads will be constructed as soon as possible; however, where it is necessary to maintain temporary roadways the unpaved areas will be moistened with water and traffic will be limited to construction equipment.

Smoke control will be achieved by restrictions on open burning for

the disposal of waste generated by site-preparation activities or by hotel operations.

D. NOISE GENERATION*

This section contains estimates of noise generation for three different geographic areas - the resort site, the access road, and the Queen Ka'ahumanu Highway - during three different stages in the development of the site: construction of Step 1A, Increment One resort operation and construction of Increment Two, and full operation of Increments One and Two.

Initial Construction Phase

Noise generated during the initial construction phase will be primarily from the use of heavy earth-moving and construction equipment at the Boise quarry area and at the Step 1A resort-construction areas and from diesel-powered trucks hauling materials to the site, much of it from the Boise quarry. (Table IV-D.1)

Tractors doing clearing and grading work for the golf course and hotel at the resort site will produce at least 86 dBA at a 50-foot distance. (Table IV-D.2.) This noise level cannot be considered a serious problem, however, for no one will be in residence at the site.

Table IV-D.1 INITIAL CONSTRUCTION PHASE TRAFFIC NOISE LEVELS
Assuming a background noise level of 50 dBA, L50(4)

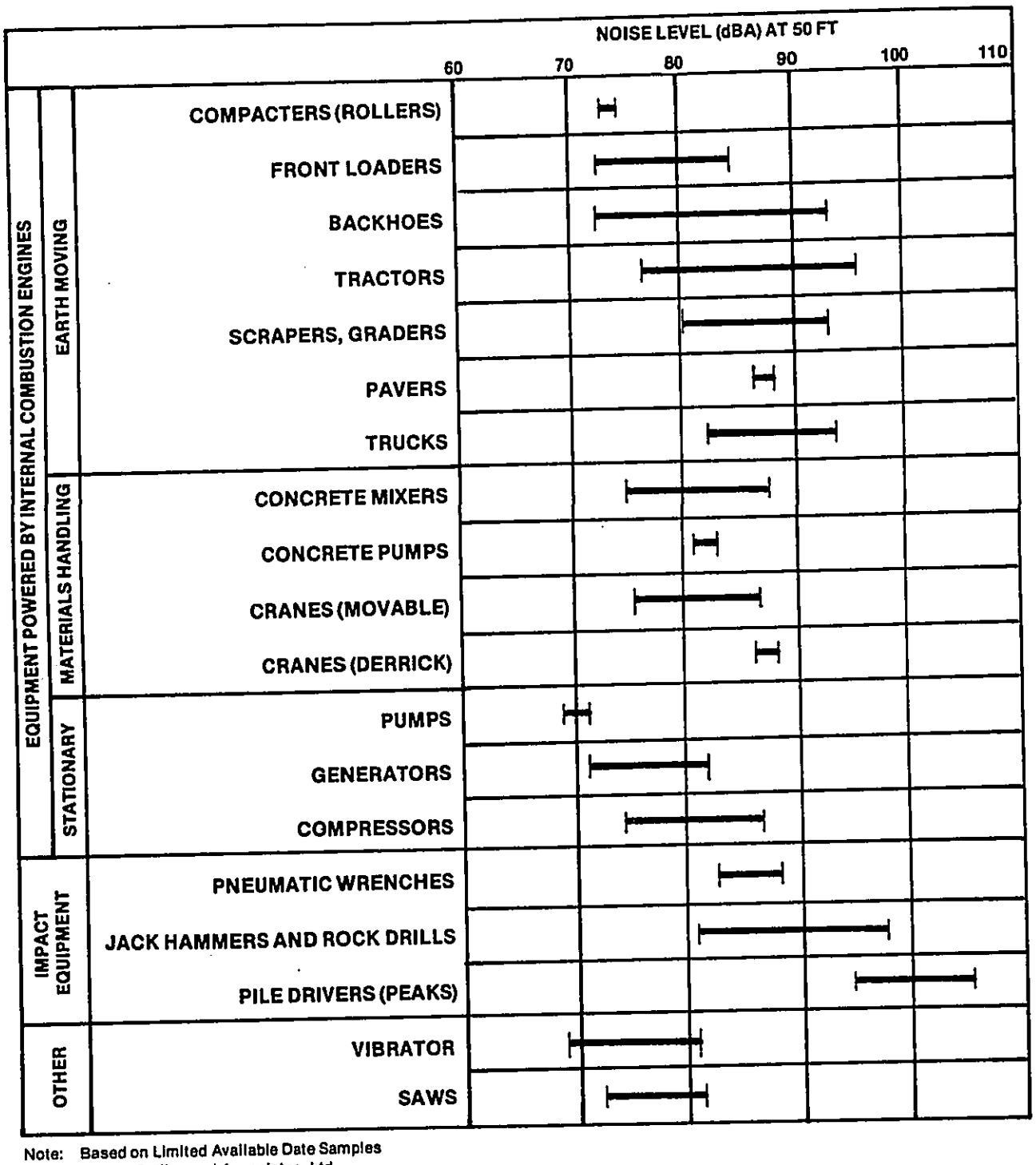
Location	Maximum Vehicle Flow(1) (vehicle/hr)	Sound at Observer Distance(2) (dBA, L10(3))		
		50 ft	150 ft	1,000 ft
Access Road	233	83	78	70
Queen Ka'ahumanu Highway				
North to Waikoloa Rd.	233	81	76	68
North of Waikoloa Rd. to Kawaihae and South to Kona	116	65	61	52
Waikoloa, Mahukona and Kawaihae, Waimea Rds.	116	65	61	52

(1)From Section I.
(2)86 dBA is the State maximum allowable daytime noise level.
(3)L10 is the 10-percentile level--the sound level that is exceeded only 10 per cent of the time, the level indicating the noisiest events at a point.
(4)L50 if the madian sound level--the sound level that is exceeded 50 per cent of the time; the typical value of noise level at a point. The 50 dBA is assumed because of the proximity of the ocean.

*Source: Belt, Collins and Associates, Ltd.

CONSTRUCTION EQUIPMENT NOISE RANGES.

TABLE IV-D. 2



Note: Based on Limited Available Date Samples
Source: Belt, Collins and Associates, Ltd.

Noise from trucks using the access road will be audible to a distance of over 2,000 feet.* It should be noted that the noise generated by traffic along the Queen Ka'ahumanu Highway does not constitute a problem at the present time because of the absence of settlement along the highway right-of-way.

Typically, noise decreases approximately 6 dBA with each doubling of the distance between its source and the listener. Thus, the noise produced by a bulldozer will have attenuated to approximately 37 dBA (far below the background noises of 50 dBA, L50) or less before it reaches the nearest existing house, two miles from the site.

Remaining Increment One Construction Period and Step 1A Resort Operation

Construction of future steps of Increment One and the normal operation of the Step 1A resort complex will be the primary generators of noise during this period. Traffic noise generation will remain at a relatively high level because of the need to truck large amounts of material to the site from the Boise quarry area on Waikoloa Road.

Compliance with State noise regulations that limit heavy vehicle noise to 86 dBA between 6 a.m. and 6 p.m., 84 dBA from 6 to 10 p.m., and 73 dBA between 10 p.m. and 6 a.m. (Honolulu Star-Bulletin, May 23, 1973, p. B-6), will effectively limit construction to the 6 a.m. to 6 p.m. period. During those hours, normal construction activities will generate a significant amount of noise. As stated previously, the site's relative isolation will effectively preclude any disturbance to adjoining properties. It will not, however, prevent noise generated during later stages of construction from disturbing previously completed units.

During certain phases in the development of the project, new construction will occur within less than 400 feet of completed units and, therefore, subject them to a noise level of approximately 67 dBA. While this is well under both State and Federal standards, it is sufficient to cause some speech interference and annoyance in people exposed to it for extended periods of time (Table IV-D.3). It should be noted that the figures given for noise generation did not take into consideration the possible use of existing noise suppression devices which, while technically and economically feasible, are not in widespread use.

Traffic noise will continue at higher than normal levels because of the continuing high percentage of construction truck traffic (Table IV-D.4), but will be substantially less than that present during the initial construction phase - primarily because of reduced traffic between the

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*All traffic noise figures shown in this report were derived by using the nomographic method outlined in the Mannual for Highway Noise Prediction (short version) prepared by the U.S. Department of Transportation, Transportation Systems Center. Calculations are shown in Appendix 6. Estimates are for preliminary assessment of potential noise problems only, not for final noise-level prediction.

Table IV-D.3 ESTIMATES OF MAGNITUDES AT WHICH THE EFFECTS OF NOISE BECOMES APPRECIABLE

Effect	Sound Level (in dBA) at which effect becomes appreciable
Hearing Damage Risk(1)	90
Speech Interference(2)	60
Sleep Interference(3)	70
Physiological Stress(4)	90
Startle(5)	110
Annoyance(6)	60
Task Interference(7)	75

(1)Based on 8 hours (day exposure).

(2)Based on a minimum comprehension of 98 per cent of all sentences or an equivalent rate of comprehension of 85 per cent of all the words of a standard phonetically balanced (PB) list.

(3)The level at which approximately 50 per cent of the population will be awakened or find falling asleep difficult.

(4)Geber, et al.

(5)"Represented a noise level sufficiently rarely heard and of a signal-to-noise ratio sufficiently great to make a significant startle reaction highly probable."

(6)The lowest level at which any of the effects listed can occur.

(7)No specific definition given.

Source: Bolt, Beranek, and Newman (12/71), Noise From Construction Equipment and Operation's, Building Equipment, and Home Appliances.

Table IV-D.4

REMAINING INCREMENT ONE CONSTRUCTION AND STEP 1A OPERATION TRAFFIC NOISE LEVELS (Assuming 60 dBA, L50)

Location	Maximum Vehicle Flow (vehicle/hr)	Sound at Oberver Distance+ (dBA, L10)		
		50 ft	150 ft	1,000 ft
Access Road	96	72	68	59
Queen Ka'ahumanu Highway				
North to Waikoloa Road	57	70	65	56
North of Waikoloa Rd. to Kawaihae and South to Kona	38	65	61	52
Waikoloa, Mahukona and Kawaihae, Waimea Rds.	19	65	61	52

+86 dBA is the State maximum daytime noise level.

Boise quarry and the various construction sites. Noise from the trucks will be audible for approximately 1,500 feet on either side of the main access road. Two factors minimize the impact of this noise:

1. The access road passes through an undeveloped area from the Queen Ka'ahumanu Highway to a point just below the King's Trail.
2. Below the King's Trail, the road splits into two with a resulting decrease in the volume of traffic using each thoroughfare.

Step 1A Resort Operation Noise

The noise generated by the operation of Step 1A of the resort will be the result of guest entertainment, such as cultural shows, dancing, night club acts, etc. will generally be contained within enclosed entertainment areas in the hotels and in the resort commercial complex, and will occur in the late afternoon to late evening hours. The vast majority of noise will originate in spaces that are typically air-conditioned and, to a degree, sound-proofed, so that noise will normally be well contained.

Some forms of outdoor entertainment within a resort area, however, are highly desirable and, if located properly, can occur without major disturbance to nearby residential areas. It can be expected that on a periodic basis (an average of once a week), an outdoor luau will be held with accompanying Hawaiian music and entertainment. Such events normally take place on a site within the hotel grounds, and can be situated and screened with vegetation and other buffers to minimize noise transmission. Examples of luau and outdoor entertainment areas which are generally effective in channeling noise so as not to be offensive to surrounding areas are found at the Mauna Kea Beach Hotel and at the Kahala Hilton Hotel near Waikiki. Both entertainment areas are situated near the ocean and are surrounded by dense foliage. Music and entertainment are directed toward the ocean and are typically of a soothing and non-offensive nature. Hard rock, jazz and other louder types of music will normally be confined within enclosed entertainment areas. The offshore evening-wind pattern experienced in Puako-Kawaihae area (see Section II) will serve to further minimize sound transmission to interior residential areas.

Increment One Resort Operation, Increment Two Construction, and Increments One and Two Resort Operation Traffic and Construction Noise

The noise level projections for Increment One resort operation and Increment Two construction and for Increments One and Two operation are virtually identical. This is because the additional visitor traffic caused by the operation of Increment Two produces about the same amount of noise as the construction effort to build Increment Two. Noise generated during Increments One and Two resort operation will consist of normal hotel operations noise and noise from visitor and employee traffic. Construction noise will no longer be a factor.

At the resort sites the noise level will be quite low, consisting of only those elements identified above for normal hotel operations.

Traffic noise will be from normal traffic only. Table IV-D.5 shows the noise level estimated for peak-hour traffic flow.

The noise levels are still well within the State limits even though the traffic has increased almost 10-fold. The distance required to attenuate the traffic noise to the background noise level has dropped to about 1,200 feet because of the low truck component in the traffic mix.

Table IV-D.5 INCREMENTS ONE AND TWO
RESORT OPERATION TRAFFIC NOISE LEVELS
(Assuming 50 dBA, L50)

Location	Maximum Vehicle Flow (vehicle/hr)	Sound at Observer Distance (dba, L10)		
		50 ft	150 ft	1,000 ft
Access Road	1,615	80	75	66
Queen Ka'ahumanu Highway				
North to Waikoloa Rd.	969	76	71	62
North of Waikoloa Rd. to Kawaihae and South to Kona	646	75	70	61
Waikoloa, Mahukona and Kawaihae, Waimea Roads	323	71	67	58

Conclusion

In conclusion, it does not appear that noise will be a serious problem in the construction or operation of the resort area because of the lack of existing development in the area and the relative isolation of the site. However, during the period after some operation has started and construction is still going on in other parts of the development, construction noise will have to be carefully controlled to avoid nuisance-level noise problems.

E. ANTICIPATED BIOLOGICAL IMPACTS*

1. Effects on Aquatic Ecosystems

The changes in the physical and chemical quality of nearshore waters that may result from the proposed development have been discussed in Section IV-B.3, Impact on Coastal Water Quality. Certain of these changes affect aquatic life, but while the physical and chemical changes are dependent upon a relatively limited and well known set of factors and processes, the biological response depends upon the complicated interaction of an almost limitless variety of unique organisms about which scientists know discouragingly little.

There are at least two basic reasons for this relative ignorance regarding living systems. First, and most obviously, it has been necessary to develop a basic understanding of physio-chemical systems before beginning any in-depth research into the behavior of the biologic systems which they affect. Secondly, the number and variety of organisms in most natural systems is so great and their tolerances and interrelationships so varied and complicated that it is extremely difficult to make accurate predictions.

In view of the difficulties mentioned above, the following discussion must be considered extremely conjectural. It is aimed at outlining the general direction and approximate degree of the responses that can be expected rather than at producing exact quantitative estimates.

Development of the WBR will produce certain changes in water quality that could have some effect on the aquatic ecosystems of the area:

> Increased amounts of nitrogen in basal water discharged into the site's ponds and coastal waters with a resulting increase in the nitrogen levels in those waters.
>
> Increased levels of pesticide residues in ponds and coastal waters, resulting from their use and entrance into ground and surface waters by these substances.
>
> Possible increased surface runoff into Waiulua Bay resulting in increased sediment load and greater fluctuations in salinity in that area.

The remainder of this section of the report lays out the probable effects of each of these changes on the flora and fauna on and near the WBR.

Increased Nitrogen

Implementation of the development program outlined in this document will result in a tremendous increase in the extent of the vegetation on

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*Source: Belt, Collins and Associates, Ltd.

the site. To sustain this plant life, it will be necessary to import large amounts of soil, water, and nutrients. It is inevitable that a certain amount of these nutrients will eventually leach from the soil and be carried by groundwater to the coast. The nitrogen component of this leachate has the ability to stimulate biological activity in receiving waters, but the extent to which it will actually do so is quite difficult to estimate.

In Section IV-B.2, Impact on Basal Groundwater, it was concluded that the operation of the completed project would result in an increase in the concentration of total nitrogen in basal groundwater from the existing level of 0.9 mg/l to between 1.3 and 3.0 mg/l. The corresponding increase in total nitrogen in nearshore coastal waters was estimated as 0.03 mg/l, sufficient to bring the overall level of nitrogen there to 0.19 mg/l. This is well above the State standard for Class AA waters (0.1 mg/l), but only slightly higher than the existing levels (0.16 mg/l) and very much in line with levels recorded elsewhere in Hawaiian coastal waters (Table IV-E.1). Based on those figures and the fact that the aquatic communities in the areas listed do not appear to exhibit any structural or behavioral characteristics that can be directly attributable to the nitrogen concentrations, it seems reasonable to believe that the projected increase in total nitrogen will not have a significant detrimental effect on the WBR coastal ecosystem.

It is likely, however, that the higher concentrations of nitrogen will result in an increase in the gross primary productivity, i.e., the total rate of photosynthesis (including the amount of organic matter used up in respiration by the organism to sustain its life) in nearshore waters. Theoretically at least, the larger amounts of nitrogen available makes greater rates of primary biological production possible. Realization of this potential, of course, depends upon the availability of other factors such as phosphorous, sunlight and minor nutrients as well, but it is believed that these factors will not limit photosynthesis in the unconfined offshore waters.

Applying the estimated primary production rates given by Gundersen and Palmer (Ms.) to known physical relationships and the available data from the area, i.e.:

> Algae is composed (by dry weight) of approximately 40 per cent carbon, 10 per cent nitrogen, and 1 per cent phosphorous and will, therefore, take up nitrogen and phosphorous at a ratio of ten to one.
>
> Algae can reasonably be expected to fix carbon at a rate of approximately 200 mg/m^3/hour. This amounts to roughly 0.2 ppm carbon/m^3/hour.
>
> Given the above, it appears that nitrogen and phosphorous can reasonably be taken up at a rate of .05 ppm/hour and .005 ppm/hour, respectively.
>
> The volume of water within 200 feet of the shoreline and at a depth of less than five feet, i.e., the volume of water which is

Table IV-E.1 REPORTED CONCENTRATIONS OF NITROGEN AT SELECTED LOCATIONS IN HAWAIIAN COASTAL WATERS

Location	Predominant L.U.	Total N (Summ., p. 183) Range	Total N (Summ., p. 183) Median	Range of Total N (mg/1)	Average Total N
Kahana Bay, O'ahu[1]	Natural	0.028-0.230	0.114	.072-.390	.2293
Kahana Bay, O'ahu[2]	Natural				.11
Kahana Bay, O'ahu[3]	Natural				.115
Maunalua Bay, O'ahu	Residential	0.036-0.840	0.157	.071-.317[4]	.138[5]
Sandy Beach, O'ahu	Golf Course, Residential	0.041-0.375	0.151	.079-.215[6] .064-.149[7]	
North Kaua'i					
Waikiki	Urban	0.037-0.812	0.111		
Kilauea Plantation, Kaua'i	Sugar Plantation	0.064-0.149	0.097		
McBryde Plantation, Kaua'i	Sugar Plantation	0.104-0.252	0.196		

Source: The Quality of Coastal Waters: Second Annual Report
(1) QCW-2, p. 52
(2) QCW-2, p. 60
(3) QCW-2, p. 61
(4) QCW-2, p. 86
(5) QCW-2, p. 88
(6) QCW-2, p. 116
(7) QCW-2, p. 141

significantly affected by basal lens discharge, is approximately 300,200 m^3.

It appears that the 40.5 lb/day of nitrogen that will be added to nearshore waters by the resort can be taken up in less than 1-1/2 hours of photosynthesis each day. The nearshore phosphorous levels are sufficiently high (probably about .05 ppm) that only one-third of it would be required to fix all of the fertilizer nitrogen in photosynthesis.

Assuming that the increased nutrients do, in fact, result in more photosynthesis, what effect is that likely to have on the ecology of the coastal waters off the WBR? It is expected that the golf course and other fertilized landscape areas will leach approximately 40/lb/day of nitrogen into coastal waters. This is sufficient to produce an additional 400 lb/day of algal mass (dry weight). Since the mass of each successive trophic level normally increases about one-tenth the amount of preceding level, 400 lb/day of primarily producers could support 40 lb/day of carnivorous zooplankton and 4 lb/day of carnivorous organisms. It should be noted that these figures are rates of production and may or may not lead to an increase in the standing crop of the system. Our knowledge of the food chain and the resulting rates of nutrient cycling are too crude to permit any quantitative estimates of the extent of this change.

Our very limited knowledge of the coastal ponds and nearshore waters at WBR suggests two things about the aquatic ecosystems there. First, the abundance and diversity of the organisms in the aquatic community are not exceptional when compared with other areas along the South Kohala coast - particularly at nearby Makaiwa Bay. Second, there is considerable variation in the quality (if abundance and diversity may be equated with quality) of the aquatic systems within WBR itself.

The inner portion of Waiulua Bay, where the natural system is already stressed by a large influx of warm, nitrogen-laden groundwater and poor circulation, is likely to suffer the greatest decrease in water quality. On the other hand, the marine community of the inner bay is already adapted to those stresses, and it cannot, therefore, be determined to what extent the further deterioration in water quality resulting from increased nitrogen leaching will be accompanied by changes in the quality or quantity of organism present.

Because the coastal ponds at WBR are fed by groundwater from the basal lens, the predicted increase in nitrogen levels in basal groundwater will result in an increased input of nitrogen into the coastal ponds. We can only speculate on the probable effects of these changes on the pond systems.

The only measurements reported for the 'Anaeho'omalu ponds (Cox et al., 1969: 20) showed no nitrates present in Ku'uali'i or Kahapapa ponds. Since these ponds are fed by groundwater known to contain from approximately 0.9 ppm nitrate-nitrogen, the absence of detectable nitrogen is an indication that all of it is being consumed in photosynthetic activity. This, together with the presence of from 0.0-0.15 ppm

of residual phosphates is a clear indication that it is the level of available nitrogen that now limits the amount of photosynthesis occurring in the ponds. If we assume that the nitrogen and phosphorous levels in the pond water today are the same as they were at the time of the Cox study, i.e., none present, it seems reasonable to believe that the amount of photosynthesis will increase as a result of the proposed development.

The extent of the increase is difficult to determine precisely, but it is possible to make some rough estimates of what may occur. Earlier we projected an increase in nitrate-nitrogen concentration in the basal groundwater to from 1.3-3.0 ppm as a result of the proposed development. No increase in phosphorous is expected. Ignoring the fact that from 10-20 per cent of the water in the ponds is actually seawater allows us to assume that all water entering the ponds will have nutrient levels identical to that projected for the basal lens. With the amount of phosphorous remaining at the present level of about .049 ppm (PO_4^{-3} at 0.15 ppm) and the amount of nitrogen raised to 1.3-3.0 ppm, the nitrogen-phosphorous ratio in the ponds before any biological activity occurs will range from 27-61: 1. Since the normal photosynthesis nitrogen to phosphorous assimilation ratio is about 4.5: 1 (common values reported ranged between 2: 1 and 8: 1; Ryther and Dustan, 1970; Gundersen and Palmer Ms.), it appears that all of the phosphorous will have been exhausted while from 60-80 per cent of the nitrogen remains. The ponds, in short, will have changed from a state where the amount of nitrogen is the limiting factor and there is an excess of phosphorous to a situation where phosphorous is limiting and there is an excess of nitrogen. Whether or not the actual amount of primary production will increase to its full potential is, of course, dependent upon a number of factors in addition to the nitrogen-phosphorous levels discussed here. Other environmental conditions such as shade and turbidity, for example, may reduce the amount of light energy reaching the pond below the levels necessary to sustain photosynthesis all the way to the point of complete phosphorous depletion. Similarly, other trace materials may be exhausted before the amount of phosphorous becomes critical.

A rather similar combination of coastal ponds and proposed development was examined in an EIS prepared by Mauna Loa Land, Inc. for their activities in Kalahuipua'a, and we believe that many of the conclusions reached concerning the effects of proposed resort-residential development on the pond systems are applicable to the WBR situation as well:

> "First, it can be expected that nutrients will be abstracted at a greater rate by phytoplankton than by benthic plants such as the Enteromorpha and Ruppia . . ., but that all will increase in biomass. Gross et al. (1974) reported phytoplankton growth two to three times as rapid as bottom fauna in response to a combined nitrate, phosphate, and soil-extract fertilization. Second, the successive links in the food chain will increase in proportion to the increased amount of their food -- zooplankton will graze on the primary producers, the phytoplankton; barnacles and nehu will eat the zooplankton; milkfish shrimps

and crabs will eat the benthic plants; and carnivorous fish and crabs will feed on all of these. Third, it can be expected that production will add, to some extent, green and brown color to the water as a result of increased amounts of suspended organic particles, and that the water clarity will thus be reduced. Fourth, the increased rate of primary production will not favor the traditional food resources of Hawaiian fishponds, mullet and milkfish, since these species feed almost exclusively on micro and macro benthic plants. Rather, the greatest growth will be in herbivorous species which graze in the water column. Hiatt (1944) might be consulted for a detailed study of the biological interrelationships in Hawaiian fishponds." (Belt, Collins and Associates, 1975: 136).

At the WBR, the dredging of the Kahapapa and Ku'uali'i ponds in 1973-1974 removed most of the benthic biota mentioned above and has left the water rather turbid, although far cleaner and less odiferous. These ponds represent a key feature of the WBR, as they front on four major hotel sites and are significant to the history and culture of the area. It is likely that every effort will be made to maintain their appearance. In addition, it can be expected that as a result of wise management of the ponds, this important element in the pond ecosystem will be restored and result in at least some decrease in the turbidity that results from large amounts of water column-feeding phytoplankton.

One question that cannot be answered authoritatively at the present time is whether or not the higher nitrogen levels that will result from fertilization will stimulate algal growth beyond the carrying capacity of the ponds. It is possible, for example, that the organic decomposition that would follow a period of fertilizer stimulated algal growth might deplete the dissolved oxygen in the water to the extent that undesirable anerobic decay would take place. With the minimal data that is now available, it is impossible to offer any guarantee that such a result will not occur. It can be stated, however, that the limits imposed by the relatively low concentration of phosphorous make such an occurrence unlikely so long a careful attention is paid to insuring that phosphorous laden soil from the golf course is not carried by surface runoff into the ponds.

Increased Pesticide Residues

It is only recently that scientists have become fully aware of the ubiquitousness and persistence of pesticide residues in the natural environment. As a result, very little is known about the effects, particularly long-term ones, of the various compounds on aquatic systems. No State water quality standards exist as a guide. Until recently, Federal drinking water standards did not consider these pollutants either (compare the standards in Public Health Service 1962 with EPA 1975). The EPA's recently proposed drinking water standards -- about the closest thing to a standard for assessing the effect of pesticides that was found within the time and resource constraints faced in preparing this statement--allow pesticide constituents in waters for human consumption at concentrations which are orders of magnitude above the

parts per trillion levels measured in Hawai'i Kai waters.

The EPA's proposed standards are shown in Table IV-E.2. The allowable concentration of the most toxic constituent--endrine at 0.0002 mg/l--is approximately equal to one part per 10 billion or about 100 times greater than measured level in the Hawai'i Kai waters. If the EPA's drinking water standards for human consumption can be considered to reflect the threat to marine organisms as well (admittedly a great leap of faith), then it might be concluded that pesticides discharged in the runoff, as well as those in the groundwater, from the WBR site will not threaten marine ecosystems. Quite frankly, no better indication of the possible impact can be offered because the true effects are just not known.

Table IV-E.2 PESTICIDE LEVELS OF THE EPA'S INTERIM PRIMARY DRINKING WATER STANDARDS

Chlorinated Hydrocarbons	Concentration (mg/l)*
endrine	0.002
lindane	0.004
methoxychlor	0.1
toxaphane	0.005
Chlorophenoxys	
2,4-D	
2,4,5-TP Silvex	0.1

*The unit of mg/l is approximately one part per million.

Increased Surface Runoff

The increase in surface runoff that has been predicted for the area surrounding Waiulua Bay may have some effect on the bay ecosystem by producing recurring, but short-lived, decreases in surface salinity and increased sediment input. Both the character of the proposed development and the nature of the existing biological systems are such that these changes are not expected to result in a significant biological impact.

As pointed out elsewhere in this report, Waiulua Bay is already under some stress as the result of the influx of freshwater from the basal lens. As a result, the ecosystem that now exists in the inner bay is well adapted to survival in low salinity conditions. It is not, therefore, expected that this change will have a significant impact.

At present, there is no measurable surface runoff from the site and, therefore, no sedimentation of nearshore waters. This will change following the development of WBR. Given the low frequency and intensity of storm events and the coarseness of the imported soil material, however, it is not expected that the sediment load will be appreciable. It very definitely will not approach the much higher rates that have been measured in other areas which nonetheless maintain healthy benthic communities.

2. Impact on Terrestrial Wild Life*

In general there are three different ways in which development can impact upon biological systems:

1. It can involve the physical loss of a habitat.

2. It may alter one or more characteristics of the environment upon which certain members of the biological community are dependent for good health or survival.

3. It may disrupt the food chain by interfering with the movement of organisms or by reducing the number of organisms that are available as prey to support trophic levels.

The impacts can be direct, as when the development activity involves the physical destruction of organisms. More frequently, however, they are circuitous. Construction or operation of the new facility produces subtle change in the environment - increased noise, changes in nutrient levels in both fertilized soil and bodies of water, obstacles to migratory movement, increased food for scavengers, etc. - which eventually result in changes within the biologic community. Given man's very limited understanding of the dynamics of complex natural systems, these biological impacts are extremely difficult to predict with certainty, but they are one of the keys to rational environmental management. This section outlines, in very qualitative terms, the likely and possible effects, both direct and indirect, that the proposed development will have on the plants and animals that live at 'Anaeho'omalu.

At present, the barren lava flows that cover the vast majority of the site contain no significant sources of food or water that might support wildlife. They are, however, used as transit areas by goats moving back and forth between coastal ponds and the grasslands that begin several miles mauka of the WBR site. While the introduction of additional vegetation in the form of landscaping and a golf course will, theoretically at least, increase the potential food supply for these animals, the noise and activity associated with the resort operation - to say nothing of the gardners responsible for maintaining the landscaping - will have an opposite influence that will far outweigh these theoretical improvements.

It is to be expected that the goats, which can now be seen in relatively small numbers, will probably leave the area occupied by the WBR. It is not known what effect this will have on the overall goat population. Neither is it clear if the modifications proposed on and around the King's Trail will affect its continued use as a regional thoroughfare by goats crossing over the rough 'a'a of the Kaniku lava flow.

The introduction of landscaping, a golf course and organic wastes will

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*Source: Belt, Collins and Associates, Ltd.

probably increase both the number of habitats and the primary food supply present on the site. As a result, birds and animals that thrive in open grass, tree, and shrub habitats and are tolerant of the constant movement and noise associated with human use of the site, e.g., mynahs, sparrows, cardinals, golden plovers, mongooses, etc. will probably become established.

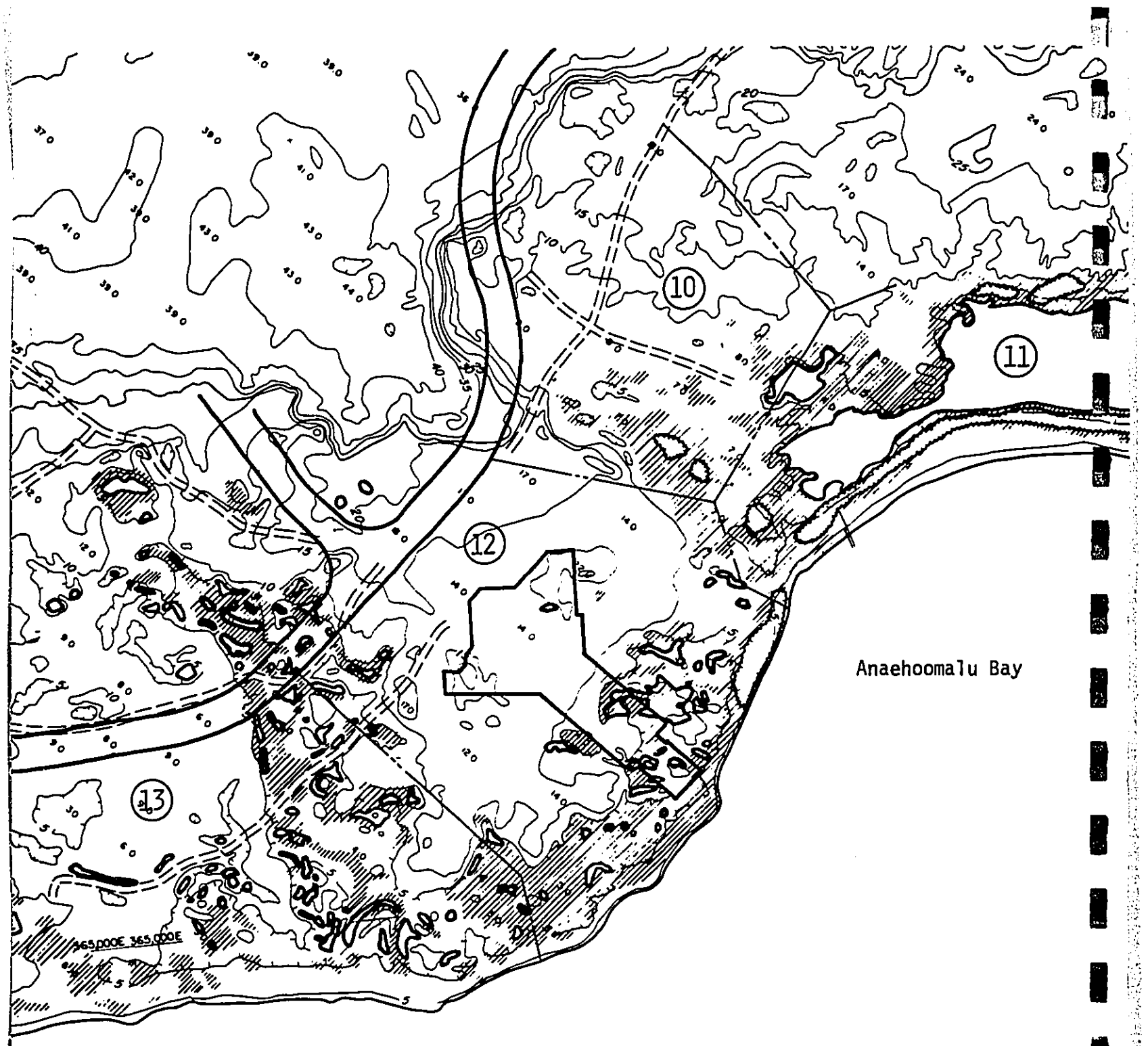
The impact of the proposed development on the terrestrial wildlife in the vicinity of the fishpond oasis will probably be minimal. Nearly all of the native vegetation is being retained and there will be, therefore, little change in the habitats available. The hotel development on the lava flow may have some "spillover" effect, but, it is not expected to be significant.

The waterbirds seen on one of the larger inland ponds have not been identified. It is therefore difficult to assess the impact that the proposed development will have on them. It is possible, however, that the increased activity may discourage their continued use of this area. It must be noted that the ponds have never been identified as a significant waterbird habitat, and their abandonment is not likely to be significant.

3. Impact on Terrestrial Plant Life

Plant life is nonexistent over most of WBR. Thus, the vegetation that is clustered around the ponds and in a narrow strip along the shoreline (which, in different surroundings, would probably be regarded as insignificant scrub), stands out as a green oasis. The development proposed for the site will leave perhaps 90 to 95 per cent of this existing vegetation intact. It will, in fact, complement it by extending the existing strand vegetation into at least four of the six hotel sites. The coconut palms, milo, and kiawe that are now in the area are extremely competitive and well suited to the local environment, and there is little chance of introduced species supplanting them.

The extensive landscaping planned for areas that are now unvegetated lava will increase both the number and density of organisms present. To the extent to which the introduced vegetation is dependent upon a regular irrigation, of course, the new system will be somewhat less stable than at present (assuming that lifelessness is a very stable condition). Nevertheless, we believe that the relief that the landscaped areas will bring to mile after mile of otherwise uninterrupted rock will be a positive change in the environment.



LEGEND

Vegetated High Water Table Area*

Coastal Ponds

* Vegetation Identified From Aerial

FIGURE AN
WAIKOLOA BEACH RESORT
COASTAL PONDS - HOTEL PARCEL 12

400' 0 400'

4. Physical Impact on Coastal Ponds

Given the wide distribution of ponds in the area between the access road and the shoreline on Parcels 12, 13, 14, and 16 it is impossible to develop these parcels as zoned without covering some of the ponds with buildings.

The exact number of ponds that will be affected is dependent upon the detailed design of each of the structures and ancillary facilities. The hotel planned for Parcel 12, the only building for which floor plans are now available, will require the filling of at least five small ponds with approximately 500 square feet of surface area. Several other ponds are within such close proximity to the proposed structure that they may also be affected by the construction activity. (Figure AN).

All ponds within the 40 foot setback and lot line setbacks will obviously be preserved. However, it is Boise's intention ot preserve as many ponds as possible. They provide a very desirable landscape amenity to both hotel and condominium projects. The only modifications that might be made to the ponds planned for preservation would be the construction of walkways for the shoreline trail and the possible augmentation of the existing vegetation.

F. IMPACT ON ARCHAEOLOGICAL SITES*

As even a cursory examination of the description presented in Section II-C must reveal, the WBR site contains an abundance of archaeological resources. It is, of course, impossible to preserve all of these and still proceed with the proposed project, but Boise has worked very closely with professional archaeologists, planners, and government officials to arrive at a development plan which respects, and in many ways enhances, the existing historic and cultural resources of the area. This section describes the actions which will be taken with respect to the archaeological sites that have been designated for special consideration by the Bishop Museum, the County zoning plan and the nominations that have been or will be made to either the State or Federal register of historic places.

Step 1A (See Figure B). Five of the site's most important historic areas will be restored and opened to the public under controlled conditions during this phase of development.

The King's Trail. While the King's Trail is not within the zoned area that will be developed, it will be used as a part of the archaeological display. With the exception of the required road and service crossings (already established and graded), it will be maintained as is. The buffer space between the trail and the adjacent zoning will be landscaped as necessary to screen the development areas from the trail and to separate the trail from the golf course. At road crossings, a textured pattern of paving will be placed across the road to maintain the continuity of the trail.

'Anaeho'omalu Petroglyph Field. This site, which is also outside the present zoned area, will be used as a part of the public archaeological display. The preliminary plan is to construct a designated path with interpretive signs through the petroglyph field and to establish a dense landscaped buffer between the golf course and the petroglyph field to protect the fragile pahoehoe lava from golf spikes.

Site 100, The Cave Complex. This site has been placed within a special open zoned area to insure its preservation. The complex will be buffered from surrounding development by a landscaped belt and developed as a public archaeologic and geologic display area.

The Camel Area, Group H. This group is within a special open zoned area set aside specifically for the preservation of this historic site complex. The geologic feature known as the "camel" will be incorporated into a landscaped belt that will run from the main access road to the fishpond area. It will be nominated to the National Register of Historic Places.

Ku'uali'i Fishpond Area, Group G. Preservation of sites 126 and 127 has been insured by incorporating them into an open zoned area

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*Source: Belt, Collins and Associates, Ltd.

around the fishponds. Boise intends to restore these sites using authentic materials and techniques. If possible, the restoration process itself will be open to the public under controlled conditions.

'Anaeho'omalu Point Cluster Group D. This cluster is within hotel Parcel 12, the hotel site designated for the first hotel. Some of the area has been graded in the past three years, but a cluster of features still remains. The Bishop Museum has been commissioned to finish the midden excavation before hotel development starts. When the archaeological retrieval is completed, the hotel developer will be encouraged to preserve this cluster as a part of his hotel design.

Remainder of Increment 1. Several additional sites that have been designated as important will be affected by construction of the remainder of the first increment of development.

Site 148, a collapsed lava tube in the vicinity of the old jeep road, contains a large midden deposit. Its location close to the makai boundary of hotel Parcel 4 makes it possible to preserve this site for future excavation within a landscaped buffer zone.

The petroglyph field comprising Site 241 is situated on the boundary between hotel Parcels 10 and 12 and will be incorporated into the landscaped buffer zone between the two hotels. The best petroglyphs have been removed and stored in a safe place by Claude Jenkins of the Boise staff.

Ridge Cluster Group E is within a multi-family housing area adjacent to the site of the temporary golf clubhouse. If this site is nominated to the National or State Register of Historic Places, the developer will submit a request for State action to complete excavation prior to any construction activity. Should the State fail to act, the developer of the multi-family cluster on this parcel will be encouraged to preserve some portion of the assemblage within the building groups.

Golf Course Area Group I. The petroglyph field identified as site No. 135 is situated on unzoned land just makai of the King's Trail. It is on land that will be preserved as part of the buffer zone around the trail.

Ahu-o-Lono Area Group F. This site falls within an area designated for multi-family development. The actual developer of the site will be required to preserve it -- probably within a parking area.

Increment 2. The archaeological sites that will be affected during the development of the second increment of zoning are those situated along the ocean face of the Kaniku lava flow.

Kaniku Settlement Group A. No specific sites are identified for preservation. However, the group is strung along the edge of the Kaniku lava flow adjacent to Waiulua Bay, placing the majority of the sites within the 40 foot shoreline setback required by the State. Means to preserve the area will be considered at the time of development of the adjacent hotel site.

Nawahine Rock Settlement Group B. Some of this group is also within the 40 foot shoreline setback and protected from development. The remainder of the cluster will be preserved as a part of the golf course open zone designation, and hole number 12 will be aligned in the field in such a way as to avoid this group.

Kaniku Settlement Group C. Some of this group is within the 40 foot shoreline setback. The remainder will be preserved when the adjacent area is developed into multi-family housing.

The three groups listed above are not a part of the first increment of zoning. However, the golf course that will be built in this area as part of Step 1A of Increment One will be located in such a way that the least disturbance possible will be done to the sites. Since there will be a requirement for a coastal trail to provide public access to the ocean, the poorly defined coastal trail connecting the sites can also be preserved. (It is also partially in the 40 foot shoreline setback).

Some of the sites that have been judged to contain material of significant archaeological value may not be preserved intact. Where appropriate, however, additional salvage work by the State Historic Preservation Office, the Hawai'i County Planning Department and the Bishop Museum will be encouraged. More specifically:

The 'Anaeho'omalu Point cluster (and particularly Site No. 133 on hotel Parcel 12) will be excavated by professional archaeologists at the request of the landowner. All salvage work will be completed prior to development of this Step 1A hotel site.

Other sites that have been identified as worthy of salvage will be nominated to the State or National Registry of Historic Places in order to qualify archaeological research done on them for financial assistance from State and Federal agencies. Once salvage operations have been completed, the sites are of little archaeological or cultural value and may be removed or incorporated as minor features within the overall landscaping plan.

Once salvaged material has been studied and interpreted, it will be utilized in two different ways. The best preserved and most significant pieces will be retained by the owner and displayed at the various restored sites that are planned or used in the interpretive program being developed by the County for the Kohala Regional Historic District. Salvaged material which cannot be used in this manner will be placed in the Bishop Museum, the designated State Archaeological Repository.

G. VISUAL CHARACTER*

1. Present Visual Character

Visually, the South Kohala coastal region is characterized by expansive, uninterrupted open space framed by the ocean, distant mountains, and sky. Vast, gently sloping gray and brown lava flows slant into clear blue waters. The shoreline is accented by scattered groves of coconut palms and kiawe trees that have won a tenuous foot-hold on the lava. They share the narrow coastal strip with many coastal ponds and water holes and with an occasional crescent of white sand.

2. Visual Impact of the Proposed Development

The visual impact of WBR must be considered on two scales: (1) The specific visual impact close-up of each hotel, condominium or other building can only be determined when the design for that building is finalized; (2) However, the large-scale visual impact of the WBR as a whole can be presently evaluated, since it is based, not on specific design of particular buildings, but on the overall pattern of the height, bulk and color of the structures, and the character of the landscape matrix within which they are situated.

Development at WBR will be designed to blend with and complement the dominant natural forms and colors of the South Kohala coastline by:

a) Expanding from an existing coastal oasis.

b) Using, where possible, earth tones and accents of wood to blend or contrast tastefully with the existing vegetation and lava.

c) Shielding structures from external vantage points through the use of shade trees and coconut palms.

While WBR starts from an existing visual focal point at 'Anaeho'omalu Bay, the introduction of landscaped grounds and recreational facilities, particularly the golf courses, will significantly increase the amount of vegetated area. It will also create a less isolated feeling for those in close proximity to its boundaries. Given the huge scale of the South Kohala region, however, it will not significantly affect the character of the area when seen from afar.

3. The View of the Development from Queen Ka'ahumanu Highway

The openness of the area makes it highly visible from both the Queen Ka'ahumanu Highway and the more distant upper Belt Road (Mamalahoa Highway). The impact on views from the Queen Ka'ahumanu Highway of construction of a hotel on each of the hotel-zoned parcels was stud-

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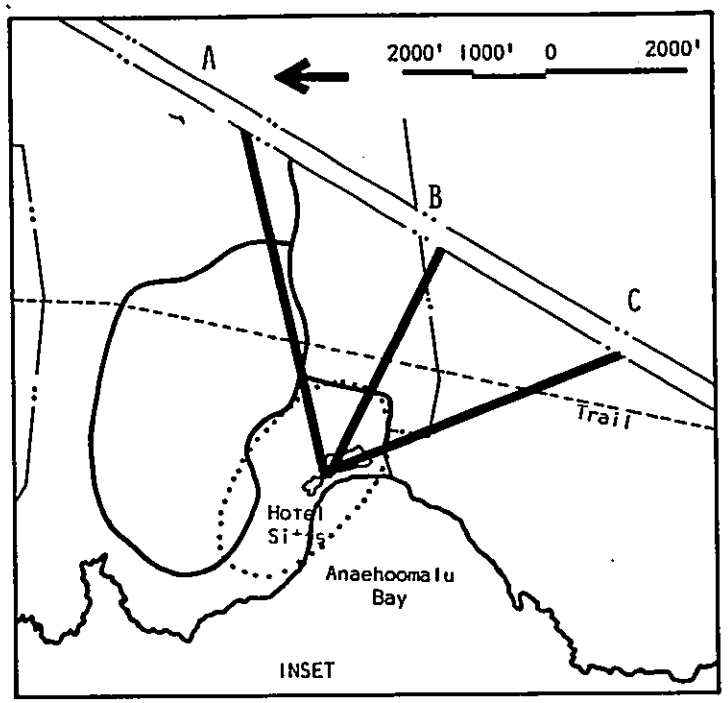
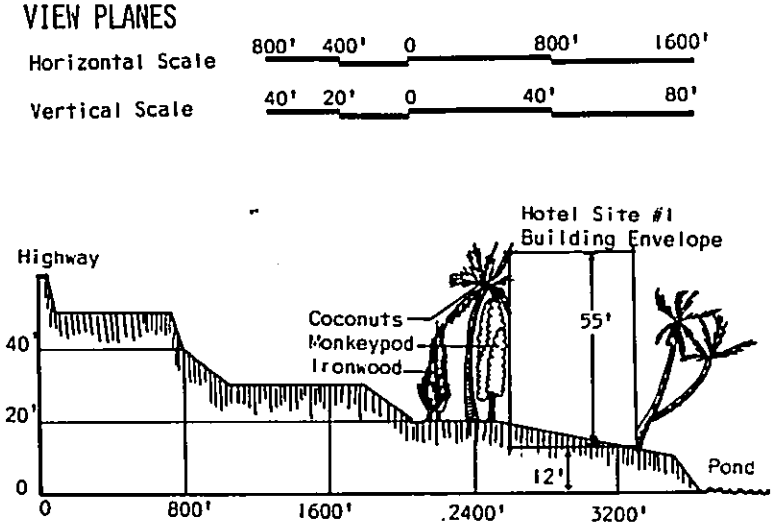
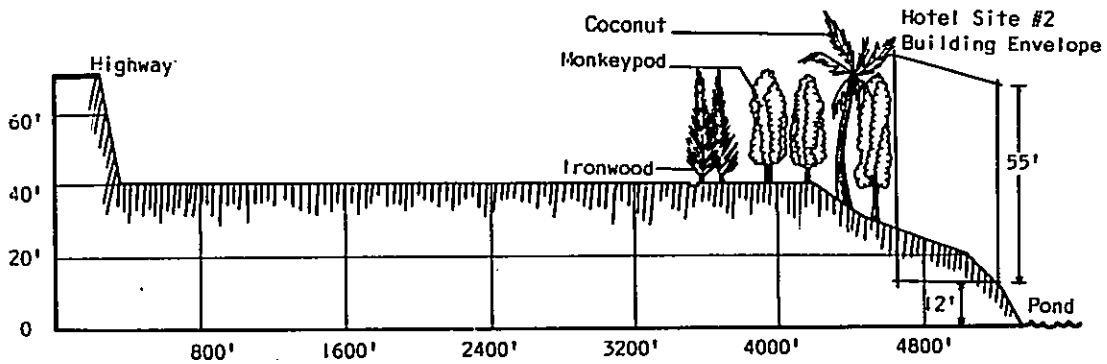
*Source: Belt, Collins and Associates, Ltd.

FIGURE AO
WAIKOLOA BEACH RESORT
VIEW PLANES

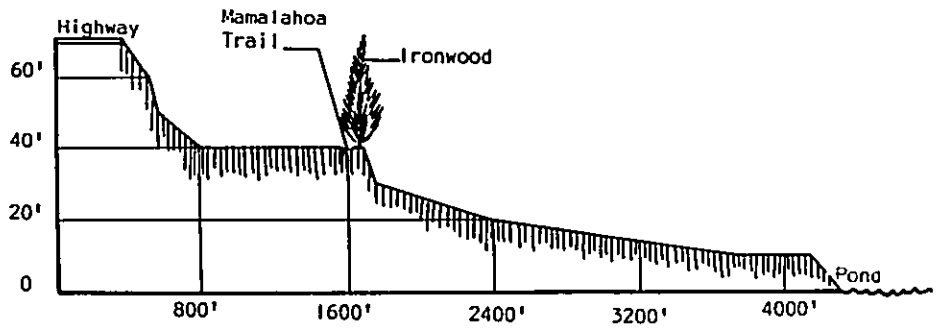




SECTION B



SECTION A



SECTION C

ied. This analysis indicated those stretches of highway from which the resort area would be visible and the overall visual impact of the proposed construction. This information was then used as a guide in locating tree plantings that would be used to screen the hotel from the highway.

As can be seen from Figure AO, the resort area is visible from a two-mile stretch of Queen Ka'ahumanu Highway that begins at the south edge of the Kaniku lava flow and extends nearly to the jeep road linking the highway with the southern portion of 'Anaeho'omalu Bay. The sections shown in Figure AO show the view of the hotel sites from the center and either end of this zone of visibility. (Please note that the sections have a vertical dimension with an exaggeration of 16 times the horizontal dimension in order to make them meaningful at this small scale.)

Also shown in the sections and on the plan is the landscaping buffer that will be planted just makai of the King's Trail along the King's Trail buffer strip and the access road landscaping. The combination of the two landscape buffers (to be established at the same time as the Step 1A hotel; see Section 1) will (when mature) effectively screen the hotel development.

H. ECONOMIC IMPACT*

Economic impact of the resort is discussed in the following subsections:

1. The number of visitor industry jobs that will be generated at the WBR site.
2. Construction employment, and indirect employment not necessarily on-site.
3. Characteristics of employment.
4. The need for in-migration.
5. Impact on income.
6. New housing demand.
7. Impact on population.
8. Revenues to the State and local governments.

The degree of sophistication and accuracy of the projections of these economic activities vary considerably. This is due largely to the availability of adequate data for some forecasts and some delineations. In other cases, accurate information as to indirect jobs created elsewhere in the District and County, or hidden cost to government incurred for services for resort employees and their dependents cannot be predicted with much confidence by the best of experts.

The lack of precision of some of the economic projections is not particularly disturbing however. Generally, in terms of monetary changes, the net effect of the resort on both private and public sectors would be to provide employment and concomitantly, increase income in the region. The resort will provide income to those now without jobs, increase income for those who consider themselves underemployed, increase family incomes for jobs that are taken by second members of households, stimulate the supportive sector of the regional economy by the multiplier effects of spending and respending, and by all indications of previous economic studies, result in greater revenues than costs to government.

1. Impact on Employment

The next table, Table IV-H.1, shows the estimated marketability of primary resort facilities at WBR based upon estimated demands presented earlier. Retail space in the hotels is based upon an estimated 25 square feet per room requirement. Retail space for condominium users is based upon the assumption that only 25 per cent of the condominium units would be occupied as transient accommodations, and the level of retail expenditures of those users would be only half that of hotel room users. This assumption is made since most of the condominium users stay for longer periods. As such, much of the impulse purchasing for clothing, jewelry and so forth is not made on a day-in and day-out basis as in the case of hotel rooms where the guest turnover is much faster.

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*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.1

ESTIMATED MARKETABILITY OF PRIMARY RESORT FACILITIES
Waikoloa Beach Resort 1978-1990
County of Hawai'i

	Hotel Rooms	Resort Condominium Units	Retail Space In Hotels (Sq. Ft.)(1)	Retail Space For Condos (Sq. Ft.)(2)	Golf Course
1978	350	100- 160	8,800	300- 500	18 Holes
1979		100- 160		300- 500	
1980	300	100- 160	7,500	300- 500	
1981		130- 200		400- 600	
1982		130- 200		400- 600	
1983	300	130- 200	7,500	400- 600	
1984		130- 200		400- 600	
1985	300	130- 200	7,500	400- 600	
1986		190- 300		600- 900	
1987		190- 300		600- 900	
1988	300	190- 300	7,500	600- 900	
1989		190- 300		600- 900	
1990	300	190- 300	7,500	600- 900	18 Holes
Totals	1,850	1,900-2,980	46,300	5,900-9,000	

(1) At 25 square feet per room.
(2) Assumes 25 per cent of condominium units occupied as transient accommodations, sales at one-half the rate of hotel occupants.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

The forecast shows that approximately 350 rooms will be demanded starting in 1978 with periodic requirements for another 300 rooms about every two and one-half years thereafter to 1990. Thus, over the period 1978 to 1990, a total of 1,850 rooms are estimated to be in demand. Hotel rooms will create by far the largest requirement for employees in the resort project. This is shown in Table IV-H.2, which shows projected direct employment for WBR from 1978 to 1990. Data relating to employment ratios, characteristics and composition were derived from estimates made by Princess Hotels International, hotels situated in West Hawai'i and from results of research by Merrill (1974). For the first hotel in 1978, Princess estimates that their employee ratio will be 1.3 employees per room on a Modified American Plan.

The preceeding market section suggests that the first hotel facility be a high quality hotel. The luxury class hotel proposed by Princess is within this category and will likely achieve favorable market acceptance. Other hotel facilities proposed are envisioned to be the quality of hotel referred to earlier. The ratio used for the remaining hotel jobs was taken from the Merrill study in which five Neighbor Island resort hotels and two Neighbor Island limited amenity hotels were analyzed. Based upon the results of the study, it appeared that the hotels analyzed consisted of the Inter-Island Resort properties. Further, the hotel in the sample which most closely approximated the hotel facilities envisioned at WBR after the first hotel was the Kona Surf Hotel. Review of the Merrill study results indicated that the employment level at the Kona Surf was 0.72 employees per room; even though the employee ratio averaged 0.76 for all five resort hotels. In the hotel market section, it was recommended that hotel facilities at WBR, generally, be of a quality between the Kona Surf and the Mauna Kea Beach Hotel, which has an employee-to-room ratio of 1.87. However, the Mauna Kea Beach Hotel operates on the modified American Plan with two meals included in the price of the room and, therefore, has more eating and drinking facilities than a hotel not operating on the American Plan. Since the envisioned remaining facilities would approximate the quality of facilities at the Kona Surf, the employee ratio would also be closer to that experienced there. As a result of this comparison and analysis, we concluded that the estimated number of employees per room for the remaining proposed WBR hotel facilities should average 0.76, the same average as the five full resort facilities included in the Merrill study. This would apply as well on a marginal basis to the additional 50 rooms anticipated at the Princess facility. Thus in Table IV-H.2, we see that the first 350-room luxury hotel will generate 455 new jobs. In Table IV-H.2, we also see that each succeeding 300 hotel rooms should create jobs for 228 persons.

Based upon a study conducted by Hastings, Martin, Hallstrom and Chew, Ltd. (1974), it was determined that manpower requirements for resort condominiums was about 0.15 employees per gross dwelling unit. Since our forecast indicated a demand for 100 to 160 units per year from 1978 to 1980 and increasing thereafter, the resort condominiums should create employment for 15 to 24 persons through 1980 with proportional increases thereafter to 1990.

Regarding the jobs created by retail space requirements, we have as-

Table IV-H.2

ESTIMATED NEW JOBS CREATED BY PRIMARY RESORT FACILITIES
(EXCLUDING CONSTRUCTION)
Waikoloa Beach Resort 1978-1990
County of Hawai'i

	Hotel Jobs	Resort Condominium Jobs	Retail Jobs In Hotels	Retail Jobs For Condo Users	Golf Course And Club House Jobs	Maintenance And Other Recreation	Total Yearly[1]	Total Cumulative
1978	455	15- 24	44	2	30	10	565	565
1979		15- 24		2			26	591
1980	228	15- 24	38	2		8	300	891
1981		20- 30		2- 3			33	924
1982		20- 30		2- 3			33	957
1983	228	20- 30	38	2- 3			299	1,256
1984		20- 30		2- 3			33	1,289
1985	228	20- 30	38	2- 3			299	1,588
1986		28- 45		3- 4			49	1,637
1987		28- 45		3- 4			49	1,686
1988	228	28- 45	38	3- 4			315	2,001
1989		28- 45		3- 4			49	2,050
1990	228	28- 45	38	3- 4	20	4	339	2,389
1978-1990 Total	1,595	285-447	234	31-41	50	22	2,389	

(1) High range.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

sumed that the persons staying in hotels will generate a demand for approximately 25 square feet per room and that retail employment will consist of one person per 200 square feet of retail space. Thus, 8,800 square feet of retail space and 44 retail employees would be required for the first hotel and each of the succeeding 300-room additions will create a retail employee demand for 38 persons. In addition, persons staying in condominiums will make retail expenditures, although at a much lower pace than those staying in hotels. Again, we assumed one employee per 200 square feet of retail space. Retail jobs created by this use are also shown in Table IV-H.2.

Other facilities and functions which will generate direct employment are the golf course and clubhouse, service and maintenance of infrastructure and requirements for other recreational activities. Based upon the number of jobs at Mauna Kea Beach Hotel and other resort golf courses, it is expected that WBR's 18-hole resort golf course and clubhouse facility will employ a total of about 30 persons initially. The future expansion of the clubhouse facilities and possible addition of another 18-hole golf course will require approximately 20 more employees.

Thus, over the period from 1978 to 1990, the high estimate new jobs created by the WBR primary resort facilities will be 2,389, most of which will be created by the resort hotels.

2. Construction and Indirect Jobs

A large construction effort is anticipated in the initial development of the first hotel, golf course and clubhouse facilities, roadwork and utility services, related grading and site improvements, possibly the construction of condominium units, and so forth. Construction of subsequent increments would include hotels, condominiums and commercial facilities in addition to recreational facilities and historical site restoration. Later, housing for permanent residents will sustain a demand for an ongoing construction force.

Off island contractors of hotels and other large scale projects normally draw available workers from the local labor pool primarily in the semi-skilled labor categories, and then import their remaining management and skilled labor requirements. It is expected that this pattern will continue through the WBR development. After consulting with Honolulu construction firms and with Mauna Kea Beach Hotel and Boise staff personnel, it has been estimated that the initial construction effort will require approximately 300 persons for about two to three years. The bulk of these workers will be in the categories of craftsmen and foremen, operators and laborers.

It is estimated that about 50 per cent of the initial construction labor force requirement will come from the available labor force in North and South Kohala Districts.

In addition to the direct employment predicted for the resort and construction, a number of other jobs will be created in the local Kohala Districts and elsewhere in the County. Trade and services outlets,

and public utilities for the local residents will be created or expanded as a result of the development of WBR. In addition, changing tastes resulting from higher incomes of the existing population and in-migrants will create additional demands for new types of goods and services, including those of higher quality.

Many attempts have been made to predict the employment multiplier effect for the visitor industry. For example, in planning for the dispersion of tourism in the West Hawai'i area in the 1960's, the State expected that 0.7 indirect jobs would be created for each direct job created at a hotel site (DPED of 1972).

However, indirect jobs did not materialize at nearly that rate. Dr. Robert Anderson, an economist currently working on the Kohala Community Development Plan, estimates that a more conservative multiplier is appropriate, based upon the results of studies done on Kaua'i. To predict indirect jobs within the region as a result of new resort projects, he has used a ratio of 0.2 indirect jobs to one direct job. This ratio is for new private sector jobs and does not include government. However, it is estimated that the public sector additions will occur in Hilo and not necessarily in the region itself.

The indirect impact of construction jobs on the community is likely to be less than that for resort jobs. This is due mainly to the fact that about 50 per cent of the construction labor force consists of temporary in-migrants who save and then make expenditures elsewhere, or those who commute to the job site from outside the region. As a result, we estimate that the indirect effect of construction jobs is only 0.1 to 1.0.

Again, these estimates are only approximations and should be treated as such. Also, many of the indirect jobs will be created throughout the County, not just in the District. For example, a significant portion of the jobs are likely to be at Hilo and Ke-ahole Airports. However, in order to conservatively assess their impacts, we have assumed that these indirect jobs will occur locally and therefore have taken their impacts into account.

Table IV-H.3, shows our estimates of the direct resort and construction jobs and their indirect effects from 1976 to 1990. The table shows that by the end of the forecast period there will be some 2,390 direct and 490 indirect jobs resulting from the resort. Over the same period, it is expected that the construction requirements at the site will drop from 300 in 1976 and 1977, and stabilize at a level of 150 from 1978 through 1990. The indirect construction effect will be 30 new jobs in 1976 to 1977, declining to 20 from 1978 to 1990. Thus, the total effect of the construction activity will be a demand for 330 jobs in 1976 to 1977, declining to 170 from 1978 through 1990. The total effect at the end of 1990 will be a direct job requirement of 2,540 jobs, and an indirect requirement of 510 jobs, and thus an overall requirement for 3,050 total jobs.

3. Characteristics of Employment

Estimated incomes for the jobs that will be created at WBR are based

upon the prevailing wage scales per department at the Mauna Kea Beach Hotel. This also reflects the wage levels of the current contract between the ILWU Local 142 and Hotel Employers' Association of Hawai'i, and is generally applicable to those for other hotel operations in West Hawai'i. Wage scales for non-hotel jobs in the resort are based upon data for current recreation and maintenance facility employees at Waikoloa and the Mauna Kea Beach Hotel. Table IV-H.4 shows the distribution of the various income levels by type of job which can be expected at WBR.

Several points should be made about the estimated wage level distribution. First, the degree of precision reflected in the numbers in the table is actually greater than our ability to predict them. Therefore, the number of jobs in each category should be viewed as estimates only. Second, the bulk of the jobs will be in the $4,500 to $8,000 range (in 1975 dollars) reflecting the relatively low level of skills required for most of the jobs. Third, the wage figures in the table do not reflect the additional income that most of the employees will receive from tips and distribution of service charges. A study on visitor spending patterns (Touche, Ross, Bailey and Smart, 1966) found that these add about 17 per cent to the income for the total hotel payroll. Since upper management and certain other job categories do not normally receive tips for distribution of service charges, the bulk of this added income will go to the lower level wage earners.

The data in the table can also be used to estimate the annual wages of all resort employees. Taking the mid-point of each wage level category as the average salary in that category and using $20,000 as the average income in the above $15,000 category, the table shows an average salary per employee in 1975 dollars of $6,819. An addition of 17 per cent for tips and distribution of services to the annual income yields an average employee salary of $7,978 per year, in 1975 dollars.

The distribution of skills for construction workers appears in Table IV-H.5. It is interesting to note that the distribution of skills as indicated by the scale category is approximately the same as that indicated by the distribution of skills recorded for the Kohala Sugar Company by DPED in 1972 (this distribution also shown). It is probable that 50 per cent of the required construction labor force can be drawn from the local labor force.

The August 1975 wage scales for construction employees published by the State Department of Labor and Industrial Relations were applied to the employment categories listed earlier. The results are shown in Table IV-H.6. Based upon the rates shown, the average construction yearly salary would amount to $14,643 per year.

Another characteristic of visitor industry employment is that a large proportion of the job holders are wives, dependents within a family, or persons for whom the job is only supplemental income. It is important to distinguish between these job holders and those for whom the resort job will be the primary source of household income. If the local labor pool is insufficient to meet the employment needs of a resort, i.e., if labor must be imported from beyond the region, mainly indi-

Table IV-H.3

DIRECT AND INDIRECT JOBS[1] CREATED BY PRIMARY RESORT FACILITIES
(EXCLUDING CONSTRUCTION)
Waikoloa Beach Resort 1975-1990
County of Hawai'i

	Operation of Resort Facilities						Construction (Annual On-Site Average)			Total Cumulative Jobs		
	Direct		Indirect[2]		Total							
	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative	Direct	Indirect[2]	Total	Direct	Indirect	Total
1976	-	-	-	-	-	-	300	30	330	300	30	330
1977	-	-	-	-	-	-	300	30	330	300	30	330
1978	560	560	110	110	670	670	150	20	170	710	130	840
1979	30	590	10	120	40	710	150	20	170	740	140	880
1980	300	890	60	180	360	1,070	150	20	170	1,040	200	1,240
1981	30	920	10	190	40	1,110	150	20	170	1,070	210	1,280
1982	30	950	10	200	40	1,150	150	20	170	1,100	220	1,320
1983	300	1,250	60	260	360	1,510	150	20	170	1,400	280	1,680
1984	30	1,280	10	270	40	1,550	150	20	170	1,430	290	1,720
1985	300	1,580	60	330	360	1,910	150	20	170	1,730	350	2,080
1986	50	1,630	10	340	60	1,970	150	20	170	1,780	360	2,140
1987	50	1,680	10	350	60	2,030	150	20	170	1,830	370	2,200
1988	320	2,000	60	410	380	2,410	150	20	170	2,150	430	2,580
1989	50	2,050	10	420	60	2,470	150	20	170	2,200	440	2,640
1990	340	2,390	70	490	410	2,880	150	20	170	2,540	510	3,050

(1) Estimated maxima, rounded.
(2) Indirect employment not necessarily on-site. Estimated to be 20 per cent of direct resort employment and 10 per cent of construction employment.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.4

ANTICIPATED DISTRIBUTION OF GROSS WAGE LEVELS
FOR WAIKOLOA BEACH RESORT EMPLOYMENT (1975 DOLLARS)
Waikoloa Beach Resort
County of Hawaii

	Number of Full-Time Jobs(1) in Each Wage Level Category				Part-Time Employees(2) at $3,000 Average Annual Wage	Casual Employees(3) at $1,000 Average Annual Wage	Total
	$4,500-8,000	$ 8,000-12,000	$12,000-15,000	Above $15,000			
Hotel Employment							
Front Office	0.9%	0.9%	0.5%	0.2%	0.0%	0.3%	2.8%
Housekeeping	13.8	1.5	0.2	0.2	0.5	1.7	17.9
Uniform Services	1.4	0.7	0.3	0.0	0.0	0.5	2.9
Beverage Services	1.4	0.8	0.3	0.2	0.7	0.9	4.3
Food Preparation	7.5	5.5	0.5	0.5	0.0	1.4	15.4
Food Service	10.3	2.2	0.3	0.2	4.4	6.6	24.0
Accounting	2.9	1.7	0.9	0.2	0.2	0.7	6.6
Grounds/Maintenance	4.8	2.6	1.1	0.3	0.0	1.5	10.3
Miscellaneous Services	3.9	1.2	0.7	0.2	0.7	0.9	7.6
Management	0.0	0.2	0.3	0.6	0.0	0.0	1.1
Subtotal For Hotels	46.9%	17.3%	5.1%	2.6%	6.5%	14.5%	92.9%
Other Employment	3.9	1.4	1.2	0.3	0.0	0.3	7.1
Total in Each Wage-Level Category	50.8%	18.7%	6.3%	2.9%	6.5%	14.8%	100.0%

(1) Defined as those who work on a consecutive weekly schedule of 30 hours or more.
(2) Defined as those who work on a consecutive weekly schedule of more than 20 but less than 30 hours.
(3) Defined as those who normally work for less than 20 hours per week on an annual average.

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.5 DISTRIBUTION OF POTENTIAL CONSTRUCTION WORKERS AND KOHALA SUGAR COMPANY EMPLOYEES*

Skill Category	Estimate of Total Required for Construction	Kohala Sugar Company Employees Total to be Released
Professional, Technical	4%	2%
Managers	4	3
Clerical	2	5
Craftsmen & Foremen	30	31
Operators	30	24
Laborers, including:		
Farm, Foremen and Laborers	30	33
Service	--	--
Unclassified	--	2
TOTALS	100%	100%

viduals for whom the job would be a primary income source would migrate to the area. Jobs taken to supplement income usually do not add to the resident population. Rather, these job holders come from the existing regional population by an increase in labor force participation, or they are commuters to their employment from other communities.

Table IV-H.6 PROJECTED WAGES OF CONSTRUCTION WORKERS* Waikoloa Beach Resort County of Hawai'i

Classification	Per Cent of Jobs	Hourly Wage ($)
Professional, Technical	4%	10.00
Managers	4	10.00
Clerical	2	4.50
Craftsman & Foreman	30	7.50
Operators	30	7.50
Laborers	30	5.50
TOTALS	100%	--

The estimated split of primary versus secondary income job holders should be viewed with some caution. All are based on the assumption that the WBR job holders will mirror past employment patterns in West Hawai'i. When the Mauna Kea Beach Hotel opened, many previously non-working wives took the newly created jobs. Thus, the proportion

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

of supplemental income job holders at that hotel is high because employment demands were met by a dramatic increase in the female labor force participation rate. To a lesser extent, the visitor industry employment opportunities in Kailua-Kona and Keauhou have been met in the same manner. However, the situation now differs in that the female participation rate in the area is relatively high and the pool of non-working wives has diminished. Also, the termination of the Kohala Sugar Company has left many primary wage earners unemployed despite employment in Kohala Task Force supported ventures. Therefore, the primary-secondary split of jobs at WBR could be more heavily weighted toward primary job holders than has occurred at other resorts.

4. Need for In-Migration

Our conceptual approach to determining the level of required in-migration to fill the jobs being created at WBR consisted of first determining the current and prospective availability of potential labor force participants from the existing population in North and South Kohala. Then, estimates were made of the anticipated decline in available jobs in North and South Kohala assuming no new resort developments. The current and future labor force availability was compared to the projected number of jobs in North and South Kohala to determine the potential availability of labor force for new jobs being created by WBR. A comparison then was made between the potential availability and the number of jobs expected to be created at WBR to calculate the requirements for net migration. This calculation was refined further to account for the traditional pattern of importing from outside the region persons with management and special skills for operation or construction of remote resort projects.

To determine the potential availability of labor force from the existing population, we first aged the 1970 census population using Hawai'i-specific mortality rates developed by DPED. Series E birth statistics were applied to determine the level of new births expected. These projections utilizing the cohort-survival population forecasting technique, but excluding migration, are shown next in Table IV-H.7. The forecasts, delineated into male and female cohorts, show that, based upon natural increase (the net of births over deaths), both male and female populations are projected to increase through 1990.

Next, an estimate was made of the available labor force in North and South Kohala in 1970 based upon statistics reported in the 1970 Census of Population and Housing. Again, delineations were made between male and female.

In calculating the available male labor force, we assumed that males 16 years and older, excluding those enrolled in school and a portion of those 65 years and older, would be available for the labor force. As seen in Table IV-H.8 the estimated availability of labor force participants is slightly higher than the level reported in the civilian labor force in 1970. For females, we also assumed that those 16 years and older would provide the basis for estimating the labor force availability. From this quantity, we deducted those females not in the labor

Table IV-H.7

FORECAST OF KOHALA POPULATION EXCLUDING MIGRATION
North and South Kohala 1970-1990
County of Hawaii

Age	1970 Male	1970 Female	Est. 1975 Male	Est. 1975 Female	Est. 1980 Male	Est. 1980 Female	Est. 1985 Male	Est. 1985 Female	Est. 1990 Male	Est. 1990 Female
Under 5	272	276	263	270	234	239	286	290	313	318
5 - 9	299	295	270	274	261	268	232	237	284	288
10 - 14	375	314	298	294	269	274	260	268	231	237
15 - 19	241	229	373	313	297	293	268	273	259	267
20 - 24	165	162	231	228	370	312	295	292	266	272
25 - 29	175	174	164	161	229	227	367	311	292	291
30 - 34	137	149	173	173	163	160	227	226	364	310
35 - 39	164	178	135	148	171	172	161	159	225	225
40 - 44	185	185	159	176	133	146	168	170	158	157
45 - 49	177	165	176	182	155	173	129	144	164	167
50 - 54	150	141	164	161	168	172	148	169	123	141
55 - 59	193	124	139	136	152	155	156	166	138	163
60 - 64	157	92	173	117	125	129	136	147	122	158
65+	261	201	317	244	371	302	371	360	382	461
Total	2,951	2,685	3,035	2,877	3,098	3,022	3,204	3,212	3,321	3,455

Birth By Age of Mother

Age	1975 - 1980		1980 - 1985		1985 - 1990	
15 - 19	46	47	44	44	41	41
20 - 24	90	92	124	126	116	118
25 - 29	52	53	73	75	100	102
30 - 34	30	31	28	28	39	40
35 - 39	12	12	14	14	13	13
40 - 44	4	4	3	3	4	4
Total	234	239	286	290	313	318

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.8

ESTIMATED AVAILABLE LABOR FORCE
North and South Kohala - 1970
County of Hawaii

	South[1] Kohala	North[2] Kohala	South and North Kohala
Males 16 Years and Over	739	1,196	1,935
Less: Those Enrolled in School	-	77	77
Less: Over 65, Not in Labor Force	54	152	206
Males 16+ Available for Labor Force	685	967	1,652
Males Employed	609	844	1,453
Males Not Employed, Available for Labor Force	76	123	199
Estimated Employed Plus Not Employed, Available for Labor Force	685	967	1,652
Reported Civilian Labor Force	624	856	1,480
Females 16 Years and Over	707	1,044	1,751
Less: Those Not in Labor Force, With Child Under 6	109	125	234
Less: 90 Percent of the 65+ Population	64	117	181
Less: Those Enrolled in School	21	37	58
Females 16+ Available for Labor Force	513	765	1,278
Females Employed	303	486	789
Females Not Employed	210	279	489
Not Employed and Available for Labor Force (50%)	105	140	245
Estimated Employed Plus Not Employed, Available for Labor Force	408	626	1,034
Reported Civilian Labor Force	327	499	826

(1) Census Tract 217.
(2) Census Tract 218.

Source: Bureau of the Census, 1970 Census of Population and Housing; Hastings, Martin, Hallstrom and Chew, Ltd.

force with children under six years of age, 90 per cent of the 65 and older female population, as well as those estimated to be enrolled in school. Next, we deducted the females who were reported employed. Since there is less need for all females to be employed, we assumed that only 50 per cent of the residual would realistically be available for the labor force, the other proportion being those who for domestic or other reasons would not be available for employment.

We then utilized the percentages in the various categories as determined from this analysis and applied them to the cohort-survival population forecast shown earlier to estimate the potential labor force availability excluding migration for North and South Kohala from 1970 to 1990. These calculations appear in Table IV-H.9. As seen, the availability of males for the labor force is expected to increase from 1,652 in 1970 to approximately 1,861 by 1975, and to 2,096 by 1990. Thus, over the next 15 years another 235 males are expected to be available in the labor force. Females available for the labor force are expected to increase faster than males. Having amounted to 1,034 in 1970, we estimated that the females available for the labor force number 1,161 in 1975. This is expected to increase to 1,543 by 1990. Thus, in the next 15 years, 382 additional females are expected to be available in the labor force in North and South Kohala.

Table IV-H.10 compares the projection of jobs in North and South Kohala with the anticipated labor force availability. Jobs were estimated by assuming that the number available in North Kohala declined 20 per cent from 1970 to 1975 as a result of the phaseout of the Kohala Sugar Company operations. With this major erosion in the agricultural base of the region, we estimated that jobs subsequently would decline at the rate of approximately 15 per cent over each of the succeeding five year periods. We have also detected that with recent activity in South Kohala, particularly in Waimea, Kawaihae and Waikoloa, employment has increased about ten per cent offsetting the decline in North Kohala and suggesting intra-district migration. Assuming that no new resort development will occur, we anticipate that employment gains in South Kohala may continue increasing at about one per cent per year or five per cent for each of the succeeding five year periods to 1990. Based upon the previously calculated labor force availability, we estimate that about 88 per cent of the truly available labor force was employed in 1970 and in 1975, only 72 per cent of the male force was employed. Assuming no new migration and no development of new resort facilities, there will be a diverging trend of available jobs declining due to the eroding agricultural base, and increasing labor force caused by the natural increase of persons aging into the labor force. The result would be a decline in the percentage of available labor force employed from 72 per cent in 1975, to 66 per cent in 1980, to 60 per cent in 1985, and then to 57 per cent in 1990. Correspondingly, we estimate that the female available labor force employed will decline from 62 per cent in 1970 continually to 44 per cent by 1990. We estimate, assuming that no migration has occurred in the North and South Kohala regions from 1970 and 1975, that there are approximately 520 males who are potentially available for the labor force in North and South Kohala. By 1990, this would increase by 75 per cent to a level of 910 males potentially available for the labor force.

Table IV-H.9

ESTIMATED LABOR FORCE AVAILABILITY EXCLUDING MIGRATION
North and South Kohala 1970-1990
County of Hawaii

	1970	1975	1980	1985	1990
Male Labor Force					
16+ Population	1,935	2,195	2,287	2,372	2,441
Less: Those Enrolled in School(1)	77	112	89	80	78
Less: 80% of 65+ Age Group	206	222	260	260	267
Males 16+ Years Old, Available For Labor Force	1,652	1,861	1,938	2,032	2,096
Female Labor Force					
16+ Population	1,751	1,976	2,194	2,362	2,559
Less: Those Enrolled in School(2)	57	78	73	68	67
Less: 90% of 65+ Age Group	181	220	272	324	415
Less: Those Out in Labor Force With Children Under 6 Years Of Age(3)	234	262	278	276	262
Less: Other Not Available For Labor Force(4)	245	255	267	271	272
Females 16+ Years Old, Available For Labor Force	1,034	1,161	1,304	1,423	1,543

(1) Thirty percent of 15-19 age cohort.
(2) Twenty-five percent of 15-19 age cohort.
(3) Thirty-three percent of 15-34 female cohort in 1970, 30 percent in 1975, 28 percent in 1980, 25 percent in 1985 and 23 percent in 1990.
(4) Nineteen percent of remaining female available labor force after deductions for preceding three items in 1970, 18 percent in 1975, 17 percent in 1980, 16 percent in 1985 and 15 percent in 1990.

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.10

ESTIMATED JOBS EXCLUDING MAJOR VISITOR INDUSTRY DEVELOPMENTS
AND ESTIMATED LABOR FORCE AVAILABLE EXCLUDING MIGRATION
North and South Kohala 1970-1990
County of Hawaii

	1970	Estimated Employment Change	1975	Estimated Change	1980	Estimated Change	1985	Estimated Change	1990
Male Labor Force									
N. Kohala Males Employed	844	-20%	675	-15%	574	-15%	488	-15%	415
S. Kohala Males Employed	609	+10%	670	+ 5%	704	+ 5%	739	+ 5%	776
Total Employed	1,453		1,345		1,278		1,227		1,191
Labor Force Available	1,652		1,861		1,938		2,032		2,096
Percent of Available Labor Force Employed	88%		72%		66%		60%		57%
Labor Force Available For New Jobs	199		516		660		805		905
Rounded	200		520		660		810		910
Female Labor Force									
N. Kohala Females Employed	486	-20%	389	-15%	331	-15%	281	-15%	239
S. Kohala Females Employed	303	+10%	333	+ 5%	350	+ 5%	367	+ 5%	385
Total Employed	789		722		681		648		624
Labor Force Available	1,034		1,161		1,304		1,423		1,543
Percent of Available Labor Force Employed	76%		62%		52%		46%		40%
Labor Force Available For New Jobs	245		439		623		775		919
Rounded	250		440		620		780		920

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

In comparison, the number of females available for new jobs in the Kohala District would more than double from 440 in 1975 to 920 by 1990.

Therefore, there will be a very large pool of potential labor force participants in the North and South Kohala Districts available for the new jobs to be created by resort development at WBR. These effects, summarized in Table IV-H.11, compare the estimated net availability of labor force with the anticipated job requirements at WBR. Based upon the Merrill study, we estimate that approximately 50 per cent of the direct WBR jobs will need to be filled by males and the rest by females. Construction, on the other hand, shows 95 per cent of the jobs being demanded by males and only five per cent by females. A comparison of the total new jobs delineated by the male and female with the potential labor force availability in North and South Kohala, also delineated by male and female, shows that sufficient resources are available to satisfy all of the requirements in terms of total numbers until about 1980. The potential labor force availability in 1975 may seem high. However, it must be remembered that many of the potential labor force participants are not reported in the labor force or even looking for work in North and South Kohala due to their general knowledge that no jobs exist and their final resignation to joblessness after unsuccessfully searching for employment. Additionally, a number of prospective participants are out of the labor force due to their recognition that they would be underemployed. If adequate employment were available, these persons might return to the labor force. The same applies to females who may currently be choosing to perform domestic chores due to the lack of job opportunities. Again, if adequate jobs were available, they might choose to enter the labor force.

As mentioned earlier, management and specially skilled employees are usually brought into a remote region for construction or operation of resort facilities. Therefore, a refinement in our forecast was made to account for this in-migration to the area. Table IV-H.12 shows the assumptions which we made in order to carry out this calculation.

Briefly, our criteria considered that a certain proportion of the jobs projected would be filled by in-migrants having managerial or special skills. These in-migrants would also bring with them a number of dependents or wives who would also be available for the labor force. We assumed that the next increment of demand for labor would be satisfied by the local labor force. Once the local labor force has been utilized, then migrants with general skills were assumed to in-migrate to fill the remaining available jobs.

Applying these criteria to the number of jobs needed results in Table IV-H.13. We see that, until almost 1985, most of the jobs are filled by the in-migrants with the managerial and special skills and their dependents, in addition to the local labor force with general skills. It is not until 1985 that the local available labor force is depleted and 30 male and 120 female in-migrants with general skills would be required. In 1990, we expect that 310 males and 370 females with general skills will need to be brought in for the required jobs.

Table IV-H.11

ESTIMATED NET AVAILABILITY OF LABOR FORCE AFTER SATISFYING DEMAND FOR NEW JOBS (INCLUDING INDIRECT JOBS)[1]
North and South Kohala 1975-1990
County of Hawai'i

	1975	1976	1977	1978	1980	1985	1990
New Waikoloa Beach Resort Jobs (Cumulative)							
Male (approx. 50%)				340	540	960	1,440
Female (approx. 50%)				330	530	950	1,440
Total				670	1,070	1,910	2,880
New Construction Jobs (Average On-Site)							
Male (95%)		280	280	140	140	140	140
Female (5%)		20	20	10	10	10	10
Total		300	300	150	150	150	150
Total New Jobs							
Male		280	280	480	680	1,100	1,580
Female		20	20	340	540	960	1,450
Total		300	300	820	1,220	2,060	3,030
Labor Force in North and South Kohala Available for New Jobs							
Male	520	550	580	600	660	810	910
Female	440	480	510	550	620	780	920
Total	960	1,030	1,090	1,150	1,280	1,590	1,830
Net Availability After Satisfying Demand for New Jobs							
Male	520	270	300	120	-20	-290	-670
Female	440	460	490	210	80	-180	-530
Total	960	730	790	330	60	-470	-1,200

(1) Assumes no net in-migration.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.12

CRITERIA FOR ESTIMATING SOURCE OF LABOR FORCE
Waikoloa Beach Resort 1976-1990
County of Hawai'i

New Waikoloa Beach Resort Jobs	
Male: In-Migrants -	
Management and Special Skilled	20 per cent of jobs, 5 per cent for management and 15 per cent for special skills.
General Skilled	Residual supply consisting of excess of demand over combined local supply and in-migrants for management and special skills.
Local -	80 per cent of jobs up to local labor force potential availability.
Female: In-Migrants -	
Dependents of Management and Special Skilled Migrants	20 per cent times male in-migrants for management and special skills.
Dependents of General Skilled Migrants	Residual supply consisting of 30 per cent times male in-migrants for general skills, assuming 60 per cent will have dependents, and 50 per cent of those will have a dependent available for the labor force.
Local -	The amount of demand less female in-migrant dependents of management and special skilled in-migrants.
New Construction Jobs	
Male: In-Migrants -	
Management and Special Skilled	50 per cent of jobs, 10 per cent for management and 40 per cent for special skills.
General Skilled	Residual supply consisting of excess of demand over combined local supply and in-migrants for management and special skills.
Local -	50 per cent of jobs up to local labor force potential availability.
Female: In-Migrants -	
Dependents of Management and Special Skilled Migrants	20 per cent times male in-migrants for management and special skills.
Dependents of General Skilled Migrants	Residual supply consisting of 30 per cent times male in-migrants for general skills, assuming 60 per cent will have dependents, and 50 per cent of those will have a dependent available for the labor force.
Local -	The amount of demand less female in-migrant dependents of management and special skilled in-migrants.

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.13

ESTIMATE OF SOURCE OF LABOR FORCE
Waikoloa Beach Resort 1976-1990
County of Hawai'i

	1976	1977	1978	1980	1985	1990
Waikoloa Beach Resort Jobs						
Male: In-Migrants -						
Management and Special Skilled	-	-	70	110	190	290
General Skilled	-	-	-	-	30	310
Local, General Skilled -	-	-	270	430	740	840
Total	-	-	340	540	960	1,440
Female: In-Migrants -						
Along With Management and Special Skilled	-	-	10	20	40	60
Along With General Skilled	-	-	-	-	10	90
General Skilled	-	-	-	-	120	370
Local, General Skilled -	-	-	320	510	780	920
Total	-	-	330	530	950	1,440
Construction Jobs						
Male: In-Migrants -						
Management and Special Skilled	140	140	70	70	70	70
General Skilled	-	-	-	-	-	-
Local, General Skilled -	140	140	70	70	70	70
Total	280	280	140	140	140	140
Female: In-Migrants -						
Along With Management and Special Skilled	20	20	10	10	10	10
Along With General Skilled	-	-	-	-	-	-
General Skilled	-	-	-	-	-	-
Local, General Skilled -	-	-	-	-	-	-
Total	20	20	10	10	10	10
Total Jobs						
Male: In-Migrants -						
Management and Special Skilled	140	140	140	180	260	360
General Skilled	-	-	-	-	30	310
Local, General Skilled -	140	140	340	500	810	910
Total	280	280	480	680	1,100	1,580
Female: In-Migrants -						
Along With Management and Special Skilled	20	20	20	30	50	130
Along With General Skilled	-	-	-	-	10	90
General Skilled	-	-	-	-	120	370
Local, General Skilled -	-	-	320	510	780	920
Total	20	20	340	540	960	1,510
Summary						
Male: In-Migrants	140	140	140	180	290	670
Local	140	140	340	500	810	910
Female: In-Migrants	20	20	20	30	180	590
Local	-	-	320	510	780	920
Total: In-Migrants	160	160	160	210	470	1,260
Local	140	140	660	1,010	1,590	1,830
Grand Total(1)	300	300	820	1,220	2,060	3,090

(1) Does not match with total in Table IV-H.3 due to rounding.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Preceding sections have presented the demand analysis supporting project justification on an annual basis to 1990. This presentation format has facilitated project analysis from the standpoint of project scheduling and timing of events. For example, this format has permitted assessing that major in-migration requirements are not likely to materialize until just before 1985 when surplus potential labor force is finally utilized. In order to show the effects by project phasing, the marketability analyses were delineated into the major project scheduling phases. This is shown in Table IV-H.14.

As seen, it is estimated that the complete project will probably require an absorption period extending to the year 2005. Marketability of different types of uses vary from an expected absorption of all condominium units (assuming the optimistic range of sales) before 1995, the absorption of hotel rooms by the year 2000, and of all commercial space by 2005. Table IV-H.14 also show the estimated additional new jobs generated by the new developments beyond 1990 to completion of the project.

Table IV-H.15 shows the impact of the new jobs generated beyond 1990 on the requirements for in-migration. First, an estimate was made of the anticipated new labor force availability from residents aging into the labor force and due to increasing participation. From Table IV-H.10, the increase in the labor force potential availabiltiy was projected to be 300 from 1975 to 1980, 310 from 1980 to 1985, and 240 from 1985 to 1990. Therefore, with the increasing population resulting from prior in-migration, it is estimated that the natural increase in labor force would amount to 300 from 1990 to 1995, 350 from 1995 to 2000, and 400 persons from the year 2000 to 2005.

The marketability rate of new facilities was converted to anticipated new jobs. From these amounts, the anticipated new labor force availability was subtracted to calculate migration requirements, which were further delineated as shown. As seen, in-migrants will be needed through the year 2000 as a result of new jobs created at WBR. However, by 2005, as WBR completes its development program the additions to the labor force availability will again exceed the new jobs available, and out-migration of the local general skilled labor force will occur.

Incorporating projections to the year 2005 permits delineating the labor force analysis into the project phases as shown in Table IV-H.16. This table shows the combined direct and indirect jobs generated by each phase of WBR. In addition, the corresponding impact on the local labor force is shown. As seen, most of the available local labor force is accommodated in the initial stages of WBR, and toward the end, all of the available labor force can be accommodated. In-migrants account for only 20 per cent of the total jobs filled in Step 1A of Increment One to a high of 51 per cent for the remainder of Increment One, and a low of 16 per cent of those filled in Increment Two. From a level of 660 local labor force members employed in the initial step, the total by the end of the project rises over six times to 2,880. By then, in-migration will have risen from an initial 160 persons to a total of 1,800.

Table IV-H.14 DELINEATION OF PROJECTED MARKETABILITY[1] BY PROJECT PHASE
Waikoloa Beach Resort
County of Hawai'i

Year	Step 1A Incr. I Hotel	Remainder of Incr. I Hotel, Rooms	Remainder of Incr. I Condo, Units	Remainder of Incr. I Commercial, Sq. Ft.	Incr. II Hotel, Rooms	Incr. II Condo, Units	Incr. II Commercial, Sq. Ft.
1978	350		160	9,300			
1980		300	320	8,500			
1985		600	1,000	18,000			
1990		600	185	17,400		1,315	
1995		600		20,000		450	
2000		130		22,800	420		
2005							33,000
Total	350	2,230	1,665	96,000	420	1,765	33,000

Total Labor Requirements Beyond 1990

Amounts of facilities, units	730 rms.	42,800 s.f.	420 rms.	450 units	33,000 s.f.
Direct Labor, Jobs	555	214	319	68	165
Total Labor Incl. Indirect, jobs	666	257	383	81	198
Rounded	670	260	380	80	200

[1] Interperiod additions
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.15

ESTIMATE OF MIGRATION REQUIREMENTS
Waikoloa Beach Resort 1990-2005
County of Hawai'i

	Net New Local Labor Force	Remainder of Incre. I New Jobs(1)	Incr. II New Jobs(1)	Total New Jobs(1)	Migration Requirements			
					Mgmt. and Spec. Skilled	Dependent of Mgmt. and Spec. Skilled	General Skilled and Dependents	Total
1990								
1995	300	670	80	750	90	20	340	450
2000	350	260	380	640	60	10	220	290
2005	400	-	200	200	40	10	(250)	(200)
Total	1,050	930	660	1,590	190	40	310	540

(1) Includes indirect new jobs.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.16

DELINEATION OF MIGRATION REQUIREMENTS BY PROJECT PHASE
Waikoloa Beach Resort
County of Hawai'i

	Increment I			Increment II	Project Total
	Step 1A	Remainder	Total		
Estimated Jobs, Including Construction and Indirect Jobs,					
1978 - 1990	820	2,030	2,850	240	3,090
1990 - 2005	--	930	930	660	1,590
Total	820	2,960	3,780	900	4,680
Delineation of Jobs					
1978 - 1990					
Local	660	1,050	1,710	120	1,830
In-Migrants	160	980	1,140	120	1,260
Total	820	2,030	2,850	240	3,090
1990 2005					
Local	--	410	410	640	1,050
In-Migrants	--	520	520	20	540
Total	--	930	930	660	1,590
Total 1978 - 1990					
Local	660	1,460	2,120	760	2,880
In-Migrants	160	1,500	1,660	140	1,800
Grand Total	820	2,960	3,780	900	4,680

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

5. Impact on Income

The preceding sections have shown the large amounts of new direct and indirect employment which will be generated by WBR. Of the total, it is the direct employment which brings new income to the area. Part of this income is respent locally giving rise to the secondary, or indirect employment. Therefore, in order to determine the impact of WBR on income, only the direct employment was considered.

The schedule of direct employment for the entire project (combining data from Tables IV-H.3 and IV-H.4) shows that prior to completion of the first facility in 1978, employment at the site will consist of 300 construction workers. In 1978, the first year of operations, there will be 560 direct resort employees, and the level of construction workers will decline to 150. By the end of the project, the construction employment is assumed to still be at that level, and the direct resort employment would have increased to 3,720 (2,390 by 1990, and 1,330 from then through the year 2005). Utilizing the average resort and construction job salaries yields the following impacts of income on the region.

Table IV-H.17 ESTIMATED INCOME(1) IMPACT FROM DIRECT JOBS
Waikoloa Beach Resort 1976-2005
County of Hawai'i

Period	Jobs	Average Annual Salary	Direct Annual Income from Jobs
1976-1977:			
Construction	300	$14,643	$ 4,393,000
1978:			
Construction	150	$14,643	$ 2,196,000
Resort	560	$ 7,978	4,468,000
			$ 6,664,000
2005:			
Construction	150	$14,643	$ 2,196,000
Resort	3,720	$ 7,978	29,678,000
			$31,874,000

(1) Annual salaries and incomes in terms of 1975 dollars.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Thus the project will provide $4,393,000 annually in 1976 and 1977 to construction workers. About half of the workers will be from the local labor force. This will increase to $6,664,000 in 1978, the first year of anticipated operations at WBR. Later, by the end of project development, annual income will rise more than seven times to $31,874,000.

6. New Housing Demand

Estimating housing demand resulting from the development at WBR is

very subjective since the forecasted available local labor force is assumed to be adequately housed at present in the North and South Kohala areas. As new employment activities are generated at Waikoloa, it is likely that WBR employees and construction personnel will want to locate closer to their place of employment. Although some of the employees are adequately housed at present, they may desire to relocate and create effective housing demand at Waikoloa.

In-migrants will also desire to reside close to their place of employment. However, since many of the in-migrants will have income levels sufficient to compete in the private sector, many will reside in areas of their choosing such as Waimea and commute to the project site. Thus, residential location decisions are so dependent upon individual preferences, identifying specific housing demand at Waikoloa is difficult.

Nonetheless, we have assumed a relatively high propensity for relocating to Waikoloa and on that basis have calculated the housing demand by permanent residents in Waikoloa.

Table IV-H.18 outlines the primary sources of housing demand in Waikoloa. In the earlier years, this will consist primarily of the in-migrants with management and special skills. The table also compares the local labor force employed at Waikoloa with the total available labor force in 1975. As seen, the labor force employed will number less than the labor force available in 1975. This condition will exist until 1980 when jobs will exceed the current 1975 availability. This calculation assumes that the current available labor force is adequately housed and there will be no new demand for housing until the number of new jobs exceeds the current labor force availability. At that time, new housing will be required to accommodate the expanding number of households.

In order to convert the estimated available labor force to households, we assumed the following conversion factors:

> Management and special skilled households would require one unit per new employee. Both the general skilled in-migrants and the local labor force would require one unit per 1.75 new employees, based upon the ratio of available labor force per household registered in the North and South Kohala Districts in 1970. This relatively high ratio of new employees per housing unit also took into account the prospects of a number of the in-migrants being single and living together as unrelated individuals, so that a number of households will have two and three employees per unit.

Application of these factors resulted in a demand for 140 new housing units in 1976 and another 80 in 1980. By 1985, the demand for new housing units would increase rapidly to a level of 490 units as a result of housing required for the local labor force. Prior to that time, the labor force was assumed to be adequately housed and it is not until 1980 that the number of jobs available will exceed the labor force available in 1975. Applying the 1.75 employees per unit factor converts the 70 additional local job holders in 1980 to a demand for 40 housing

Table IV-H.18

ESTIMATED IMPACT OF HOUSING DEMAND
County of Hawai'i
Waikoloa Beach Resort
1976-1990

Source of Household Head	1975	1976	1977	1978	1980	1985	1990
In-Migrant Employee Demand							
Management and Special Skilled	--	140	140	140	180	260	360
Change from Prior Period		140	--		40	80	100
General Skilled							
Male	--	--	--	--	--	30	310
Female	--	--	--	--	--	120	370
Total						150	680
Change from prior period	--	--	--	--	--	150	530
Local Employee Demand							
Male	(520)(1)	140	140	340	500	810	910
Female	(440)(1)			320	510	780	920
Total	(960)(1)	140	140	660	1,010	1,590	1,830
Demand in Excess of 1975 Availability							
Male		--	--	--	--	290	390
Female		--	--	--	70	340	480
Total					70	630	870
Change from Prior Period		--	--	--	70	560	240
New Housing Demand							
Management & Special Skilled @ 1 unit/new empl., units		140	--	--	40	80	100
General Skilled Immigrants @ 1 unit/1.75 new empl., units		--	--	--	--	90	300
Local Labor Force Growth @ 1 unit/1.75 new empl., units		--	--	--	40	320	140
Total New Housing Demand Units		140	--	--	80	490	540

(1) Estimated availability in 1975.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

units. This, coupled with the 40 units required for management and special skilled in-migrants, raises the total in 1980 to 80 residential units.

By 1985, the total number of new jobs created will not only exhaust the available local labor force, they will generate a need for in-migration of general skilled labor. Housing demand resulting from this increment of in-migration, along with the housing required for management and special skilled in-migrants, will raise the total of new housing needs to 490 units.

The next table, Table IV-H.19, shows the estimated demand for housing at Waikoloa. In this table, we estimated geographic preferences, and delineated the demand by household type to the various geographic locations. For example, we have assumed that approximately 75 per cent of the management and special skilled in-migrants will desire to reside in Waikoloa. The other 25 per cent, we assume, will desire residing elsewhere in South Kohala. The general skilled in-migrants will likely choose to locate in both Waikoloa and other parts of South Kohala, except in this case, we have assumed that the split

Table IV-H.19 ESTIMATED DEMAND FOR HOUSING UNITS RESULTING FROM WAIKOLOA BEACH RESORT*
By Location 1976-1990
County of Hawai'i

	1976	1977	1980	1985	1990
Management and Special Skilled					
Waikoloa @ 75%	100		30	60	80
Other S. Kohala @ 25%	40		10	20	20
Total	140		40	80	100
General Skilled In-Migrants					
Waikoloa @ 50%				50	150
Other S. Kohala @ 50%				40	150
Total				90	300
Local Labor Force					
Waikoloa @ 33-1/3%			20	110	50
Other S. Kohala @ 33-1/3%			10	110	50
N. Kohala @ 33-1/3%			10	100	40
Total			40	320	140
Summary					
Waikoloa	100		50	220	280
Other S. Kohala	40		20	170	220
N. Kohala			10	100	40
Total	140		80	490	540

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

will be 50 per cent to Waikoloa and 50 per cent to other parts of South Kohala. As mentioned earlier, with the center of activity moving to WBR and to the Waikoloa area, it's very likely that much of the local labor force will desire to move from their current residence to Waikoloa. To estimate this amount, we have assumed that of the total labor force, approximately one-third will choose to move to Waikoloa, another third will choose other locations in South Kohala, and the other third will be in North Kohala. Thus, we have estimated that most of the new housing demand will be in Waikoloa.

Table IV-H.20 delineates the type of housing which will be required by residents choosing Waikoloa. These have been divided into group quarters, resort condominium apartments, and other Waikoloa housing. Group housing used by construction workers in the initial phases of Waikoloa is currently available. Some of the resort hotel operators may desire to construct dormitory-type facilities for their own employees also. We have included in the potential housing supply the WBR condominium apartments proposed in the resort area. Experience indicates that approximately half of such facilities are usually put into use as transient accommodations. Another 25 per cent are usually held for occasional use by their owners, and the other fourth are usually purchased for occupancy by their owners on a full-time basis, or purchased as an investment for rental on a long term basis to permanent residents. Therefore, we have assumed that approximately 25 per cent of the resort condominium apartments would be available as a potential source of housing supply. The other potential source, we have described as other village housing, could be in the form of single family dwellings constructed on the house lots available in the village, other forms of multi-family housing constructed on available multi-family housing sites, or housing constructed on land currently offered by Boise for low cost housing.

In making our estimates, we have assumed that approximately 20 per cent of the management and 50 per cent of the special skilled and general skilled in-migrants would require group quarters. Most of the others could be housed in the WBR condominium apartments, except in the year 1976 before those facilities are constructed. In 1976, since the group quarters are available, we have assumed that all of the in-migrants will be housed in the available facilities. In-migrants bringing their families will find adequate housing in Waikoloa Village at the rental condominiums or in the houselot subdivision. Housing for the general skilled in-migrants would not be required until 1985, at which time we have estimated that approximately 50 per cent would be in group quarters, another fourth would be housed in the resort condominium apartments and the remaining fourth would require other village housing. In the case of the local labor force, we have also assumed that group quarters would be required for approximately 50 per cent of the requirements and that approximately 20 per cent of the local labor force would be able to buy or rent in the resort condominiums. The remaining 30 per cent would require other village housing.

Table IV-H.21, as an indication of new housing needs, compares the cumulative Waikoloa housing requirements delineated by housing type with the estimated housing availability by corresponding type.

Table IV-H.20 DELINEATION OF WAIKOLOA HOUSING DEMAND
Resulting from Waikoloa Beach Resort 1976-1990
County of Hawai'i

	1976	1977	1978	1980	1985	1990
Net New Waikoloa Housing Demand						
Management and Special Skilled	100			30	60	80
General Skilled In-Migrants					50	150
Local Labor Force	—			20	110	50
Total	100			50	220	280
Estimated Waikoloa Housing Needs						
Management and Special Skilled						
Group Quarters	100		(50)	10	10	20
WBR Condominium Apartments			30	30	50	60
Other Village Housing	—		20	—	—	—
Total	100		0	40	60	80
General Skilled In-Migrants						
Group Quarters					30	70
WBR Condominium Apartments					10	40
Other Village Housing					10	40
Total					50	150
Local Labor Force						
Group Quarters				10	60	20
WBR Condominium Apartments					20	10
Other Village Housing				10	30	20
Total				20	110	50
Summary						
Group Quarters	100		(50)	20	100	110
WBR Condominium Apartments			30	30	80	110
Other Village Housing	—		20	10	40	60
Total	100		0	60	220	280

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

As seen in the earlier years of the project, group quarters are available for approximately 140 persons, of which we estimate only 100 accommodations will be required. In 1978, some modification in demand characteristics will occur since construction employment will cut back, with a corresponding gain in resort jobs. The adjustment is shown by a reduction in group quarters demand and an increase in demand for resort condominiums and other Waikoloa housing.

Beginning with completion of the resort condominium apartments in 1978, application of the 25 per cent availability factor yields sufficient condominium apartments to satisfy the demand by permanent residents throughout the period to 1990. The large excess of group quarters will also be available, until about 1985 when a large influx of general skilled in-migrants is expected. On the other hand, it can be seen that the demand for other village housing will increase from 20 units in 1978 to 70 units by 1985 and to 130 by 1990.

Table IV-H.21

ESTIMATION OF NEW
WAIKOLOA HOUSING NEEDS*
Waikoloa Beach Resort 1976-1990
County of Hawai'i

	1976	1977	1978	1980	1985	1990
Cumulative Waikoloa Housing Needs						
Group Quarters	100	100	50	70	170	280
WBR Condominium Apartments			30	60	140	250
Other Village Housing			20	30	70	130
Total	100	100	100	160	380	660
Estimated Waikoloa Housing Availability						
Group Quarters	140	140	140	140	140	140
WBR Condominium Apartments			30	80	200	320
Total	140	140	170	220	340	460
Net Housing Availability						
Group Quarters	30	30	90	70	30	140
WBR Condominium Apartments				20	60	70
Other Village Housing			(20)	(30)	(70)	(130)

It appears very likely that the 20 to 30 units of housing required in the 1978 to 1980 period could be satisfied by the available housing in Waikoloa Village. Alternatively, the housing could be located in other parts of South Kohala with provisions for subsidizing commuting costs or for some form of transportation. By 1978, with the completion of the resort condominium apartments, the 30 units available will accommodate the

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

projected demand. From 1980 to 1985, there would be sufficient additional WBR condominium apartments to almost satisfy the deficits indicated for other village housing needs. By 1990, the 70 extra condominium apartment units would offset much of the 130 unit deficit indicated for other village housing for that year. However, by 1990, other forms of housing would likely be available either on the land being donated by Boise or on some of the multi-family parcels in the village or on the house lots. In particular, it is expected that some form of group quarters will be developed to handle the excess demand beginning in 1985.

The general housing demand analysis was extended to the year 2005, and the results delineated into the WBR project phases. First, the housing requirements for the years 1976 to 1990 (shown in Table IV-H.18) were delineated by general source of household head and shown as Increment One. Then an adjustment was made since part of the housing demand created by condominium developments would occur in Increment Two.

Next, migration requirements from 1990 to 2005 (shown in Table IV-H.15) were delineated by project phase. This is shown in Table IV-H.22, along with housing demand calculated using appropriate factors. As seen, by the period, 2000-2005, the available local labor force is expected to exceed the new jobs created, and some net out-migration is expected. The negative housing requirements reflect out-migration since our conceptual calculation model had sequentially housed the local labor force first. The negative amounts signify the amount of housing which will not actually be needed by the natural increase in labor force since these persons will not have employment, and will out-migrate; thus, the number of negative units shown does not signify the number of units vacated by the out-migrants.

In Table IV-H.23, we summarize these effects. Included are the houses required by the local labor force additions from 1990 to 2005.

A total of 2,210 new units in the region will be required to house the workers holding the direct and indirect jobs created by WBR. Of this amount, 1,100 units or about half of the housing, will be required for additions to the local labor force who are retained in the area by the availability of jobs. The other half of the net new housing will be required for in-migrants, and almost half of this amount would be required anyway for management and special skilled workers. Thus, it appears that only 25 per cent or one-fourth of the new housing will be needed by general skilled in-migrants brought into the area to fill jobs in excess of those for which local workers are available.

7. Impact on Population

The Kohala District has had a continual population decline because of the lack of employment opportunities in the region. The development of the WBR will affect the population of Kohala by (a) presenting job opportunities for those who might leave the region because they are currently unemployed or under-employed, (b) slowing down the out-migration of those who enter the job market age by providing employment opportunities that presently do not exist, (c) bringing into the

Table IV-H.22

ESTIMATION OF MIGRATION AND HOUSING REQUIREMENTS
Waikoloa Beach Resort 1990-2005
County of Hawai'i

	Increment I Requirements				Increment II Requirements			
	Mgmt. and Spec. Skilled	Dependents of Mgmt. & Spec. Skilled	General Skilled & Dependents	Total	Mgmt. and Spec. Skilled	Dependents of Mgmt. & Spec. Skilled	General Skilled & Dependents	Total
MIGRATION								
1990-1995	80	20	300	400	10	--	40	50
1995-2000	20		90	110	40	10	130	180
2000-2005	--	--	--	---	40	10	(250)	(200)
Total	100	20	390	510	90	20	(80)	30
HOUSING UNITS								
Mgmt. + Spec. Skilled @ 1 unit/employee	100			100	90			90
General Skilled @ 1 unit/1.75 employee	—		220	220	—		(50)	(50)
Total	100		220	320	90		(50)	40

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

Table IV-H.23

DELINEATION OF HOUSING DEMAND BY PROJECT PHASE
Waikoloa Beach Resort
County of Hawai'i

	Increment I			Increment	Project
	Step 1A	Remainder	Total	II	Total
Estimates from 1976-1990					
Management and Special Skilled	140	220	360	--	360
General Skilled In-Migrants	--	390	390	--	390
Local Labor Force	--	500	500	--	500
Total	140	1,110	1,250		1,250
Adjustments to 1976-1990 for Increment I/Increment II					
Management and Special Skilled	--	(30)	(30)	30	--
General Skilled In-Migrants	--	(110)	(110)	110	--
Local Labor Force	--	--	--	--	--
Total		(140)	(140)	140	
Additions for 1990-2005					
Management and Special Skilled	--	100	100	90	190
General Skilled In-Migrants	--	220	220	(50)	170
Local Labor Force	--	230	230	370	600
Total		550	550	410	960
Total 1976-2005					
Management and Special Skilled	140	290	430	120	550
General Skilled In-Migrants	--	500	500	60	560
Local Labor Force		730	730	370	1,100
Grand Total	140	1,520	1,660	550	2,210

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

region on a continuing basis workers with management or special skills, and (d) later in the project's development, inducing general skilled workers to migrate into the region. All of these factors will serve to increase the local population, and since many of these workers will have dependents in their households, their effects on the regional population will be compounded.

The simpliest way of quantifying the population effect is to relate the estimated population per household to the anticipated increase in housing shown earlier.

In 1970, the household size was 3.51 persons in South Kohala, 3.75 in North Kohala, and 3.61 for the entire County. The weighted average for North and South Kohala was 3.64. Since household sizes have been declining, it is estimated that a reasonable average for Kohala would be 3.5 currently. In-migrants are likely to have slightly less members in the average household due to the expected number of single workers attracted. Thus, a household size of 3.0 persons is considered reasonable for in-migrants. Applying these factors results in the impact shown in Table IV-H.24.

Table IV-H.24 ESTIMATED POPULATION IMPACT*
(Based on Labor Force Increases)
Waikoloa Beach Resort
County of Hawai'i

	Increment I			Increment II	Project Total
	Step 1A	Remainder	Total		
Demand for New Housing					
In-Migrants	140	790	930	180	1,110
Local	---	730	730	370	1,100
Total	140	1,520	1,660	550	2,210
Associated Population					
In-Migrants	420	2,370	2,790	540	3,300
Local	---	2,550	2,550	1,300	3,850
Total	420	4,920	5,340	1,840	7,150

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

From Table IV-H.24, it can be seen that WBR is expected to induce a population increase of 7,180 persons as a result of potential jobs created. This rate over the next 30 years to the year 2005 would amount to an average increase of about 240 persons per year.

However, 54 per cent, or over half, of the population will probably consist of existing local residents or their family members who age into labor force participation ages. These are the persons who will be provided the opportunity to remain in the region as a result of employment opportunities created at WBR. Less than half will be in-migrants and their families, and most of these are not expected to arrive until after 1985, when the current surplus of labor force availability

is finally utilized.

In addition to population gains caused by increases in the labor force, the daily census will be increased by transient visitors at WBR and non-labor force households staying at the WBR resort condominiums. At 70 per cent average occupancy and an average party size of 1.9, the average daily visitor census for the 3,000 rooms planned at WBR would be 3,990 persons.

The resort condominiums are expected to be about 50 per cent occupied on the average. Of this amount, 25 per cent will be by labor force participants and the other 25 per cent by non-employed permanent residents (such as retirees) and occasional users. The population associated with the labor force component has been included in previous calculations. Assuming that the average household size of retirees and occasional users is 2.0, this increment of population should amount to 1,720 persons.

Thus, including the 7,180 persons associated with the labor force, the total population impact of WBR would be a gain of 12,890 persons daily in the region.

8. Impact on Revenues to Government

The calculation of government benefits and costs accruing from resort developments is quite complicated as pointed out in prior studies by Mathematica (1970a, 1970b). In that study, the authors concluded that Hawai'i visitors pay their way for both State and County services. While we know of no new conditions which would change that conclusion, we nonetheless undertook a simplified evaluation of WBR's impact.

Conceptually, our approach consisted of measuring the benefits to the State and County from only their major sources of revenues directly influenced by WBR. For the County in 1974, this consisted of real property taxes, which amounted to almost 75 per cent of revenues excluding State and Federal grants. For the State, it was the combination of general excise taxes and personal income taxes, which together accounted for slightly over 75 per cent of revenues exclusive of Federal grants. Other sources of revenues from permits, fees, corporate taxes, fines and special excise taxes are likely to also be generated by WBR, although not included in our analysis; therefore, our approach understates actual revenues.

It was then assumed that the operating expenditures at both the State and County levels are made not only in support of the resident population, but also the visitor population. With assistance from the Tax Foundation of Hawai'i, all categories in the State's and County's schedules of expenditures were delineated to estimate the effect of increasing residents and visitors in Kohala and at WBR. In assessing the impact of increasing resident population, we assumed that most of the hotel employees would come from the Big Island, from O'ahu and from other islands in the State. Since most per capita State expenditures would be made anyway, only incremental costs for relocating the expenditures were charged. Since the intrastate migrants would be relocating

to Hawai'i County, new services would have to be provided, and therefore, per capita total costs were charged in most cost categories to the County.

To calculate the potential property tax yield, values were applied as though the scheduled improvements existed at present. Values from the Appraisal Report prepared in August 1975 by Hastings, Martin, Hallstrom and Chew, Ltd. were used for the land. It was assumed that the initial hotel would be valued at $75,000 per room and subsequent hotels at $55,000 per room, exclusive of land. Resort condominiums were valued at an average of $75,000 per unit and the commercial space outside hotels were valued at $50 per square foot. It was assumed that the golf course would be dedicated to golf course use, and that it then would be assessed on that basis, rather than in its highest and best use. Non-resort employee housing was valued at $50,000 for single family houses, and $40,000 per unit for multi-family housing. Applying a 70 per cent assessment ratio and the Hawai'i County tax rates for 1975-1976 resulted in the following estimate of property taxes generated by WBR:

Phase	Estimated Property Taxes
Increment One	
1A	$ 366,000
Remainder	3,727,000
Total	$4,093,000
Increment Two	$1,922,000
PROJECT TOTAL	$6,015,000

General excise taxes were determined by calculating the total estimated expenditures by both visitors and residents, and then applying a four per cent tax rate to them. Since WBR is intended to be a very high quality facility, visitor expenditures are expected to be higher than the statewide average.

Hotel visitors are expected to spend $100 per day at the luxury facility, and $90 per day at the subsequent hotels. Resort condominium visitors are projected to spend $60 per day. Regarding construction workers and resort employees, it was assumed that 70 per cent of their salaries and wages were spent for taxable consumption items. Further, it was assumed that, based on Anderson's work on Kaua'i, an output multiplier of 2.0 was appropriate for the resident expenditures. Not tracing through the secondary implications of visitor expenditures except to employee salaries tends to again understate the potential tax benefits. The results of these calculations show the following impact of WBR on general excise taxes:

Phase	Estimated General Excise Taxes[1]
Increment One	
1A	$ 504,000
Remainder	1,192,000
Total	$1,448,000
Increment Two	$ 456,000
PROJECTED TOTAL	$1,784,000

The last major item of government revenues calculated was the personal income tax yield. In this case, we applied average annual salaries and wages to both the number of construction and resort employees. Again, a 2.0 output multiplier was used. Then, based upon the average 1974 tax yield of 3.3 per cent, the following table of personal income taxes resulting from WBR was calculated:

Phase	Estimated Personal Income Taxes[1]
Increment One	
1A	$ 587,000
Remainder	1,412,000
Total	$1,709,000
Increment Two	$ 541,000
PROJECT TOTAL	$2,105,000

Table IV-H.25 delineates the State and County schedule of expenditures to show which portions are costs attributable to relocating state residents to Kohala and Waikoloa, and visitors to WBR. Per capita figures for 1974 were raised 10 per cent to reflect 1975 costs.

Table IV-H.26 summarizes our conservative analysis of the fiscal impact of WBR on the State and County by project phase. Net benefits during the first year of operation in 1978 is projected to be $966,000 to the State and $134,000 to the County. For the entire project, these amounts increase to $2,068,000 and $2,451,000, respectively. At the end of the project, the ratio of benefits to costs will be 2.1 for the State and 1.7 for the County.

It should be noted that the cost of government services is rising faster than income or local expenditures. This means that the now favorable benefit/cost ratios will erode over the years unless the cost of government services relative to revenues are curtailed. Another point is that

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[1] Does not add down since construction employment is 300 in Phase 1A and 150 in each succeeding period.

Table IV-H.25

ESTIMATED STATE AND COUNTY COSTS ATTRIBUTABLE TO RELOCATED POPULATION AND VISITORS
County of Hawaii and State of Hawaii
1974

	1974 State Expenditures(1)					1974 County Expenditures(1)				
	Total	Percent To Relocated Population	Amount To Relocated Population	Percent To Visitors	Amount To Visitors	Total	Percent To Relocated Population	Amount To Relocated Population	Percent To Visitors	Amount To Visitors
In Situ Population	909,000	93%	846,000	7%	63,000	60,300	86%	51,800	14%	8,500
Function										
General Government	42.0	10%	4.2	0	-	2.9	75%	2.2	5%	.1
Public Safety	35.2	5%	1.7	5%	1.7	8.1	50%	4.1	10%	.8
Highways	16.2	90%	14.6	10%	1.6	2.6	86%	2.2	14%	.4
Natural Resources	10.6	10%	1.1	0	-	-	0	-	0	-
Health & Sanitation	16.9	10%	1.7	5%	.8	.7	50%	.4	5%	-
Hospitals & Institutions	42.1	10%	4.2	0	-	-	0	-	0	-
Public Welfare	118.2	0	-	0	-	.2	0	-	0	-
Education	306.3	10%	30.6	0	-	.2	75%	.2	0	-
Recreation	4.4	10%	.4	10%	.4	2.1	86%	1.8	14%	.3
Utilities & Other Enterprises	39.2	10%	3.9	5%	2.0	-	0	-	0	-
Debt Service	62.6	5%	3.1	1%	.6	2.5	5%	.1	1%	-
Retirement and Pension	47.1	0	-	0	-	2.2	75%	1.7	0	-
Employee's Health & Life Insurance	8.1	0	-	0	-	-	0	-	0	-
Unemployment Compensation	45.2	0	-	0	-	-	0	-	0	-
Grants-In-Aid to Counties	19.4	0	-	0	-	-	0	-	0	-
Urban Redevelopment & Housing	12.6	0	-	0	-	-	0	-	0	-
Miscellaneous	11.5	10%	1.2	0	-	.4	50%	.2	0	-
Cash Capital Improvements	61.3	10%	6.1	5%	3.1	1.6	86%	1.4	14%	.2
Total	898.9		72.8		10.2	23.5		14.3		1.8
Per Capita Cost - 1974	$ 989/Yr.		$ 86/Yr.		$162/Yr.	$390/Yr.		$276/Yr.		$212/Yr.
Estimated 1975 Costs (+10%)	$1,088/Yr.		$ 95/Yr.		$178/Yr.	$429/Yr.		$304/Yr.		$233/Yr.
Rounded	$1,090/Yr.		$100/Yr.		$180/Yr.	$430/Yr.		$300/Yr.		$230/Yr.

(1) Million Dollars

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

if immigrants to the state rather than local residents take newly created resort jobs, then the cost of government services will be greater and the benefit/cost ratio will be less. In other words, resorts offering replacement jobs for declining agriculture employment are more advantageous to the state than those giving jobs to immigrants to the state.

The same points apply to the County as well. The one difference is that immigrant employees--those resort workers who will increase the cost of County services more than if residents held the jobs--are defined in this instance as those who do not reside on the island. Again, it is more advantageous to the county if a greater portion of the jobs at the WBR are filled by existing county residents, particularly those presently unemployed or who may become unemployed by declines in agriculture, than by off-island workers.

Table IV-H.26

ANALYSIS OF FISCAL IMPACT ON STATE AND COUNTY OF HAWAII
Waikoloa Beach Resort
Island of Hawaii

	Increment I			Increment	Project
	1A	Remainder	Total	II	Total
Additional Visitors	460	4,010	4,470	1,660	6,130
Additional Residents	420	4,920	5,340	1,840	7,180
Additional Population	880	8,930	9,810	3,500	13,310
State					
Estimated Costs					
Additional Visitors	$ 83,000	$ 722,000	$ 805,000	$ 299,000	$1,103,000
Additional Residents	42,000	492,000	534,000	184,000	718,000
Total	$ 125,000	$1,214,000	$1,339,000	$ 483,000	$1,821,000
Estimated Benefits					
General Excise Taxes	$ 504,000	$1,192,000	$1,448,000	$ 456,000	$1,784,000
Personal Income Taxes	587,000	1,412,000	1,709,000	541,000	2,105,000
Total(1)	$1,091,000	$2,604,000	$3,157,000	$ 997,000	$3,889,000
Net State Benefits	$ 966,000	$1,390,000	$1,818,000	$ 514,000	$2,068,000
Benefit/Cost Ratio	8.7	2.1	2.4	2.1	2.1
County					
Estimated Costs					
Additional Visitors	$ 106,000	$ 922,000	$1,028,000	$ 382,000	$1,410,000
Additional Residents	126,000	1,476,000	1,602,000	552,000	2,154,000
Total	$ 232,000	$2,398,000	$2,630,000	$ 934,000	$3,564,000
Estimated Benefits					
Property Taxes	$ 366,000	$3,727,000	$4,093,000	$1,922,000	$6,015,000
Net County Benefits	$ 134,000	$1,329,000	$1,463,000	$ 988,000	$2,451,000
Benefit/Cost Ratio	1.6	1.6	1.6	2.1	1.7

(1) Does not add across due to using 300 construction workers in 1A, and 150 for Increment totals and project totals.

Source: Hastings, Martin, Hallstrom and Chew, Ltd.

I. SOCIAL IMPACTS*

Social changes and effects caused by resort development are generally more difficult to measure than economic or physical changes as they are not as easy to quantify. The approach taken to assess the social change for this project was to identify the principal causal factors and to then evaluate the characteristics of each as to their affect and degree of change on the area's social structure and composition.

The principal causal factors for social change associated with the development of WBR are:

Generated employment and related increased population from expansion of South Kohala's resort hotel and tourism industry.

Increased overnight and day visitors utilizing tourist facilities within the resort project.

New residents living within the resort community.

The effects of each of these are described in the following paragraphs.

1. Generated Employment

Employment generated from expanded resort-hotel and tourism development is composed of two principal employment categories:

Employees who come from the local labor force (new local employees)

Employees who are attracted to or must be brought in from outside North and South Kohala to fill a portion of the new jobs (new immigrant employees).

Each of these employment components has both common and unique characteristics that will have a potential affect on social change within the region. The components are delineated in Table IV-I.1.

Table IV-I.1 SUMMARY OF LABOR FORCE SOURCE BY PROJECT PHASE**
Waikoloa Beach Resort
County of Hawai'i

	Increment I				Project
	Step 1A	Remainder	Total	Incr. II	Total
Local	660	1,460	2,120	760	2,880
In-Migrants	160	1,500	1,660	140	1,800
Total	820	2,960	3,780	900	4,680

**Source: Hastings, Martin, Hallstrom and Chew, Ltd.

*Source: Mauna Loa Land, Inc., EIS, and Hastings, Martin, Hallstrom and Chew, Ltd.

New Local Employment

As previously stated, it is anticipated that 50 per cent of new jobs associated with WBR will be filled by local residents now living in North or South Kohala. Such employment will generally not require the moving of households or the building of additional housing units, thus minimizing this aspect of potential social disruption within the community. There will be, however, some increase in commuting distances between the employees' residences and their source of employment at the WBR, especially for resort employees living in the Hawi and Kapa'au areas of North Kohala. These potential employees will be drawn principally from the ranks of the unemployed, from young people coming of age and entering the labor market, and from wives and dependents not previously in the labor market. Each of these categories of local employees carries with it different aspects of potential social change, as discussed below.

From Unemployment Ranks

Typically, these employees will be capable of filling new hotel, resort and construction jobs requiring moderate or minimal skill levels. Such jobs include food and beverage, landscaping maintenance, golf course groundskeeping, housekeeping and laborer functions and are generally in the middle to lower income categories. Although the number varies from time to time, approximately one-half to one-third of employees filling these jobs will be heads of household. The remaining number will be dependents whose income will supplement or be independent of maintaining the household.

The social effects of obtaining needed employees from the ranks of the presently unemployed are all positive.

> New jobs for the unemployed reduce the social costs of welfare, unemployment compensation, and other public expenditures associated with unemployed workers. Increased employment will reduce this primary social and economic liability within the region.
>
> New jobs greatly reduce or remove the frustrations, anxieties and apprehensions characteristic of families when the head of the household is unemployed. Employment, by reducing the family's economic burdens, restores family stability.
>
> New jobs reduce idleness typically associated with unemployment. Prolonged periods of worker idleness have been in many instances directly related to increased crime, juvenile delinquency, and other social disorders.
>
> New jobs contribute to a reversing of out-migration trends often associated with limited or lacking new employment opportunities, such as is now being experienced in North Kohala and was experienced on all Neighbor Islands prior to increased tourism-industry development in the State outside Waikiki.

Young Adults Entering the Labor Market

This group consists principally of young people who have just graduated from high school or college and are entering the labor market for the first time. Most of this category are single and are dependents within family households.

Again the social effects are positive.

> New jobs in a growing industry within the region will generally retain a high proportion of these young employees within the North and South Kohala area. Without increased employment, many, if not most, of these young workers would be forced to migrate outside the region to seek employment opportunities.
>
> The retention of these young adults within the region, and the attraction of other young workers to the region for employment opportunities, would maintain a balanced demographic composition of the population, which in turn would tend to reinforce a normal population-growth situation.

Previously Unemployed Wives and Other Dependents

This category of potential local employees generates perhaps the greatest degree of possible adverse social change, especially in areas such as North and South Kohala, which are traditionally rural and agrarian, with strong traditional roles of male breadwinner, female wife/mother, and young dependents. The principal impact comes with the added income to the family and associated increased buying power with two or more adult family members working, and with the change from the wife's traditional role as wife/mother to worker. Both factors can have a substantial effect in altering the life style and stability of the family as well as each of the family members.

A 1968 study to assess certain aspects of social change brought on by hotel development in rural areas focused on the impact of the Mauna Kea Beach Hotel (Cottington 1969). The study revealed many instances of family deterioration and increased psychological tensions and problems experienced by employees (principally wives) who had previously never been employed outside the home. The Mauna Kea Beach Hotel initally employed a high proportion of never-before-employed local female workers. The situation resulted in a substantial increase in divorces among local employees with corresponding disruption of the families, overspending and family indebtedness because of the inability to manage double family incomes, and a higher percentage of juvenile delinquency, principally because of less child supervision. Further, a high proportion of these employees and other family members suffered from increased psychological problems. Husbands found it difficult to accept the increased independence of their wives, who demanded to share in decisions related to spending money. Husbands became jealous and suspicious of wives exposed to the "beautiful people" (hotel guests) and of the wives' improved grooming and appearance. Further, the husband and other family members still expected the wife/mother to maintain her traditional family role.

While the study points out these problems, it is important to note that it focused on only the first of a series of stages within the evolution of social, cultural and community development in the area over the past ten years. The initial impact in such a situation is typically substantial and initiates a series of community changes and adjustments. However, in the decade since 1965, when the MKBH opened, it can be expected that many, if not most, of the major social and cultural adjustments linked with hotel and tourism development have taken place and that the lives of affected individuals and families have become stabilized in the altered social environment.

Following this premise, the construction of one or several additional hotels in the South Kohala coastal area should not have the same degree of adverse social impact as was reported in that study. New hotels will continue to attract heretofor nonworking wives and other dependents into the labor market, but the associated social and psychological stresses should be greatly reduced because the communities have had ten years to adjust to the presence of tourism activities and the related visitor population. Tourism is no longer new to the area--the area has for the most part passed through the initial and major social adjustment period in the continuing evolution from predominately rural, agarian and more isolated communities to an economic and social structure now tied to both agriculture and tourism. The phasing out of Kohala Sugar operations in North Kohala will place even greater dependence on the tourism industry.

A North Kohala household survey indicated that in 1971, 39 per cent of all households with two or more individuals had working wives (DPED 1971). Comparison of this with the O'ahu average of 62 per cent of the households with working wives during the same period, indicates that wives are still a significant potential participant in North and South Kohala's labor market as the area continues to evolve from a solely agarian base to one of mixed agriculture and tourism. The statewide trend is also toward more working wives (DPED 1972).

With previously unemployed wives and other dependent family members entering the labor force, this employee component will experience many of the social and psychological effects and adjustments discussed above (Cottington 1969). The degree of this social change, however, should be considerably less because the hotel and tourism industry is no longer new to the area.

The principal social effects and adjustments related to this employee component will include the following:

> Family income will be augmented with two or more wage earners per family and increased buying power; corresponding adjustments will be necessary in spending patterns and decision-making processes within the family.
>
> With two or more wage earners within a family, the traditional basis for the large family economic unit will be negated. With added income and buying power, the need to have a large number of family members to share nonwage work such as

subsistance gardening is no longer justified.

The less responsible and younger members of the traditional families will be exposed to different value systems and life styles, which in turn may cause marital and other family problems.

Supervision of children could become critical as mothers leave the house for part- or full-time work. This problem can lead to increased juvenile delinquency and crime. The possible adverse effects can be mitigated with additional facilities for child care and supervised play available during times when mothers are working outside the home and with adult education and counseling programs related to household financial management and family and marital relationships which focus on problems associated with the expected social adjustments. These educational programs can be offered both through the public educational system and by hotels and tourism industry.

Summary

It is anticipated that until almost 1990, the majority of employees hired to fill the new jobs will come from the local labor force. The principal sources of local potential employee will be from the ranks of the unemployed, from young adults entering the labor market, and from wives and dependents attracted into the labor market for economic or other reasons.

The net social effect for the first two categories--the unemployed and young adults coming of employable age--will be principally beneficial as new job opportunities will enable families to remain in Kohala, reduce the social costs of unemployment and alleviate individual and family frustrations and anxieties. The social effects of the third category--employed wives and other dependents entering the labor market for the first time--could be both beneficial and adverse. New child-care facilities and adult-education and counseling programs could minimize these adverse effects.

New Immigrant Employment

It is expected that the local labor force will not be able to supply the WBR project with its total employment needs, and additional employees will therefore have to be sought from outside the North and South Kohala areas for both the immediate and later development increments.

Initially, most, if not all of these will be heads of households (either single or married) and the majority will be professionals and highly skilled employees in the upper-income levels (such as general and assistant managers and managers of the various departments, department supervisors, engineers, chefs, accountants, and the like), as such individuals are generally not available in the local labor market. Later, general skilled in-migrants will be needed.

The character magnitude of social change associated with new immigrant

employees is basically different from those related to the creation of new jobs which are filled by people from the local labor force. Both categories, however, share some common social aspects. Local employees are drawn from the existing community structure, and thus do not generate any appreciable additional needs for housing, public facilities or service requirements. With the immigration of new employees and their families, however, the community's population base is expanded, and additional housing and public facilities are required to meet the increased population's needs. This added population will also affect to a degree the settlement and urbanization patterns and trends within the region, as well as the actual composition of the population with respect to age, marital status, and ethnic background.

As previously stated, this category of employees will require housing and generally the same level of public facilities and services as required by the region's existing population. It should be noted, however, that because the majority of the immigrant resort employees will tend to be the higher-paid professional and highly skilled employees, it can be expected that they will pay for their share, and perhaps more than their share, of the added public and social costs related to an increased population base. This is in contrast to a situation in which the immigrants would be predominately lower-wage employees, who would typically, in time, look to the community for some form of welfare or other financial and family assistance. This same lower-wage employee category also often increases the need for police and security protection and other social aids.

2. Settlement Patterns

An assessment of the potential social changes in North and South Kohala likely to be brought on principally by immigrant employees and their families is presented in the following paragraphs.

Residents of North or South Kohala traditionally have expressed pride in the rural, small-community character and life style typically found throughout the two districts and are understandably concerned about any new activity that would potentially alter their community's structure or way of life. On the other hand, new families entering an area will be attracted to existing communities that offer housing and the public services and facilities, such as schools, parks, and libraries, and commercial activities, which are essential to their normal living patterns.

In this respect, the Hawai'i County General Plan has established a regional development policy which encourages the establishment of new urban centers in areas adjacent to coastal resort development as a means of concentrating employees and their families near their sources of employment, and thereby reducing long-distance commuting associated traffic and energy-utilization problems, and as a device which will help to maintain the character and other attributes of the region's existing communities (Waimea, Hawi, etc.). New immigrants seeking housing will be channeled to new communities near their source of employment and will reduce the pressures of substantial urban expansion and growth within Waimea and other existing North and South

Kohala communities.

Waikoloa Village is a 2,800 acre recreational residential community constituting the non-resort urban center of the entire 31,000 acre Waikoloa project. This community is consistent with the County General Plan's land development philosophy and will contain a wide range of housing opportunities for all employee income levels as well as the essential commercial, recreational, and public facilities and services associated with a self-contained urban center. The community is open to any potential residents, and thus, it provides an attractive living environment that will be convenient to employees working within the WBR.

3. Housing Needs

A recent housing survey to assess local housing requirements (Belt, Collins 1975) showed that, currently, there is virtually no adequate vacant housing available in either North or South Kohala. Further, this situation will in all likelihood continue to exist until a demonstrated need for additional housing arises, and the present capital and financing constraints are eased.

Prior calculations indicate an expected need starting in 1976 for a limited number of dwellings for management and special skilled in-migrants. These are expected to be accommodated in the existing group quarters, condominium apartments or houses in Waikoloa Village. Alternatively, due to their special skills these in-migrants should have sufficient household incomes to purchase or rent effectively on the open market.

In addition to permanent employees, there will be a need for 300 construction employees on a daily basis during the development of Step 1A of Increment One. Subsequently, about 150 construction employees will be needed. Almost half are expected to be from the local labor force. Again, management and special skilled workers are expected to have incomes sufficient to compete effectively for housing on the open market. In any case, dormitory-type accommodations are potentially available for 140 single workers in the construction camp site near Waikoloa Village.

Any housing problem may be reduced or mitigated by 1978, the time when WBR expects to open its first hotel, as a result of the following conditions:

-- It is possible that private developers and residential builders will respond to the anticipated need and build at least a portion of the needed residences to be available for occupancy by the hotel's opening date. This might be in Waikoloa Village or on 500 acres of land already offered by Boise.

-- The continuing and accelerated economic readjustment in North Kohala, and the related out-migration of residents who take jobs elsewhere, will in all probability create additional housing vacancies, which in turn will be available to WBR in-migrants.

-- North Kona presently experiences a larger percentage of housing vacancies than either North or South Kohala. The 1970 Census reported that some 228 (11.5 per cent) of the total housing units were available for occupancy. This high vacancy rate was attributed primarily to a sizable number of non-owner-occupied resort condominiums being built in the Kailua-Kona area, a condition which generally continues to exist today. Because of North Kona's relatively higher number of vacancies and tolerable commuting time between North Kona and Puako with the opening of the Queen Ka'ahumanu Highway, it is reasonable to assume that the North Kona area could serve at least a portion of the immediate and temporary housing needs for WBR employees until additional housing is provided in North and South Kohala.

While the preceding housing analyses have been very general, for subsequent increments of the resort complex, Boise will assess the labor and housing situation at that time since this is the only realistic method of identifying the housing situation or labor market at a particular point in time.

4. Social Interaction

A high percentage of the new immigrants could be characterized as "higher-income *haoles*", as the employment demands for the majority of immigrant workers will be for upper level management and highly skilled personnel and these jobs in the past have often been filled by Caucasians or *haoles*. This may not be the case in the future as more and more non-*haoles* enter the management level of the travel industry from university tourism schools, such as the University of Hawai'i's School of Travel Industry Management, or through training and advancement in hotels throughout the state, and will therefore have the experience and/or training to assume such positions.

It can be expected, however, that the immigrant employees, whether *haole* or non-*haole*, will have larger incomes and a different social background and their presence will have an effect on the socio-economic composition of local communities and in their interactions with existing residents. The principal effects can be categorized as follows:

Cultural Adjustments - Immigrant employees and their families may well have different cultural backgrounds and life styles from existing residents and this could cause conflicts and social disruption as the new and existing individuals and families interact within local communities and in schools and other public facilities. Such interaction is educational and is beneficial in that it provides exposure to each group's culture. This, in turn, may require cultural adjustments by both new and existing residents for social harmony within the communities.

Cultural Isolation - Immigrant employees with cultural backgrounds different from those of existing residents may tend to cluster and locate in groups away from existing residents. Such groupings are beneficial since they expand the choice available for lifestyles, and anxieties are reduced by the mutual reinforce-

ment of values which occurs in each group. These cultural enclaves or separate sub-communities, however, may in time cause potential social problems in group communications, education, crime and juvenile delinquency.

Cultural Erosion - The new residents will potentially accelerate the disruption and transition of traditional life styles and cultural practices of local families to more modern ways of life. This process usually increases the living standards of the local residents.

5. Increased Visitor Population

The projected number of overnight visitors expected to occupy the initial 350 room hotel as part of Increment I-A will average 470 persons nightly (350 room x 1.9 visitors per room x 70 per cent hotel occupancy rate). For the planned 3,000 hotel rooms, it can be expected that the average nightly visitor count will approximate 3,990 guests. These figures can be increased by a factor of approximately 1.1 to reflect an average-day visitor census (day visitors to the resort will be offset to a degree by the number of hotel guests who leave the resort for day excursions outside the region). This would mean that, for the initial resort project, on any given day approximately 520 visitors would be found within the region, with the majority normally on the grounds of the resort. Upon completion of all hotels, this number would be increased to about 4,390.

The main social effects or changes which the projected resort visitors could potentially have on the existing residents and communities within the North and South Kohala region are reviewed as follows:

Social Interaction - The exposure of local employees and residents to visitors from outside the region and State promotes the opportunity for social and cultural interactions. This is particularly true for associations, in either employment or other capacities, with foreign visitors. Visitors are becoming increasingly interested in experiencing first-hand the cultures and interests of people from different parts of the country or from foreign countries. This cultural awareness encourages social and cultural interactions which can be a broadening experience for both visitor and local resident.

Perpetuation of Local Arts and Handicrafts - Visitors to the region present numerous opportunities to perpetuate local talents in singing, dancing, and related arts and in encouraging the continuation or re-establishment of traditional handicraft skills and arts. This interest in turn can be instrumental in strengthening a sense of pride in the heritage and ethnic backgrounds of the local people. Visitors have in general become more discriminating in their shopping and entertainment interests and express today a great interest in authentic and quality handicrafts and art forms characteristic of the cultures of the area.

Change in Life Style - Additional visitors to the North and South Kohala region can potentially change various aspects of the pres-

ent life styles found within the region's communities. While some changes are desirable many are considered adverse in nature. One example would be an accelerated shift from the slow-paced, person-oriented life-style characteristics of rural communities to emphasis on commercialism and commercial activities which cater "strangers" or outsiders. These would include boutique-type gift and apparal shops, Mainland-type entertainment establishments, sophisticated and exotic restaurants and the like which have more appeal to tourists than to local residents.

Increased Cost of Living - The presence of visitors, and particularly the more affluent visitors, will potentially stimulate higher prices or costs for items that appeal to only the tourist or to both tourists and local residents. The tourist-pricing practice can in time affect most, if not all, segments of the retail and wholesale goods, and this escalation will increase the cost of living within the entire area, thereby exerting an adverse socio-economic impact on local residents.

Erosion of Aloha Spirit - The increased number of visitors--particularly tour groups, which are typically characterized as more impersonal and less sensitive to local customs, traditions and life styles--could erode the warm and friendly personalities that are characteristic of the local people.

Traditional Use of Areas - Since the WBR is designed as a self-contained major destination resort, any infringement on the traditional public beaches and other public recreational areas, as a result of the increased number of visitors to the WBR, would be minimal. There should be little public concern for the development of visitor facilities at 'Anaeho'omalu and the influx of visitors to WBR, inasmuch as the area was not accessible to the public until Boise opened access roads to it. An influx of visitors will probably increase the amount of deep sea sport fishing in the South Kohala and Kona areas, thus increasing the competition for game fish.

Increased Use of Public Facilities - The presence of a sizable number of visitors in the area will add, in varying degrees, to the use of public services and facilities. However, the use will generally be minimal or insignificant, with the primary exception of transportation facilities. Sometimes the additional use of facilities resulting from more visitors has increased the service given in those facilities, particularly in the case of inter-island air terminals, so that their use by local residents has been facilitated.

Some of the adverse social effects, such as increased commercialism and change in life styles, are generally beyond Boise's ability to control or mitigate. In other aspects, WBR has incorporated within its planning and development programs, measures or elements which are addressed to mitigating the potential social problems and adverse impacts. These include the provision of public access to the heretofor inaccessible beach and principal features on the development, including the fishponds and archaeological sites; provision of additional

recreational amenities for both visitors and local residents, to reduce the increased pressures on existing public parks and recreational facilities; and the provision of a mix of hotels with balanced composition of independent and tour-regime visitors.

6. New Resort-Community Residents

WBR is expected to ultimately contain some 3,430 resort residential units to be marketed to vacation and second-home buyers. A projected ultimate population would be in the neighborhood of 4,300 residents on completion of Increment II. This resident population has been computed by multiplying the projected number of units by an occupancy level of 2.5 persons per unit and then relating that number to a daily occupancy rate of 50 per cent to reflect the generally non-permanent nature of the units' occupants.

This population segment will have the smallest social effect on the existing communities within the North and South Kohala areas. The occupants of the dwellings will typically be either retirees or couples and families who occupy their units only during vacations and holiday periods. A small portion of occupants will likely be full time employed in WBR or nearby. Their overall presence will cause few additional demands on schools, playgrounds, parks and other related public facilities, yet they will contribute, just as other land owners do, in the financial support of such facilities through real property and other forms of local and State taxation. This segment will add slightly to the requirements for police and fire protection; however, their potential contribution to juvenile delinquency and other social costs and problems will be minimal.

CORRECTION

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IMMEDIATELY FOLLOWING

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recreational amenities for both visitors and local residents, to reduce the increased pressures on existing public parks and recreational facilities; and the provision of a mix of hotels with balanced composition of independent and tour-regime visitors.

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J. IMPACT ON PUBLIC FACILITIES*

The impact of the WBR on Public facilities is evaluated on the basis of four categories: the construction force, the visitors, the immigrant employees and other permanent residents.

1. Education System

The projected impacts of the various population categories on the education system are presented below.

Construction Employment: Minimal. It is assumed that construction workers not already living in the area will not bring their families to the area during the construction periods.

Visitors: None. Children with their parents on vacation generally do not attend local schools.

Immigrant Employees: Moderate. Table IV-J.1 shows the number of in-migrant school children who can be expected to be added to the school system.

Other Permanent Residents: Minor. Permanent residents in general will be retired persons without resident children.

The K-8 students will be accommodated at the Waimea Elementary and Intermediate School and the 9-12th grade students at Honoka'a High School or at the Hawai'i Preparatory Academy, a private school in Waimea.

Table IV-J.1 ESTIMATED IN-MIGRANT STUDENTS
Waikoloa Beach Resort
Island of Hawai'i

	Increment I				Project
	1A	Remainder	Total	Incr. II	Total
In-Migrant Housing Demand	140	790	930	180	1,110
Factor for K-8(1)	.14	.14	.14	.14	.14
Factor for 9-12(1)	.06	.06	.06	.06	.06
Estimated K-8 Students	20	110	130	30	160
Estimated 9-12 Students	10	50	60	10	70
Total	30	160	190	40	230

(1)Estimated from State Department of Education planning studies for Honoka'a High School and Waimea Elementary School.
Source: Hastings, Martin, Hallstrom and Chew, Ltd.

*Source: Hastings, Martin, Hallstrom and Chew, Ltd.

2. Library System

It is assumed that all categories of new people to the area will use the local library services. According to planning design criteria, the minimum populations served by a sub-branch is 6,000 people. Thus, Step 1A, with a daily census increase of about 890 persons, including both in-migrant workers and visitors, will not substantially affect the existing library.

The total WBR development will probably increase the daily census by about 12,890 persons, enough to justify the construction of another library in the coastal area or expansion of the existing one.

3. Fire Protection

The primary criteria for fire protection are: 1) an adequate supply and location of fire-fighting water, and 2) the presence of, and distance from, fire-fighting equipment. Secondary criteria are fire-alarm systems, fire-protection programs, and building-code fire-resistance requirements.

Waikoloa's fire-fighting water system is designed to meet the generally acceptable fire-code standards.

The hotels and other major structures will be constructed in accordance with the fire-safety requirements of the Hawai'i County Building Code (based on the Uniform Building Code 1973). The nearest 24-hour service fire station is located 25 miles away in Waimea. An eight-hour manned station is located eight miles away in Kawaihae. Both stations are too far away to satisfy the two-mile optimum-service-distance standard.* Therefore, during the first phases of development, it may be necessary to provide other facilities. Mauna Kea Beach Hotel has its own fire truck and there is a small fire house and a fire truck at Waikoloa Village.

4. Police Protection

Police service for the entire South Kohala area is based in a new community services building in Waimea. The present police force of 13 men for the 1975 South Kohala population of about 3,000 persons results in a ratio of one policeman for each 230 persons in the area. Assuming similar coverage in the future, Increment 1-A (1978) will cause the daily census in South Kohala to rise by 470 visitors and 420 immigrant employees and their dependents. This increase will require that three or four more policemen be added to the Waimea force.

The completed WBR development will increase the daily census by 12,890 persons. This increase will require about 56 additional policemen, and for these new policemen at least one police station will be

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*American Insurance Association (National Board of Fire Underwriters) Special Interest Bulletin #315.

required in the coastal area.

As long as WBR has its own security force we estimate that the need for additional County policemen caused by WBR will be less than 56.

5. Hospital and Medical Facilities

The main general hospital for the County is located in Hilo. Health services are provided in the South Kohala area by a dispensary in Waimea and a hospital in Honoka'a. North Kohala is served by a 26-bed hospital in Kapa'au.

According to the State Health Department, a population of approximately 10,000 persons is required to support a small 25-bed hospital. Therefore, the anticipated population of Step 1A can be accommodated by the Waimea dispensary and the Honoka'a Hospital. The total development of WBR will increase the daily census of the region to about 12,890 persons, justifying the establishment of a hospital in the South Kohala area. A new medical facility is currently under construction in Waimea.

6. Solid Waste Disposal

Refuse disposal in South Kohala is at open dump sites in Waimea and in Puako. A sanitary landfill operation, with rubbish brought to it from several transfer station sites, is planned for the district. A transfer station has just been installed at the Puako dump site and another is planned at the Waimea dump site. The regional sanitary landfill will be installed at Ahualoa in Hamakua and will serve both North and South Kohala. The initial site will be 35 acres with a reserve of an additional 35 acres. The landfill will be in no more than two eight-foot lifts, giving a total capacity of about 1.8 million cubic yards, sufficient to support a population of 30,000 for eight years.

To date the requirements for waste disposal at Waikoloa have been met by a sanitary landfill site south of Pu'u Hina'i on the North Kona-South Kohala boundary.

Recent studies by the State Department of Health and the University of Hawai'i indicate that about 4.1 pounds of domestic refuse are generated per person per day in the County.

Considering an average daily census of 12,890 persons, the amount of solid waste refuse generated by WBR will be 52,850 pounds per day.

This will be handled by the County facilities or at a new site in a natural depression in the Boise quarry mauka of the Queen Ka'ahumanu Highway.

7. Recreation Facilities

The impact of the WBR resort on recreation areas and facilities will be felt in two ways. First, the development will add both permanent residents and visitors to the existing recreation system. Second, the

resort will include public and private recreational facilities as a part of the development.

The added requirement for recreational facilities based on additional population in the area can be estimated in two categories--neighborhood and community facilities, and general use facilities. These categories can be defined as follows:

> Neighborhood and Community Facilities - Locally used parks that are normally classified as playlot, playground, neighborhood park, and community park are categorized as "Neighborhood and Community Facilities". These range in size from 2 to 10 acres and have a service radius of about half a mile (10-15 minutes maximum walk). The area required for these facilities is forecast at 5 acres per 1,000 persons.
>
> This demand will be satisfied by the common recreation amenities which will be a part of each condominium development within WBR.
>
> General-Use Facilities - Parks such as district, regional, beach, shoreline, and general-use parks, and special facilities that are used by people from the entire city or larger area are categorized as "General Use Facilities". The service area is the entire city or larger region and the acreage is variable. In Hilo, these parks and facilities are under either County or State control. Demand area requirements are forecast at 10 acres per 1,000 persons.

This demand should be met by increased facilities in the planned State park between Mauna Loa Land and 'Olohana. The existing resident population of North and South Kohala is about 6,000 persons, and there are approximately 600 visitors/day at the Mauna Kea Beach Hotel. This total population requires a total of approximately 100 acres of recreational facilities. There presently exists in North and South Kohala about 150 acres of developed recreation facilities. Thus the existing facilities will accommodate Step 1A without requiring expansion. The total WBR, however, will require the development of an additional 190 acres of recreation facilities, or about 140 acres more than the current availability.

The lands to be occupied by the WBR include a long stretch of white sand beach which Boise Cascade has improved through the installation of restroom and shower facilities and by providing parking space. When the resort is constructed, public access to this area will be further improved by the construction of additional public parking areas and access roads. This will increase the use of the facilities.

The recreational lands which will probably be incorporated as part of

WBR are listed below:

Public-Oriented Areas	(ac.)	Resort-Oriented Areas	(ac.)
Shoreline Open Area	10.0	Golf Course	332.2
Fishpond Open Area	6.3	Small Boat Harbor	5.9
Historic Preserves	34.3		
Public Parking	5.2		

Public oriented areas are portions of the resort that include historic and natural features which have appeal and interest to a wide sector of the general public. Resort oriented recreational areas include facilities and activities which cater more to hotel guests and resort residents.

8. Public Roads*

As indicated in Sections I and II, vehicular traffic from the resort site has access to the regional highway network via a two-lane access road to Queen Ka'ahumanu Highway. Travel from the resort site to other parts of the island is funneled through four primary routes: Queen Ka'ahumanu Highway, Waikoloa Road/Mamalahoa Highway, Kawaihae-Waimea Road and Mahukona Road.

The impact on the access road and these four principal corridors has been estimated for four different phases in the project's life:

1. Initial construction.
2. Operation of Step 1a and construction of the remainder of Increment One.
3. Operation of completed Increment One and construction of Increment Two.
4. Operation of Increments One and Two.

The analysis involved first projecting the number of one way trips per day that would occur during each period (Table IV-J.2) and then distributing the estimated number of trips among the various available road corridors. (Table IV-J.3). The assumptions used in making the distribution were as follows:

Initially 100 per cent of the traffic generated will enter WBR via the main access road. Alternative access roads will not be constructed until sometime after Increment One has been completed.

Having reached Queen Ka'ahumanu Highway, 40 per cent of the vehicles will turn south towards Kailua and 60 per cent will turn north towards Kawaihae. This differential split is based on the belief that Ke-ahole Airport and the Kailua-Keauhou resort area will generate a bit less traffic than the employee housing, tourist areas, and port facilities to the north.

One-third of the vehicles that turn north (20 per cent of the vehicle trips generated by the WBR) will leave Queen Ka'ahumanu Highway at Waikoloa Road. They will take that route to Waikoloa Village, the Saddle Road to Hilo and Volcano, and mauka Kona via Mamalahoa Highway.

One-third of the vehicles that turn north will continue on to North Kohala via Mahukona Road.

One-third of the vehicles that turn north will turn inland at Kawaihae towards Waimea.

The figures shown for the initial construction period are based on the expected residence pattern of local construction

*Source: Belt, Collins and Associates, Ltd.

employees.

Table IV-J.2 OFFSITE ONE WAY TRIPS PER DAY

Basis of Trip	Initial Construction Period	Step 1A Operation: Increment I Construction	Increment I Operation Increment II Construction	Increments I and II Operation
Construction employees	275	150	150	0
Construction deliveries	191	35	92	0
Resort employees		360	2,170	2,748
Resort deliveries	0	4	20	24
Visitors and Condominium Residents Considering 100 per cent occupancy	0	320	6,800	11,912
TOTAL	466	869	9,232	14,684

Table IV-J.3 shows peak traffic expected for each period. Peak-period traffic has been estimated for the construction period on the assumption that all employees must arrive at work at the same time. Traffic for normal resort operation is much more evenly distributed throughout the day; it is assumed that 11 per cent of the total trips per day will represent the peak-period traffic for this phase of operation.

The highway carrying capacity was estimated by starting from a theoretical maximum two-lane-road capacity of 2,000 vehicles per hour for two-way traffic. This was then reduced to account for the design characteristics of the specific highway in question.

Impact of New Traffic Load

The main access road will carry the estimated total Increment One traffic volume. Eventually, however, a second access road will be constructed from the Waikoloa Road and Queen Ka'ahumanu Highway intersection down to the resort loop road, Figure L.

Queen Ka'ahumanu Highway's two lanes are capable of absorbing all of the traffic that will be generated by WBR Increments One and Two. Simultaneous development of the nearby Mauna Loa Land and 'Olohana Properties would eventually generate vehicular traffic in excess of Queen Ka'ahumanu Highway's existing capacity and would necessitate the construction of two of the additional lanes that are planned for the highway's 300-foot wide right-of-way. However, this would only come sometime after the total buildout of Increment One. Sooner or later, depending upon the rate at which both WBR and other developments

Table IV-J.3

DISTRIBUTION OF ONE-WAY TRIPS/DAY (IN UNITS OF VEHICLE/24 HR)

Road Used	Existing Load[1]	Anticipated Additional Load				Total Load			
		Initial Constr. Period[2]	Step 1A Operation Incr. I Constr.	Incr. I Operation Incr. II Constr.	Incr. I & II Operations	Initial Constr. Period[2]	Step 1A Operation Incr. I Constr.	Incr. I Operation Incr. II Constr.	Incr. I & II Operations
Access Road	0	466	869	9,232	14,684	466	869	9,232	14,684
Queen Ka'ahumanu Highway North to Waikoloa Road	1,972	466	521	5,540	8,810	2,438	2,493	7,512	10,782
North of Waikoloa Road	1,972	233	348	3,693	5,874	2,205	2,320	5,665	7,846
South to Kona	1,972	0	348	3,693	5,874	1,972	2,320	5,665	7,846
Waikoloa Road	500	233	173	1,846	2,936	733	673	2,346	3,436
Mahukona Road	1,016	117	173	1,846	2,936	1,133	1,189	2,862	3,436
Kawaihae-Waimea Road	1,990	117	173	1,846	2,936	2,107	2,163	3,836	3,436

[1] Traffic counts are from information gathered by the State in 1971 and 1972 before the Queen Ka'ahumanu Highway was completed to Kona.

[2] Initial construction period traffic distribution is considered to be 50 per cent to Waikoloa Village and equal shares of the remaining to North and South Kohala and Kona.

Table IV-J.4 ESTIMATION OF PEAK-HOUR[1] TRAFFIC IMPACT ON CARRYING CAPACITY OF EXISTING HIGHWAY NETWORK

Road Used	Maximum Carrying Capacity of Existing Roads (veh/hr)[2]	Existing Peak Load (veh/hr)	Additional Peak Traffic (veh/hr)				Total Peak Load (veh/hr)[4]			
			Initial Constr. Period[3]	Step 1a Operation Incr. I Constr.	Incr. I Operation Incr. II Constr.	Incre. I & II Operation	Initial Constr. Period	Step 1a Operation Incr. I Constr.	Incr. I Operation Incr. II Constr.	Incre. I & II Operation[5]
Access Road	1,420	0	233	96	1,016	1,615	233	96	1,016	1,615[5]
Queen Ka'ahumanu Hwy.										
N to Waikoloa Rd.	2,000	217	233	57	609	969	450	274	826	1,186
N to Waikoloa Rd.	2,000	217	116	38	406	646	333	255	623	863
S to Kona	2,000	217	40	38	406	646	257	255	623	863
Waikoloa Rd.	1,800	55	116	19	203	323	171	74	258	378
Mahukona Rd.	2,000	112	58	19	203	323	170	131	315	435
Kawaihae-Waimea Rd.	1,000	219	58	19	203	323	277	238	422	542

[1]Peak-hr-load estimated based on 11 per cent of existing 24-hr traffic load during normal operations.
[2]Max. peak-hr carrying capacity estimated using ideal of 2,000 veh/hr for a two-lane road and then reducing the capacity in accordance with the design and condition of the actual road.
[3]Assuming that all local construction workers will arrive or depart in the same hour.
[4]Includes existing 1972 traffic and load attributable to WBR; does not consider regional expansion.
[5]A second access road will be added during this period raising access road capacity to 2,840 veh/hr.

K. IMPACT TO PUBLIC UTILITIES

1. Domestic Water

There is no impact since the water system is totally within the boundaries of Waikoloa and is a direct result of development therein.

2. Sewerage

There is no impact since the sewerage system is totally within the boundaries of Waikoloa and is a direct result of development therein.

3. Electrical Power

The installation of electrical power will be permanent and a direct result of the WBR. Total buildout of Increment One will demand 16,272 KW. HELCO advises that the existing power source is capable of handling this load requirement. Increment Two will require an additional 10,579 KW. With the total Increment One and Two power demand, the power source will probably not be adequate to handle the load and an expansion program may have to be considered. Table I-E.4 shows the estimate for the connected power demand for the WBR, and will have to be considered in HELCO's planning for future expansion.

4. Telephone

The installation of telephone service will be permanent and a direct result of the WBR. Hawaiian Telephone Company advises that they will be able to meet the requirements of the WBR. The only problem is one of lead time and the ability to obtain the necessary materials. This can be resolved with scheduling coordination between Boise and the telephone company.

5. Gas

There is no impact to existing gas installations. The installation will be a permanent independent system as a direct result of the WBR development.

V. Alternatives

A. ALTERNATE USES*

Public policy, as expressed in the county of Hawai'i General Plan and the State of Hawai'i Land Use Plan, calls for resort development of the WBR. However, various alternative uses are presented. None of the alternatives appear economically feasible or justifiable, nor are most of the alternatives sound from an environmental or planning point of view.

1. Do Nothing

An alternative use would be to leave the land in its present state - with roads rough graded, a golf course partially graded, and certain archaeological sites exposed (these sites are currently being protected by Boise's security service). This, of course, would generate no economic or other benefits to Boise, and the only alternative would be to secure the property as well as possible and attempt to sell the land to either private or public buyers.

While this alternative would retain the land in its present condition, the potential economic and social benefits to the North and South Kohala communities, which would derive from WBR development, would never be realized. These include:

> The direct benefits associated with resort employment opportunities (Section IV. H. 1)
>
> The direct and indirect benefits associated with visitor spending. (Section IV. H. 8)
>
> The direct and indirect benefits of added income to the State and County derived from increased real estate and other taxation revenues. (Section IV. H. 8)
>
> The provision of public access to the 'Anaeho'omalu Beach and coastline and the archaeological sites (unless the property was acquired and protected by a public agency).

2. Park Development

This alternative assumes that the State or County would acquire the WBR from Boise in order to utilize the area for park and recreational purposes. While the physical and envionmental characteristics and attributes of the coastline, ponds, and certain archaeological areas would lend themselves to park uses, it is extremely unlikely that the State or County would purchase the site for such purposes since:

> Acquisition and development funds for such an amount may be

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*Source: Mauna Loa Land, Inc., Environmental Impact Statement
Belt, Collins and Associates, Ltd.
Hastings, Martin, Hallstrom and Chew, Ltd.

difficult to obtain or justify.

Boise is already committed to making the beach and coastline and principal archaeological sites available for public use and enjoyment.

With the exception of the coastal and pond settings and major archaeological groupings, the remaining portions of the land are principally 'a'a and pahoehoe lava and are generally unsuitable for park and recreational uses, without extensive capital improvements.

3. Agriculture

The site is clearly unsuited for agricultural uses. As mentioned above, the WBR area is totally covered by 'a'a and pahoehoe lava flows. The only existing vegetation are coconut palms and certain other indigenous coastal trees and shrubs growing within the pond area and along the beach and coastal edge. Historical accounts show that no attempts have ever been made to utilize the WBR lands for agricultural purposes. The lack of soil, coupled with the hot, dry, and often windy climatic conditions, make any form of agricultural productivity economically unfeasible. To render the site suitable for agricultural use, huge quantities of soil would have to be brought in, and water for irrigation would be far too expensive for agricultural purposes.

4. Quarrying

Portions of the site could be utilized for the quarrying of aggregate and pumice; however, this type of operation would in time become an environmental problem and would have an adverse impact on the visual and physical qualities of the site.

5. Residential Subdivision

An alternative use would be to subdivide all or the majority of the WBR into single-family residential lots. This is a possible means of recovering some of the capital investment. However, the marketability of single-family residential lots would be limited. Aside from the unfavorable economic implications, Boise does not favor this development approach because it does not optimize the site's scenic and historic resources for maximum public/private enjoyment. Resort-type uses, in which emphasis is placed on environmental amenities and outdoor recreational opportunities, are better suited for lands that have inherent unique features or character, such as the Kahapapa and Ku'uali'i Fishponds and the site's spectacular coastal setting. These features should be available for the enjoyment of visitors and local residents alike. Single-family residential development would tend to limit access to and enjoyment of these features to residential occupants only.

A second consideration is that the subdivision of the lands for single-family residential development would require essentially the same infrastructure and utility demands as will be required for resort development, but would not create an economic base (the same as Alterna-

tive 1 - Do Nothing). However, there would be some benefit to the State and County from increased real estate and other taxation revenues, but to a lesser degree than as proposed in the WBR (Section IV. H. 8). Further, with proper development controls, clustered resort and multi-family residential development balanced with open-space corridors could have a much more complementary and harmonious visual effect than numerous detached houses scattered throughout the entire site.

6. Industrial Use

The site offers no basic advantages for general or heavy industrial activities. The shoreline is void of natural harbors or inlets for harbor and transport facility development, and while the 'a'a portions of the site could be easily crushed and leveled for industrial structures and activities, such activities could in all probability be more economically viable in other geographic areas where the basic required infrastructure and proximity to markets already exist.

7. Commercial Use of Fishponds

Because of the current state of both the market and aquaculture technology, it appears that the community would benefit more from a land use which capitalizes on the ponds' historical, recreational, and cultural value than from exploitation of their questionable food-production qualities.

B. ALTERNATIVE TIME FRAMES

Boise is ready to go --- now.

Legal problems which have prevented Boise from beginning earlier are resolved --- now.

A hotel developer is committed --- now.

There is a need (market) for the development --- now.

Kohala needs employment opportunities --- now.

Given the financial pressures, Boise does not have a realistic alternative time frame. Given the existing environmental and market conditions, there appears to be no reason why some other time frame would be better - or even as good.

VI. Relationship Between Short Term and Long Term Productivity

A. SHORT AND LONG TERM USE OF THE PHYSICAL RESOURCES AT THE WBR*

The resources used would be the good physical environment, such as the "Sun, Surf and Sand", and archaeological sites, such as the fishponds, petroglyphs, burial caves, the Camel, and the King's Trail, that will be enjoyed by visitors to the area.

The work done to date and planned for the future by the 'Olohana Corporation, Mauna Loa Land, Inc. and Boise Cascade, together with what the State and County have done and are committed to do along the South Kohala Coast is transferring what was once a barren, unproductive, inaccessible area into a well planned, major destination resort region where residents throughout the State and visitors to the area can enjoy not only the beaches and coves, but develop an understanding of the history and culture of the area.

Public and private objectives for the area overlap. Boise plans to develop at the WBR a major destination resort, with hotels, residential properties, and commercial areas to accommodate retail and service facilities.

Along with the natural amenities, the WBR will have other recreational facilities such as a championship golf course and archaeological preserves, all harmonized to create a resort that will provide long term enjoyment, a variety of activities and experiences, environmental quality and an opportunity to live at Waikoloa. In addition, the WBR will satisfy a very basic need for the Kohala region and the County of Hawai'i: Employment, and concomitantly, economic diversification and stability.

Development in the past has been hindered in part due to access and availability of water. The new Queen Ka'ahumanu Highway solves the access problem and Boise has provided its own water source for the WBR.

In the short run, the use of the resources will generate construction money and jobs for the area in addition to tourism employment.

Historically, the economic base for both North and South Kohala has been agriculture. However, over the past decade the viability of agriculture has been experiencing a general and steady decline. The development of the Mauna Kea Beach Hotel and the associated tourism industry components have, to a large degree, offset the decline in employment and other economic aspects tied to agriculture. With the shutdown of the Kohala Sugar Co. and the continuing decline of agriculture as a viable economic base, Boise's WBR development can be viewed as an additional stimulus to the region's existing economy and as an alternative employment opportunity. This, in turn, will allow

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*Source: Mauna Loa Land, Inc. Environmental Impact Statement and Belt, Collins and Associates, Ltd.

families, who would otherwise have to leave the region in search of new employment sources, the option of remaining within their home communities, and enable some, who have had to leave their homes, the opportunity to return. It will also enable some who may consider themselves underemployed the opportunity to improve their status.

WBR will also provide employment and career opportunities for young graduates who are now forced to go to O'ahu or the Mainland for jobs and opportunity. Further, increased employment, coupled with additional visitor spending, will aid ailing retail businesses and other economic activities and will strengthen the region's economic base.

Residents of North Kohala who find jobs at WBR will be able to commute from their homes to their jobs over the Queen Ka'ahumanu and Mahukona highways.

The economic shift from predominately agriculture to mixed agriculture and tourism will affect the social and cultural makeup of the communities within the region. This transition began with the opening of the Mauna Kea Beach Hotel and will continue with increased tourism activities.

The overwhelming unanimity with which State and County policies encourage and favor resort development in South Kohala as an employment source indicates a determination by government and the people that it represents, that the advantages far outweigh the disadvantages.

The environment will be effected only as necessary for the project construction. Most aspects will be improved.

Long run employment and tourism expenditures in the area will be the beneficial results.

B. LAND USE ALTERATION

Resort development on Boise's WBR lands will change the environmental character of the area. The site and surrounding lands are at present part of a vast stretch of mostly barren lava fields which extend from Puako along the West Hawai'i coast to Kailua-Kona. The WBR will transform a portion of this land to a clustered hotel and multi-family residential community, urban in nature, and in conformity with the County of Hawai'i General Plan and the State Land Use Plan. The development will be limited by the County of Hawai'i Zoning and Subdivision Ordinances. Through architectural controls and landscaping, efforts will be made to harmonize the man-made additions with the surrounding environment.

In the transformation of the WBR from unused barren lava fields to a destination resort, Boise has made available to the public portions of the land which heretofore were not accessible, and will open up new areas. Public use areas will include the entire coastal shoreline and areas which contain significant archaeological sites. In addition, the public will have access to most planned recreational facilities, as well as dining, shopping, and entertainment opportunities within the resort facilities.

The State and County have established land use policies and capital improvement programs that dictate the transformation of certain areas along the South Kohala coastline from total open space to grouped development within a predominately open space setting. With the completion of the new Queen Ka'ahumanu Highway, the State has provided access to the entire South Kohala and North Kona coastline, an area which in the past was virtually inaccessible by land except for jeep trails and dirt roads that traversed the vast lava fields. Both State and County land use and planning policies identify selected areas along the coast for urban and resort development and designate other coastal areas permanent open space belts. The actual acreage designated for urban and resort development, however, is very small in comparison with the amount of coastal lands to be retained in open space.

Thus, with the transformation of land will come opportunities for public use and enjoyment of lands which heretofore were closed to the public. While the transformation will be from undeveloped open space to urban type development, such development will be limited to certain portions of the coastal area and will be balanced by major open space lands. Development will be low rise in character and, with proper selection of building forms, materials, color, and landscaping, will harmonize with the environment.

C. STATUS OF ARCHAEOLOGICAL AND HISTORICAL SITES

The South Kohala area is rich in archaeological and historical sites that represent earlier settlement and cultural patterns. Many of the sites are found in groupings, others are scattered throughout the area. As stated in Section II. C. 3 and IV. F. Boise has had in-depth archaeological surveys made of its properties and has incorporated, as a part of the existing zoning and site development plan, historic preserves that encompass the principal groupings of archaeological and historic sites found within the WBR. The preserves contain sites that are representative of all archaeological features found on the property. In addition, measures have also been taken to preserve or salvage isolated sites that have been evaluated as highly significant with respect to research and interpretive qualities. The initial salvage work recommended by the Bishop Museum has been completed, resulting in the publication of a detailed report on the first two increments of the WBR and nearly 2,500 artifacts (currently stored at the Bishop Museum in Honolulu, but still the property of Boise).

As a result of the WBR development a certain number of less significant sites will be lost. However, Boise has taken steps to minimize this loss and to insure that it will occur only to sites considered as being of a quality and value that do not necessarily merit preservation and which have undergone salvage operations. Sites will be preserved if they can be utilized in the landscaping and/or do not interfere with construction.

This minimal loss is offset by the long term gains of opening significant sites to public access and enjoyment, providing opportunities for increased educational and interpretive presentation of the history and cultures of the region, and providing a program for the protection and management of significant and valuable archaeological and historical features.

D. POPULATION INCREASES

With increased resort and tourism development will follow additional employment and growth in population. There will hopefully be a reversal of the outflow of local graduates from the area as new career opportunities become available, and there may be a "return home" by some of those now living and working on O'ahu or the Mainland. In addition, new permanent residents will be attracted by the developing resort region. These increases could in time more than double the present population within the region. The added population will increase the needs for public facilities and services and will have certain effects on the social and cultural composition of North and South Kohala communities.

County land use policies dictate the development of new urban centers near any major employment generating development such as resorts and tourism activities. Such centers serve to reduce commuting distances between employees' residences and sources of work and also reduces the growth pressures and potential social conflicts in existing communities when immigrant populations are brought into the region. Boise in developing the Waikoloa Village community will be able to offer housing sites for the WBR employees and their families. Boise has also agreed to donate up to 500 acres to provide for the development of low cost housing when and as needed.

While a significantly increased population places additional demands on existing public services and facilities, the combined population base often results in not only a greater number but a major improvement in the quality and variety of services and facilities. This upgrading, in turn, has beneficial effects on all residents within the region and contributes to a higher standard of living and a richer quality of life. This long range net gain generally offsets most, if not all, of the shorter-term social and cultural adjustments related to the increased population generated from resort development.

VII. Mitigation Measures Proposed

A separate discussion of mitigating measures implies that ways of minimizing adverse environmental impact of the WBR were considered only after the basic design had been finalized. Such, of course, was not the intent of the legislation and regulation that established the requirement for an EIS, and it does not accurately reflect the extent to which environmental considerations have shaped the design of WBR. The very knowledge that developed plans will be subject to close public scrutiny via the EIS process is an important influence on private decision-makers.

It is unrealistic to expect that the primary concern, or at least the controlling one, of private developers will not be the construction and operation of a profitable project. To fail at this is to very quickly remove oneself from the profession. It is reasonable, however, to expect that those same developers will refuse to participate in activities which are overwhelmingly negative in their effects or to strive to eliminate undesirable side effects of a project that is basically beneficial to the general public.

With this in mind, both the owner and planners working on the WBR project have made a continuing effort to eliminate design elements which have negative impacts and were not critical to the economic success of the project and to take whatever actions are necessary to mitigate the adverse effects of actions that cannot be avoided. Reference is made to most, if not all, of these in Section IV, Impacts. This section, then, is little more than a summary of information contained elsewhere in the report. It does, however, emphasize the extent to which the planning has been cognizant of and responsive to the need to maintain a high level of environmental quality.

A. LAND TRANSFORMATION

Fishponds and Tidal Pools: The resort land use and development plans have been configured in such a manner as to minimize the disturbance and alteration of the existing coastal ponds and tidal ponds. The two principal fishponds have been contained within an open space and conservation area which will generally preclude structural development. While the majority of the smaller tidal ponds will be within hotel and condominium parcels, structural and infrastructure development will be designed and sited so as to retain as many of the ponds as possible. Most of the ponds will be incorporated as part of the site landscaping and will remain essentially in their present natural state.

Erosion Control: As the resort area is now comprised predominately of lava, no significant erosion or material runoff problems are anticipated during site preparations. The only possible situation where erosion problems could be encountered is where soil is to be brought in for landscaping purposes around the proposed small boat harbor. Efforts will be taken to minimize soil erosion by planting ground covers and other vegetation which will form a rapid cover over the exposed soil. Once the vegetative cover has taken hold, problems of soil erosion within the resort should be insignificant.

Construction Impacts: Measures to reduce the adverse effects of noise, dust traffic and other conditions created as a result of grading filling activities are discussed under the heading "Airborne Emissions" below.

B. WATER RESOURCES

Domestic Water Supply: Domestic water for the resort will be from Boise's wells in the Waikoloa aquifer, and it is projected that the subterranean flow through the system should be sufficient to handle the estimated average potable water requirements. The resort will, therefore, not draw on public (County) water sources to meet resort water needs.

Basal Groundwater:

Quantity: The three principal factors which could potentially influence the basal flow rate are 1) the extent of irrigation of the golf course and other landscaped areas, 2) the use of wells as part of the air conditioning systems, and 3) the extent of a hard surfaced water runoff system. The mitigating measures to reduce the adverse effects of each are as follows:

Irrigation: The brackish water to be used for irrigation purposes will be drawn principally from the basal lens, applied in certain landscaped areas, and then allowed to return to the system through percolation to the water table. It is recognized that a percentage of the water will be lost through evapotranspiration, but with careful irrigation planning and scheduling, the loss of water can be reduced to a minimum. This would include application of water during evening hours and the use, where practical, of drip irrigation systems in lieu of impact or misting type irrigation heads.

Water for irrigation will initially be a mixture of brackish water from shallow, onsite wells and potable water from the domestic distribution system. As effluent from the resort's sewage treatment plant becomes available, it will meet all of the resort's irrigation needs, allowing the use of potable and brackish water to be correspondingly reduced, and thereby conserving a valuable natural resource.

Air Conditioning: As discussed previously, it is possible that some hotels could utilize basal water for cooling air conditioning chillers. It was further pointed out that brackish water of the basal lens is corrosive, and that current technology has not as yet overcome this problem. This will favor the use of recirculating systems using potable water and a cooling tower such as proposed by the initial hotel. Nonetheless, if brackish wells are used, the potential impact on basal flow rate could be substantial particularly where cooling systems are in close proximity to significant ponds and waterholes.

Should brackish wells be required for air conditioning, it can be expected that the possible adverse effects which are discussed in Section IV, Impacts, will be considered and used as part of the well location and design criteria to minimize the effects to the greatest degree possible.

Storm Water Runoff: With the exception of a few areas where the natural drainage ways cross roads, storm water runoff from the resort will be carried in open, turfed swales that allow natural infiltration. Therefore, with few impermeable areas, rain water will be allowed to enter the ground and percolate to the basal lens in much the same location and manner as it presently does. This, in turn, will generally aid in maintaining the present basal flow rate.

Basal Water Quality: The principal mitigating measure with respect to an adverse alteration of the quality of the water contained in basal lens centers on the treatment and use of sewage effluent. Proper treatment eliminates or minimizes the concentrations of bacteria and viruses and renders the liquid waste suitable for use for irrigation purposes. The treated effluent contains certain nutrients which can be utilized by plants and thereby substantially reduces the degree of possible nutrient contamination which actually reaches the basal lens, and reduces the requirements for added fertilization for optimum plant growth. The treated effluent therefore supplies vegetation with both water and nutrients and consequently reduces the need for these requirements to be supplied by other sources. The plants, and especially turf plants, further act as users or absorbers of the nutrients, which significantly minimizes possible leaching to and contamination of the basal lens.

Coastal Water Quality: Mitigating measures taken to reduce adverse effects on the quantity and quality of the water in the basal lens will have a direct affect on the quality of the coastal waters as any changes to coastal water quality will be a result of either altered surface or ground water discharge into the ocean. The majority of the resort area will be retained in an open space use, and the project will not result in concentrated storm water runoff. Surface runoff and discharge will, therefore, not be significantly altered nor will the general pattern of natural infiltration. Measures to minimize alterations in the quantity and quality of the basal lens were discussed in the previous paragraphs.

C. AIRBORNE EMISSIONS

Automotive Emissions: The principal mitigating measures for automotive emissions are the land use pattern and relationships, the distribution of vehicle trips, the planned circulation system within the resort and the project's construction phasing.

Land Use Relationships: The WBR land use pattern has been laid out to encourage pedestrian movement and to minimize vis-

itors' use of automobiles for transportation between one point and another within the resort. In addition, a network of trails and pathways for pedestrians and cyclists will further encourage movement by other than private or rented automobile.

In addition, the plan provides a number of onsite areas for commercial and recreational activities that should reduce the necessity for residents and visitors to travel offsite to obtain convenience retail items and to partake in recreational pursuits. Thus the intent is to reduce the need for automobile usage both within the resort and between the resort and other nearby destinations. This, in turn, will reduce the level of emissions from automobile traffic.

Internal Transportation System: An internal transportation system is planned which will provide a network of mini-bus-type vehicles to move people between different activities and points of interest within the resort. Provision will also be made for an employee parking area and an eventual transportation center where cars and buses will be concentrated and contained and employees and visitors will then be transported to hotels and other areas by the internal transportation system. A principal objective and purpose of the internal system will be to substantially reduce the movement of automobiles and buses within the resort, that, in turn, will reduce the level of vehicle emissions.

Project Phasing: It is expected that initial construction and development will start on the makai parcels and will progress inland or in a mauka direction. Since the normal pattern of wind circulation during the day (normal construction hours) is also in a makai-mauka direction, the wind will tend to carry construction equipment emissions, dust, noise and other pollutants away from completed and occupied developments and towards the undeveloped portions of the property.

Dust and Smoke: During all phases of construction, a dust control program which will meet the requirements of the County Grading Ordinance and other regulations will be in effect. Where necessary, water or oil will be applied to the crushed lava and soil that might be exposed to strong winds. Permanent roads will be constructed as soon as possible; however, where it is necessary to maintain temporary roadways, the unpaved areas will be moistened with water and traffic will be limited to construction equipment.

Smoke control will be achieved by restrictions on open burning for the disposal of waste generated by site preparation activities or by hotel operations.

D. NOISE GENERATION

Noise generated from construction activities will be subject to State noise regulations which establish maximum noise levels during certain

times of the day or night. The construction pattern of phased development, and the wind circulation patterns, as discussed previously, will also contribute to reducing noise disturbances to occupants and users of completed dwellings and activities.

Noise generated by entertainment activities will, for the most part, be contained within enclosed entertainment areas which are typically air conditioned or have some form of sound proofing to minimize noise disturbances. Some outdoor entertainment will occur, and this will normally be associated with periodic luaus and terrace bars or dining areas. Such areas will be sited and screened with vegetation and other buffers to minimize noise transmission.

Other noise mitigating measures will include the use of an internal transportation system, which should reduce vehicle traffic and associated traffic noise levels within the resort, and the use of vegetative screens (such as dense hedges) to buffer areas from adjacent roads and other noise producing activities.

E. AQUATIC ECOSYSTEMS

The two principal fishponds and a majority of the smaller tidal pools will be retained in their present state and will be contained within conservation or landscaped areas. This will minimize disturbance to the existing aquatic ecosystems, yet will make the water features available for public viewing and enjoyment. The efforts made to minimize the effects on water quality will, of course, also minimize any potential impact that the development might have on aquatic ecosystems.

F. ARCHAEOLOGICAL SITES

The principal measures which have been or will be taken to minimize the loss or destruction of significant historic and archaeological resources can be outlined as follows:

Inventory and Survey: The Bishop Museum has conducted an extensive inventory and survey of all known historic and archaeological sites to be found within the WBR area makai of the King's Trail. Through these actions, the locations of the sites have been fixed, and each has been evaluated as to the degree of historical significance and value.

Excavation and Salvage Activities: In instances where sites contained valuable artifacts, the objects were excavated and removed to the museum for further research and study and as a means of providing them for protection and security from vandalism and theft. This will contribute to a better understanding of the history and cultural basis of the project area and the South Kohala/West Hawai'i regions.

Preservation of Major Site Groupings: The significant groupings of sites have been incorporated in the overall resort plan as open and conservation areas to ensure permanent retention and preservation. Development will be precluded within these

areas, except for possible interpretive or related structures.

Recognition: Certain key sites and groupings will be nominated to both the Federal and State Register of Historic Places as an added measure of recognition and preservation control.

Restoration: Certain significant sites will be restored, and, in many instances, artifacts which were removed for research and study and safekeeping will be returned and displayed at the site as part of an interpretive presentation.

Control and Security: Measures will be taken to limit acts of vandalism and destruction of the sites. These will include the control of movement by designated pathways through site groupings, the closing of certain areas to general public access or thoroughfare, and by the possible use of security patrols.

G. VISUAL CHARACTER

The principal measures which will be taken to minimize possible adverse visual impacts as a result of structural development to be placed on the land will include the following:

Colors: Emphasis will be placed on the use of earth-toned exterior colors to harmonize and blend with the more natural surroundings.

Building Materials: Where appropriate, natural woods and lava will be used as part of structural development to help blend the structures with the surrounding environment. Highly reflectant paints and building materials will be avoided for roofs and other exterior surfaces.

Grouped or Clustered Structures: An effort will be made, where possible, to cluster or group structures within parcels to concentrate development and to retain larger areas of each parcel in an open space or landscaped uses.

Landscaping: Trees, coconut palms and larger shrubs will be used to screen or shield structures from prominant vantage points and to establish a transition between the man-made development and the natural physical surroundings.

VIII. Any Irreversible And Irretrievable Commitments of Resources

For the purposes of this environmental impact statement, the term irreversible is interpreted to refer to those events which are either impossible to reverse or which are completely unfeasible to reverse from an economic point of view.

The construction of the WBR will result in the loss of a number of archaeological sites identified in the Bishop Museum's survey of the property. However, because of the salvage operations commissioned by Boise, the artifacts and other information they contained have been preserved for study and possible inclusion in public displays.

The introduction of soil cover and, to a lesser extent, vegetation will permanently change the character of the lava flows that now cover the property. While it would be possible to remove most of the introduced vegetation, some would inevitably survive, and the presence of a soil mantle will allow other plants to gain a foothold on the land.

Related to the changes just mentioned is the effect that the urbanization of 'Anaeho'omalu will have on the visual and social texture of what has been, until quite recently, a very isolated area. The expansion of the 'Anaeho'omalu oasis will, together with the other developments planned for this portion of the South Kohala coastline, eliminate it as an isolated locale. It should be noted, however, that this is merely one step in a process that was made almost inevitable by the improved access that resulted from construction of the Queen Ka'ahumanu Highway.

As pointed out in Section IV, Probable Impact of the Proposed Action on the Environment, the development planned for some of the hotel and multi-family sites on the property will require that a limited number of the smaller coastal ponds scattered along the makai edge of the WBR be filled. The filling of those ponds will, of course, result in the elimination of the aquatic organisms that inhabit them. Unlike the terrestrial plants that may be similarly affected, it is unlikely that any of these would become reestablished if resort use of the area were ever terminated.

Construction of the WBR will involve the importation of large amounts of soil. Present plans call for the use of volcanite, a mixture of volcanic cinders from the Boise quarry and volcanic ash found nearby, for the soil that will be needed in order to landscape the property. Both are common throughout this portion of the Big Island, and their use at the WBR will not result in a significant depletion in the total stock of these materials.

Finally, the development of WBR will commit the people and government of the State and County to the provision of some of the services necessary to support urban use of the area.

IX. Offsetting Public Interests

As pointed out repeatedly in this report, for years both State and County governments have encouraged development of West Hawai'i as a major resort destination area through intensive capital investment in necessary support facilities (Ke-ahole Airport, Kawaihae Harbor, the Queen Ka'ahumanu Highway, etc.) and public land use policies (the Hawai'i County General Plan, State Land Use Plan, etc.). The Kohala region's need for the expanded economic base that resort development would bring has been greatly intensified by the recent cessation of sugar production in North Kohala and the failure of the Kohala Task Force to find suitable alternative employment for the workers displaced by the agricultural slowdown. Judging from the existing land use designation for the WBR, responsible public officials are clearly of the belief that resort use of Boise's lands is not only a reasonable but a desirable objective if it is done with skill and sensitivity to the land and its people. We believe that the development plan outlined in this EIS is responsive to all of the major environmental concerns that have been identified.

For many years agriculture was the dominant component in the State's economy. During that period, commercial activity became increasingly centralized in Honolulu, but sugar and pineapple cultivation remained widely dispersed throughout the entire chain. As a result, the Neighbor Islands were able to share in the basic economic enterprise of the State.

Following the end of World War II, however, agricultural productivity remained relatively stable while other segments of the economy entered periods of sustained growth. As a result, the relative economic importance of agriculture declined. Unfortunately, most of the non-agricultural growth occurred on O'ahu, and the Neighbor Islands entered a period of economic stagnation. To correct this long-term trend, the State government has adopted a policy of decentralizing economic activity--primarily by encouraging the development of the visitor industry on the Neighbor Islands. Development of the WBR will be a major step towards achievement of this major public policy goal.

An analysis of State tourism indicates a strong demand for additional visitor facilities. As the market expands, the need for specifically accommodating each differentiated market segment increases. The Neighbor Islands are taking on new strength in the State tourism picture as return visitors and the affluent, more and more, state their preferences for the amenities of high-quality, master-planned and environmentally-controlled destination resorts. Resort development at Waikoloa not only could accommodate market demands effectively, but such a development in the region would enhance the local economy and thereby strengthen the community fabric. Not only will new jobs be created during the initial construction phases, but also a wide range of skilled personnel will be required to operate the resort facilities.

It is anticipated that the largest number of new jobs associated with Step 1A of the WBR will be filled by local residents now living in North or South Kohala. Such employment will generally not require the

moving of households or the building of additional housing units, thus minimizing this source of potential social disruption within the community. These potential employees will be drawn principally from the ranks of the unemployed, from young people coming of age and entering the labor market and from wives and dependents not previously in the labor market.

Unlike many developers who have used the promise of improved recreational facilities as a "carrot" to attract desired land use changes and other necessary development permits, Boise has already undertaken and completed many improvements along 'Anaeho'omalu Bay which have enhanced it as a public recreational area. The first, and most obvious, of the changes that were made was the construction of a public beach access road and parking area. The completion of this facility transformed 'Anaeho'omalu from a private, virtually inaccessible preserve into a public resource open to all the people of the region. Similar things could be said of the archaeological resources that have been uncovered by Boise-supported research and the general clean-up that was undertaken on Kahapapa and Ku'uali'i ponds. Additional work on these resources that has been outlined in this report will further improve public access to and benefit from the many assets of the WBR site.

The cost benefit analysis described in Section IV-H-8, Economic Impact, of this report necessarily involved a number of assumptions as to the source of future residents and employees of the WBR and is, therefore, merely a "best guess" of the probable impact that the proposed development will have on public finances. It suggests, however, that the WBR will produce significantly more additional income in the form of taxes than expenditures for all levels of government. This additional income could be used to either reduce the tax burden on other taxpayers or to expand government-provided public services.

Finally, it is important to note that the WBR is located in an environment that is relatively insensitive to changes associated with the types of activities that are proposed. There is no complex terrestrial system to be disrupted; there is very low soil-erosion potential; there is very little rainfall and, therefore, very little suface runoff; adequate supplies of fresh water are available; and the transportation network designed to accommodate all of the growth which might occur is in place.

X. Summary of Unresolved Issues

The question of what is and what is not resolved is a difficult one to answer unless one also specifies the person or group that must be satisfied before a problem may be considered "resolved". There is always a question, for example, of what constitutes "adequate" data upon which to base judgments. This is particularly significant in the field of environmental management where there is often very little information available on the nature of the existing natural systems. Thus, it could be argued that only long-term scientific study of the site would provide the type of data necessary for rational decision-making.

While recognizing that this position contains a germ of truth, it is clearly an untenable position from the point of view of any one who must work within the constraints of limited time and resources. In light of this, only those topics where there seems to be a reasonable opportunity of obtaining additional information that might be of some use to public agencies responsible for reviewing the proposed development plans have been included within this section.

This EIS covers only the concept of the small boat harbor, not the details. It is realized that a number of special governmental approvals will be required for this portion of the project and that further investigation will be necessary.

Development of Increment Three requires additional governmental approvals. It must first receive State Urban Land Use Designation and then County Zoning. It may contain a second 18-hole golf course at the resort, to be built when demand and economics warrant.

This document includes an honest attempt to project the social and economic impacts on Hawai'i County and the State that will be produced by the proposed development. The projections are, of course, speculative and are based on public policy and values <u>as they are expressed today</u>.

Appendix

APPENDICIES

BIBLIOGRAPHY

SELECTED INTERVIEWS

APPENDICES

1. Background data on Princess Hotels International and Schematic Drawings of the Waikoloa Princess Hotel, William B. Tabler, Architect.
2. Distribution of 27 more common species and species groups of Aquatic Plants and Animals among closed ponds of the 'Anaeho'omalu area.
3. Results of fish census, Waiulua Bay.
4. Species of coral in Waiulua Bay.
5. Recommendations extracted from Bishop Museum Reconnaissance Study
6. Access Road Noise Levels

Description of Proposed Waikoloa Princess Hotel

The 350-room hotel will be situated at 'Anaeho'omalu Bay in South Kohala, Island of Hawai'i, Hawai'i. The building, five stories high, is a "Y," some five feet up from the entrance road, thus allowing for a split-level entry into the building. The building is perpendicular to the ocean frontage, with rooms at the upper three levels of the open end of the "Y" facing out only, and rooms on both sides of the stem of the "Y," allowing all guestrooms an ocean view.

Directly off the main entry is the Ballroom access. The Ballroom and the two Private Dining/Meeting Rooms, which can be incorporated into one space, will seat 800 people and have their own Prefunction Assembly as well as toilets and checkrooms. The entrace lobby continues past the Registration Facilities, with a view toward the ocean front to an open landscaped interior courtyard. The bulk of the guestrooms - one floor down and three floors up - surround the open courtyard and have ocean views. A Lobby Bar seating 50, connected to a Discotheque for 175 persons, is four feet above the lobby. The floor below the entrance lobby, at elevation 12.0 feet (and thus above storm water levels), contains bedrooms with direct access to the exterior landscaped site and pool deck, a coffee shop for 175 persons, a main dining facility for 200 and a speciality restaurant for 175. Another snack bar serves as a pre-dining facility for the latter two restaurants. The coffee shop opens into an exterior terrace overlooking the swimming pool and the ocean beyond.

Service areas on the lower floor contain the main kitchen, with direct serving capability to the 3 restaurants and the ballroom, and are supplied by way of the service entry at the other side of the open part of the "Y." Service areas on the third floor contain employee, housekeeping, and mechanical facilities, allowing for high ceiling areas in restaurants and the ballroom.

All guestrooms have full balconies, a large walk-in closet and separate dressing room facilities with lavatory counter adjacent to a bath/toilet room, which contains a 5'-6" bathtub. The guestroom floors are offset as the building rises, and corridors along the open interior courtyard provide a spacious and also stepped back approach. The passenger elevators which serve these guestrooms are located within this open interior courtyard and, by the use of a "scenic" glass car, allow for a view of the landscaped interior while rising along the five floors.

From the first entry point into the building, a series of landscaped areas, skylighted roofs, and view of the exterior, provide an integrated inside-outside feeling harmonious with the highly landscaped site leading toward the ocean front, the beach along 'Anaeho'omalu Bay and the recreational facilities of pool, tennis, etc. The swimming pool will have its own snack bar facility and terrace space for luau festivities. Parking is provided between the entrance road and the building, allowing all that portion of the site outside and in front

of the guestrooms to be available for scenic and recreational facilites.

Provisions for a future sixth floor, for guestroom expansion, are incorporated, but even with this extension, the overall height of the building, fifty-four feet, is low in profile and does not project above sitelines from the higher portions of sites inland across the access road.

An eighteen hole golf course designed by Robert Trent Jones and to be constructed by Boise will be situated immediately adjacent to the hotel.

DISTRIBUTION OF 27 MORE COMMON SPECIES AND SPECIES GROUPS OF AQUATIC PLANTS AND ANIMALS AMONG THE CLOSED PONDS OF THE 'ANAEHO'OMALU AREA, HAWAI'I ISLAND. Explanatory notes: organisms listed occurred in at least 3 per cent (10 or more) of the ponds; "x" preceding name refers to exotic species, all other being native; *Schizothrix* is the predominant alga in mineralized (white-to-orange) crusts; similarly *Rhizoclonium* is the dominant alga in dark-green, non-mineralized benthic crusts and mats; unidentified organisms are listed by major taxons only; for pond locations and physical data refer "Pond No." to Figure Y.

Pond No.	Flora				Worms	Mollusks		Crustaceans									Insects, etc.					Fishes			
	Schizothrix sp.	*Rhizoclonium* sp.	*Ruppia maritima*	Oligochaeta, 1 sp.?	Polychaeta, 1 sp.?	*Assiminea* sp.	*Melania* sp.	*Theodoxus cariosa*	Isopoda *Ligia* sp.	Amphipoda, 1 reddish sp.	Amphipoda, other sp., 1	*Metabetaeus lohena*	*Halocaridina rubra*	*Palaemon debilis*	*Macrobrachium grandimanus*	x-*Macrobrachium lar*	*Metopograpsus thukuhar*	Collembola, 1 sp.?	x-Hemiptera/Veliidae, 1 sp.?	x-*Trichocorixa reticulata*	x-Odonata, 1 sp.	Acarina, 1 sp.	*Mugil cephalus*	*Kuhlia sandvicensis*	*Eleotris sandwicensis*	x-*Tilapia mossambica*	x-Poecillidae, 1 sp.
1																											
2		+																									
3				+																							
4					+																						
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Source: Maciolek and Brock, 1974.

Appendix 2

RESULTS OF FISH CENSUS, WAIULUA BAY[1]

SPECIES	TRANSECT NUMBER[2]							TOTAL
	1	2	3	4	5	6	7	
Scarus sp.[3]		8	91	48	31	90	4	272
Acanthurus sandvicensis	9	47	29	51	6	1	3	146
Thalassoma duperreyi	5	1	28	25	15	16	23	113
Abudefduf abdominalis		19	17	55	1			92
Stethojulis axillaris				35	4	1	3	43
Pomacentrus jenkinsi			3	23	5	2	4	37
Ctenochaetus strigosus							33	33
Acanthurus nigrofuscus					1	3	22	26
Acanthurus achilles							26	26
Naso lituratus					2		18	20
Belonidae	19							19
Mulloidichthyes samoensis		15				1	2	18
Taalossoma umbrostigma	1	2	5	5				13
Parapeneus multifasciatus		1		2	2	6	2	13
Gomphosus varius				1	3	1	6	11
Acanthurus dussumieri			5	4	1	1		11
Rhinecanthus rectangulus					2	2	6	10
Scarus perspicillatus	2			2		1	1	6
Abudefduf sordidus		2	2	2				6
Chaetodon miliaris			3				3	6
Paracirrhites cinctus						1	3	4

SPECIES	TRANSECT NUMBER							TOTAL
	1	2	3	4	5	6	7	
Paracirrhites arcatus						1	3	4
Abudefduf imparipennis					2		2	4
Naso unicornis					1	3		4
Thalassoma ballieui			1				2	3
Chaetodon unimaculatus					2		1	3
Fistularia petimba				2		1		3
Unknown wrass					1		2	3
Rhinecanthus aculeatus							2	2
Canthigaster jactator					1	1		2
Caranx sp.					1	1		2
Apogon snyderi		1						1
Chaetodon lunula			1					1
Chaetodon quadrimaculatus							1	1
Parapeneus porphyreus			1					1
Ostracion lentiginosus				1				1
Aulostomus chinensis				1				1
Runula goslinei				1				1
Pervagor spilosoma							1	1
Amanses carolae							1	1
Chaetodon trifasciatus							1	1
Snyodus variegatus							1	1
Total number of fish	36	96	186	258	82	133	177	968
Total number of species	5	9	12	16	19	18	28	44

[1]Identifications and scientific names follow Gosline and Brock (1960).
[2]See Figure AM.
[3]Includes juveniles of Scarus dubius, S. sordidus and perhaps S. perspicillatus.
Source: Brock and Brock, 1974

SPECIES OF CORALS IN WAIULUA BAY

1. *Pocillopora meandrina* var. *nobilis* Dana
2. *P.* sp. cf. *ligulata* Dana
3. *Porites lobata* Dana
4. *P. brighami* Vaughan
5. *P.* sp. cf. *duerdini* Vaughan
6. *Montipora verrucosa* (Lamarck)
7. *M. patula* Verrill
8. *Pavona varians* Verrill
9. *P. explanulata* Lamarck
10. *Cyphastrea ocellina* (Dana)
11. *Leptastrea purpurea* Dana
12. *Psammocora verrilli* Vaughan
13. *Psammocora* sp.

Source: Key, Guinther and Miller, Ms., 1971.

RECOMMENDATIONS*

Only those sites which the Museum feels warrant further attention are treated here. Those which we feel are not important enough to be dealt with further will not be mentioned. Recommendations for excavating (or testing) and/or stabilizing and interpreting are only statements of the fact that these sites are suitable for such treatment, and are not intended as specific requests for such action. We are only making such requests in the case of those features that will be endangered by resort development. These specific recommendations follow the charts.

Groups A, B and C: --We feel that this is an important area, and that it deserves to be investigated more fully, especially in light of the proposed location of the roads and golf course in the area. The Museum recommends that a plane-table map of the entire area be made and that excavating and testpitting be conducted at certain selected sites. A number of sites in this area are suitable for presentation to the public in a museum atmosphere.

Group D: --The proposed location of a hotel in this area makes it imperative that a valuable burial cave and habitation caves in this group be salvaged. Especially important about this group of sites is the fact that testpits made by the Museum revealed midden deposits to a depth of one-half meter, indicating the possibility that this area was inhabited over a fairly long period of time.

Group E: --This group of features, lying in or quite near to the proposed 18th fairway, ought to be salvaged. Full-scale excavations are not required in all of these sites; limited test pitting will suffice for a good many of them.

Group F: -- This group appears to be well out of the way of any proposed construction activity, and salvage would not appear to be required at the present time.

Group G: -- While this group lies within an area proposed to be protected, and in which large-scale development is not contemplated, salvage is recommended for selected sites. The construction of a beach pavilion and the presence of people utilizing the beach facilities represent a distinct threat to these sites. Stabilization and interpretation is recommended for sites 126 and 127, which appear to have had special significance to the people living in the area. It would be too soon to designate these sites as a heiau complex, but the unusual nature of these structures and the presence of a large amount of coral leads one to suspect this. This matter will be cleared up after the more intensive investigations during Phase II are completed.

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*Extracted from Bishop Museum Phase I Reconnaisance Survey.

Group H: -- This area also lies within a protected zone, but salvage is recommended for a burial cave, a shelter cave with a deep midden deposit, which has already suffered at the hands of vandals, and another shelter cave which lies near to the proposed right-of-way for the access road to the hotel area. These sites should be salvaged to avoid possible destruction by construction activity on that road.

Group I: -- Action is recommended on only two sites in this group. A shelter cave ought to be tested, as it lies in the right-of-way of the proposed 15th fairway. A foot trail, which passes through the area and the petroglyphs found along it, might well be saved from destruction and left for view by the public.

Group J: -- It is recommended that one site in this group be salvaged, as it lies behind the large fishpond near the beach area and stands a good chance of being vandalized.

Non-grouped sites: -- Two sites in this group should be salvaged as they lie near those sites of Group G, which will be endangered by the beach pavilion and associated activities in that area. One site (128) lies quite near the boundary of the proposed "safe area" on the north end of the fishponds. If it is determined that it is outside this area, we would recommend a slight adjustment of the boundary to include this site within the "safe area." Otherwise, salvage of the site is recommended. Those foot paths and trails which are included in this group are of no great importance, but the Museum suggests that those which do not have to be destroyed be preserved for the public. The extensive burial cave with catacombs is of such importance and of such a nature that a walk-in museum accessible to the public is recommended for this feature. This is especially important in light of the publicity which this site has received.

It is strongly urged that the historic Kiholo-Puako Trail, which forms the mauka boundary of the resort area, be retained in its present condition, along with those petroglyphs that are associated with it. We suggest that the example of the National Park Service be followed and that the trail be incorporated into any roadway which is built across it, thus preserving the continuity of this significant historical landmark.

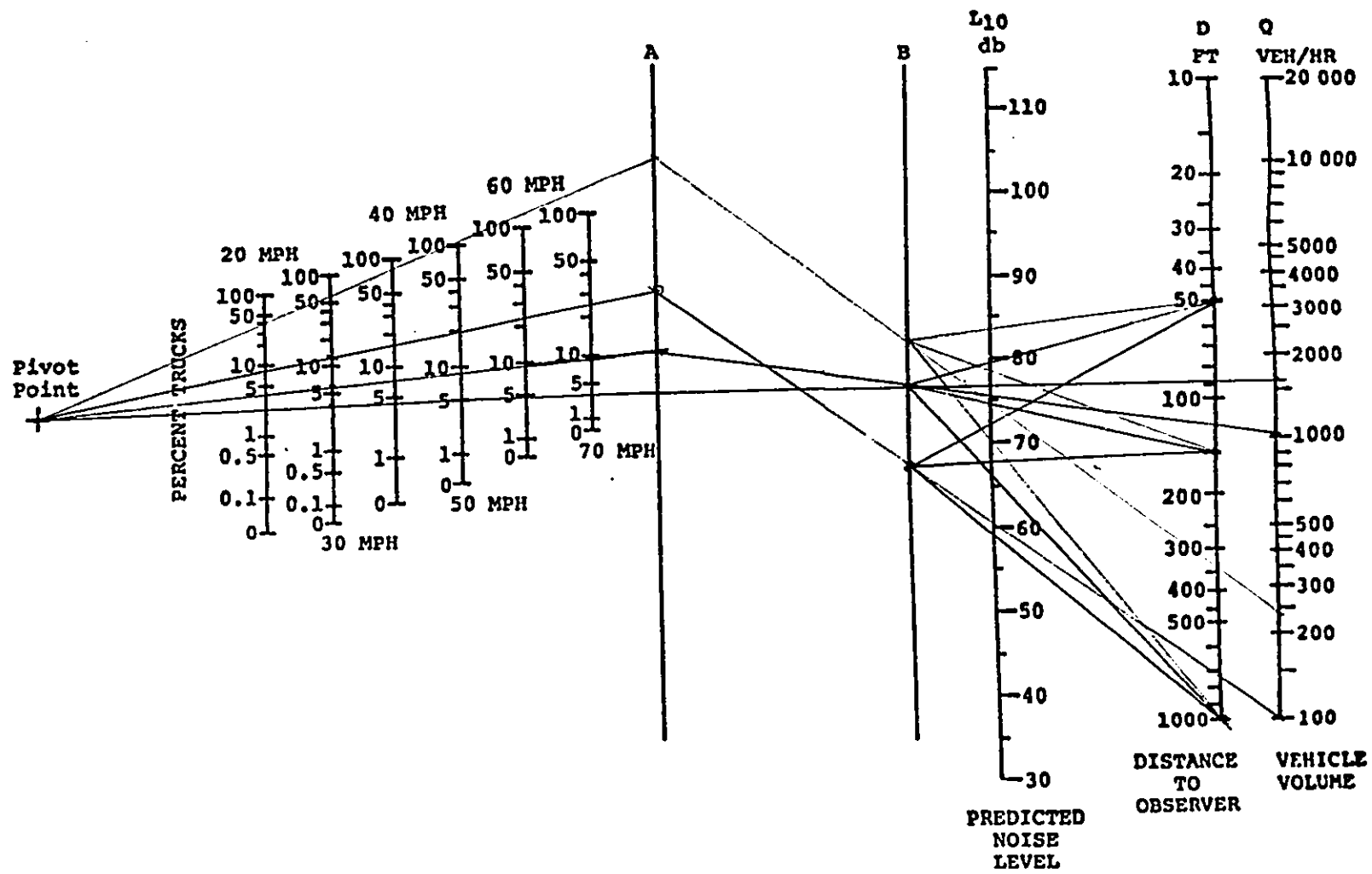
It should be noted that two burial caves on land adjacent to Boise-Cascade's property on the south were brought to the attention of the Bishop Museum party. We feel that salvage of these caves is essential to protect them from vandalism by people using the facilities which will be constructed at the beach. In the event that funds cannot be aquired to complete this work, we would request that some sort of protective enclosure be constructed across the entrances to these caves to ensure their safekeeping. A simple chain-link type of fence secured across the opening would probably be sufficient for this purpose.

Recommendations for Specific Sites

	Site Number	Excavate or Test-Pit	Stabilize and/or Interpret	Other
GROUP A	255, 257, 265, 275, 277	X	X	
	256, 258, 270, 271, 282	X		
	281		X	
GROUP B	225, 226, 228-230, 246, 247, 252	X	X	
	227, 249, 253	X		
	259, 292		X	
GROUP C	285, 291	X	X	
	155, 159, 160, 166 - 170 222 - 224, 234, 289	X		
	26, 98		X	
GROUP D	24, 27 - 30, 130, 131	X		
	133	X	X	
GROUP E	21, 67 - 70, 72, 75, 117, 137, 138	X		
GROUP F	60	X	X	
	54	X	X	Record petroglyphs
	56, 59	X		
GROUP G	126, 127	X	X	
	141			Record petroglyphs
	142 - 144, 193	X		
GROUP H	2	X	X	
	33, 85 - 91, 97, 103, 104, 106, 107, 150, 151	X		
GROUP I	44	X		
	238		X	
GROUP J	115, 148	X		
NON-GROUPED SITES	51, 128, 196, 197	X		
	101, 218, 221, 235, 237, 239		X	
	241		X	Record petroglyphs
	100	X	X	Walk-in museum

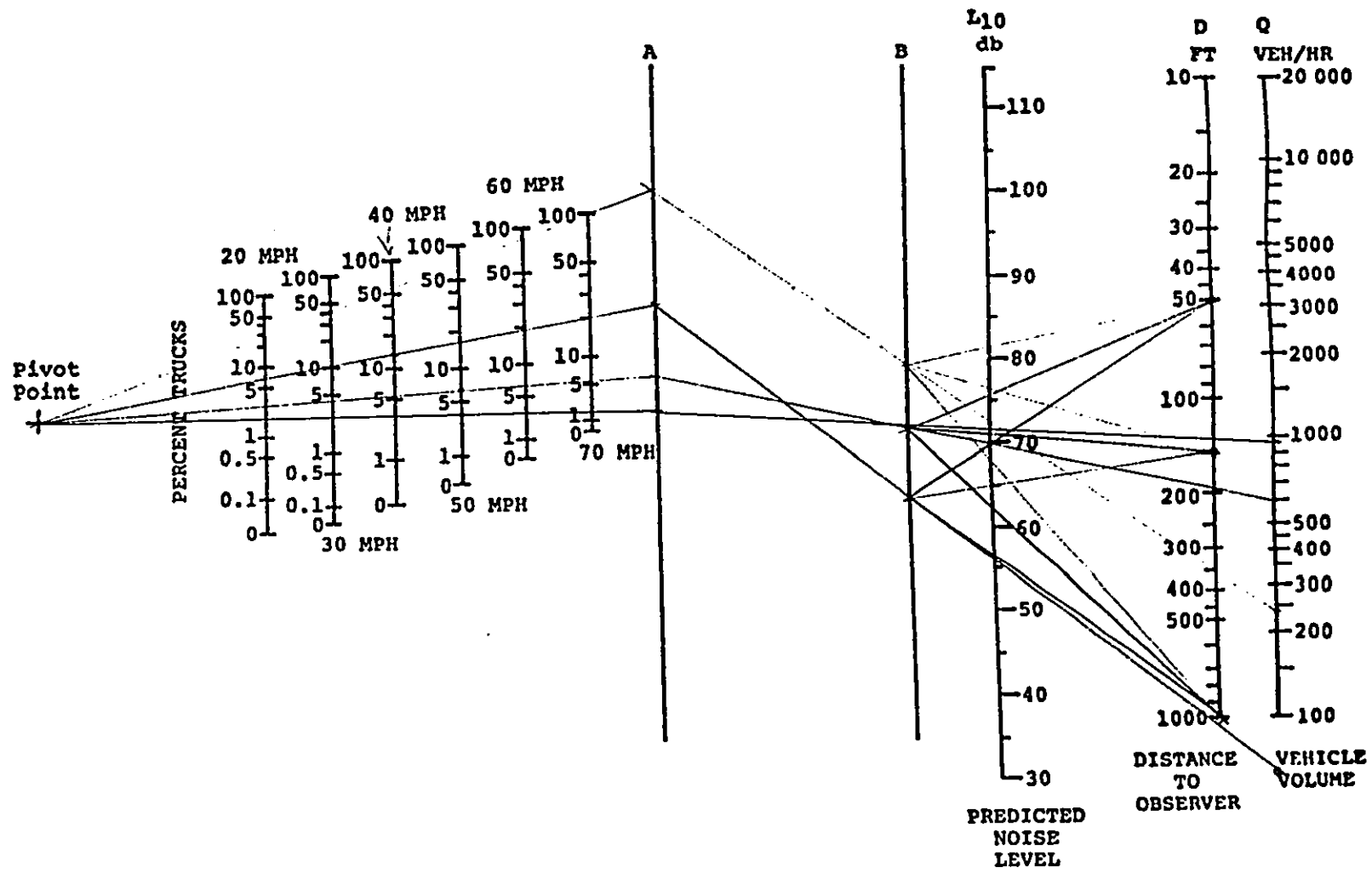
APPENDIX 6 Access Road

Assumptions	Vehicle Flow (Veh/Hr) (Peak-Hour)	Average Operating Speed (MPH)	% of Trucks & Buses	Noise Level at Observer Distances (dBa, L10) 50'	150'	1000'
Initial Construction Phase	233	20	40	83	78	70
Step Ia Operation	96	30	12	72	68	59
Increment I Construction						
Increment I Operation	1,016	30	6	80	75	66
Increment II Construction						
Increments I & II Operation	1,615	30	4	80	75	66



APPENDIX 6 Queen Kaahumanu Highway North to Waikoloa Road

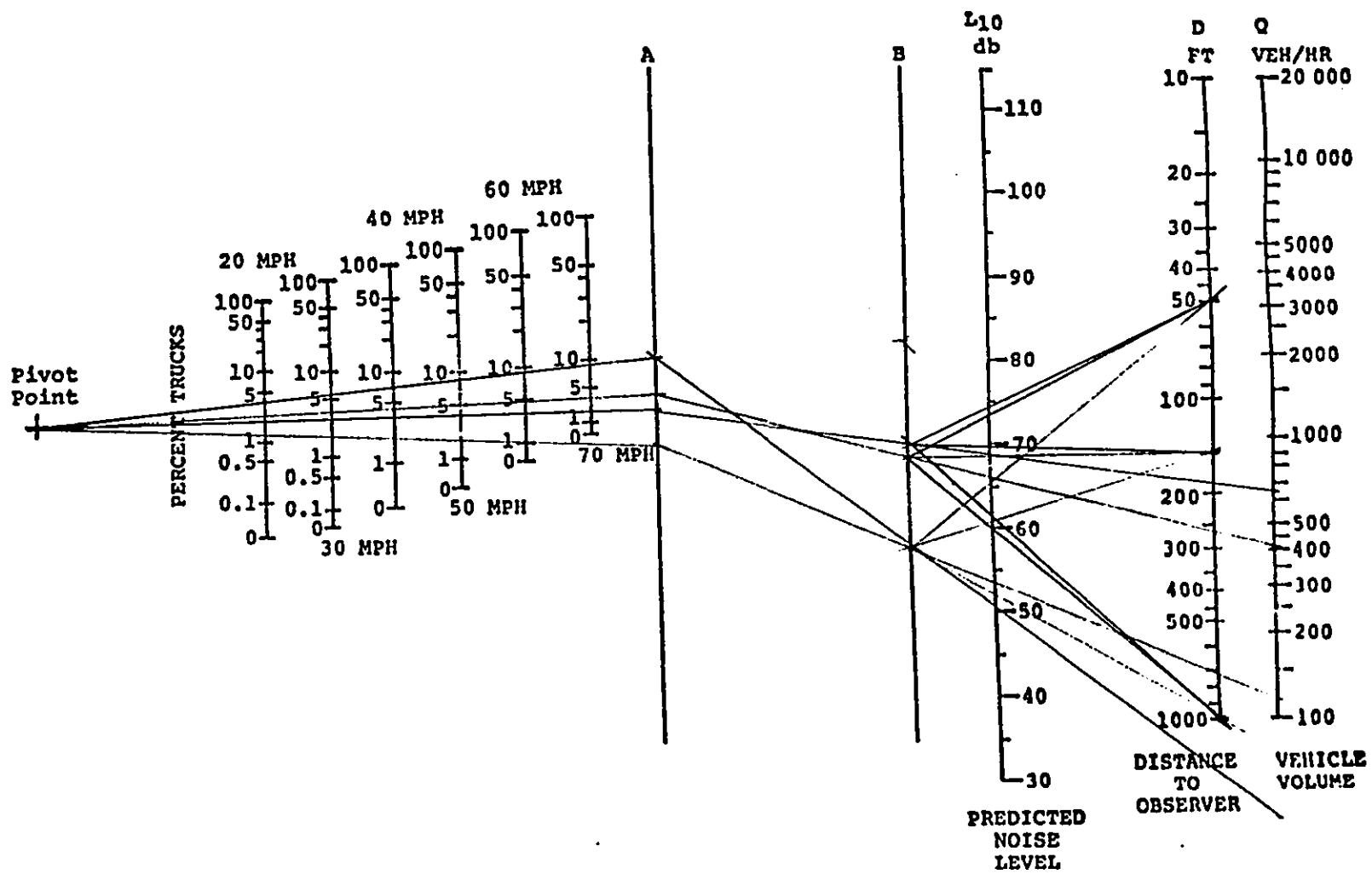
Assumptions	Vehicle Flow (Veh/Hr) (Peak-Hour)	Average Operating Speed (MPH)	% of Trucks & Buses	Noise Level at Observer Distances (dBa, L10) 50'	150'	1000'
Initial Construction Phase	233	30	40	81	76	68
Step IA operation	57	40	12	70	65	56
Increment I Construction Increment I Operation	609	50	6	76	71	62
Increment II Construction Increments I & II Operation	969	50	4	76	71	62



APPENDIX 6 Queen Kaahumanu Highway North of Waikoloa Road and South to Kona

Assumptions	Vehicle Flow (Veh/Hr) (Peak-Hour)	Average Operating Speed (MPH)	% of Trucks & Buses	Noise Level at Observer Distances (dBa, L10) 50'	150'	1000'
Initial Construction Phase*	116	50	2	65*	61*	51*
Step Ia Operation	38	50	9	65	61	51
Increment I Construction Increment I Operation	406	50	5	74	69	60
Increment II Construction Increments I & II Operation	646	50	4	75	70	61

* There will be no initial construction phase traffic south to Kona so these values will be 0.

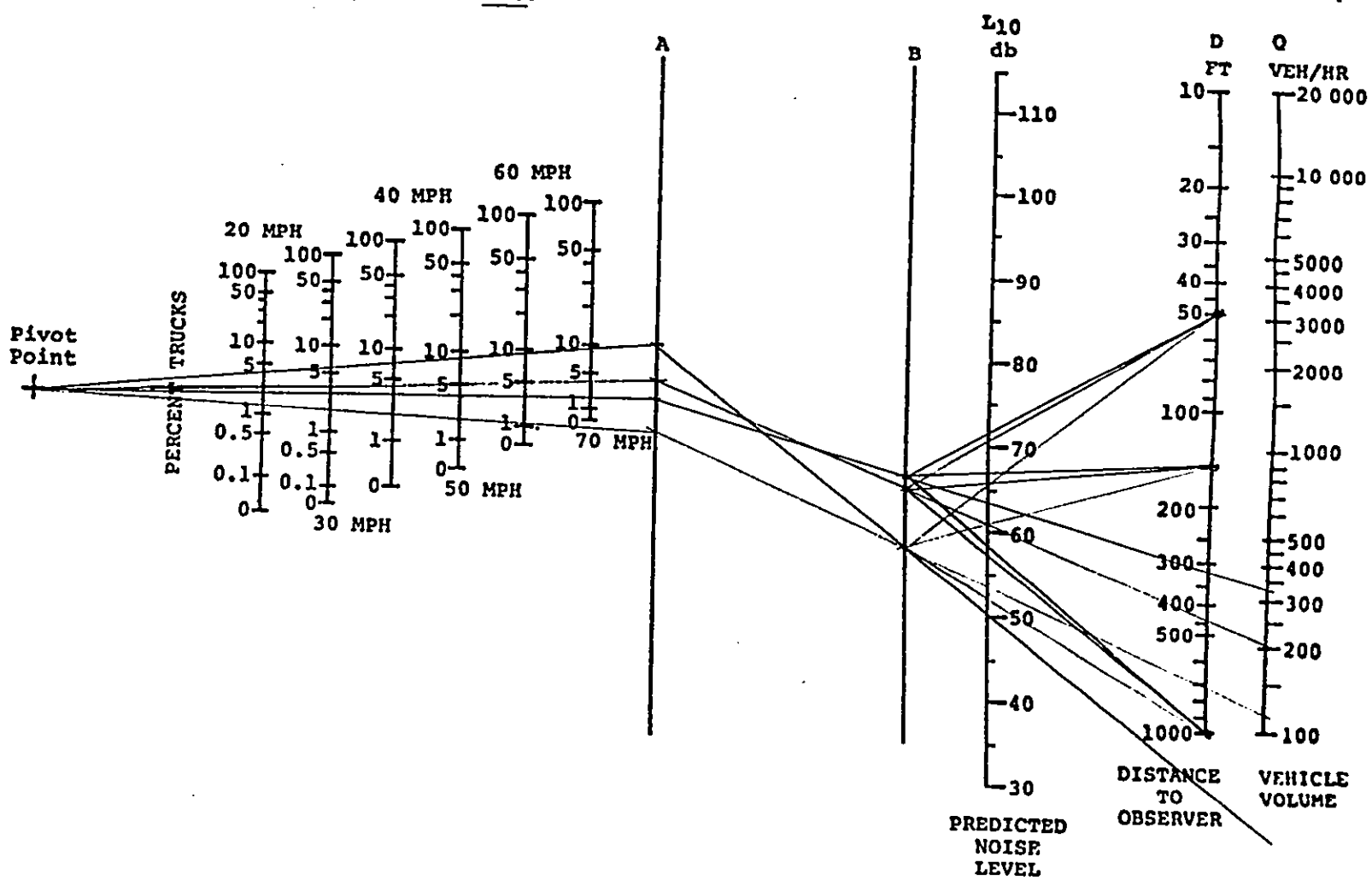


APPENDIX 6 Waikoloa Road, Mahukona Road, Kawaihae-Waimea Road

Assumptions

	Vehicle Flow (Veh/Hr) (Peak-Hour)	Average Operating Speed (MPH)	% of Trucks & Buses	Noise Level at Observer Distances (dBa, L10) 50'	150'	1000'
Initial Construction Phase*	116	50	2	65	61	52
Step IA Operation	19	50	9	65	61	52
Increment I Construction						
Increment I Operation	203	50	5	70	66	57
Increment II Construction						
Increments I & II Operation	323	50	4	71	67	58

*The road loads are the same after the construction period but during the initial construction phase Waikoloa Road will have the largest load 116.



Bibliography

What it takes to manage and market successful hotels in today's economy

Walter Sommer, President
Princess Hotels International

What it takes to manage and market successful hotels in today's economy

By Walter Sommer

Almost twenty years ago, when I was one of the few German students at the École Hôtelière de Lausanne in Switzerland, we were taught all we needed to know about hotels to enter the business as a fully trained professional. Our training was oriented totally toward providing the highest quality service to hotel guests, and providing the service in a professional and profitable manner. Since then, the hotel industry—and the travel industry in general—have grown tremendously. By this year international tourist arrivals increased more than eight fold, more than 209,000,000 persons. Today we must be familiar with computerized reservations systems, GIT's, ITX's, OTC's, corporate finance, depreciation rates, union negotiations, sophisticated and expensive marketing techniques, political diplomacy, and enlightened personnel management in multinational operations.

That is why, more than ever before, hotel corporations must demand top professional managerial and marketing disciplines to insure profitable results. The professionalism learned at Lausanne twenty years ago and being taught there today (as well as at Cornell and other fine hotel schools) is still the basis on which a successful hotel corporation must be built.

Let me outline for you what it takes to manage and market successful hotels in today's economy.

An Experienced Operating Group

By way of background, Princess Hotels International's first hotel was the original Princess in Bermuda; built in 1885. PHI bought the hotel in 1963 at the request of the Bermuda Government, and spent nine million dollars renovating it. Today, it is one of the hotel industry's great success stories. The company then expanded by building what has been called the most spectacular hotel in the world, the Acapulco Princess, followed by the Bahamas Princess (formerly the Kings Inn) and the Southampton Princess hotels. Additional hotels, such as the Xanadu in Freeport, Bahamas, and the Pierre Marques in Acapulco, Mexico, were purchased from previous owners, renovated and re-introduced as successful Princess Hotels. Other hotels are being handled on a management contract for such clients as Antenor Patino, Howard Hughes and Prince Ranier.

Our hotels are located in Europe, the United States, Mexico, Bermuda and the Bahamas. In each of the resort areas in which we operate we have the largest and most successful properties.

Each area is supervised by a Regional Vice President for Operations, with General Managers of each property reporting to the Regional Vice President. A majority of our top level hotel management at each hotel is European trained, and the hotels are managed according to European standards of quality. We also have extensive training programs for the approximately six thousand people who work for us, many of whom at the staff level are native to the country in which the hotel is located. All hotels under the Princess banner have the finest gourmet restaurants, the best night life, the best sports amenities of any of the competing hotels in those destinations.

Princess has won many awards for excellence of service, including the Gold Medal at the Société Culinaire Philanthropique show and the 106th Annual Salon de Culinary Art.

Marketing Is More Complex Than Ever

PHI's marketing organization is one of the most comprehensive in the industry.

The Sales Department is comprised of three divisions, each accountable for measurable results against budgeted targets: Convention Sales; Tour and Agency Sales; Incentive Travel and Agency Group Sales.

The Convention Sales division consists of sixteen sales professionals and administrative specialists. Offices are in New York, Miami, Chicago, San Francisco, Dallas, Toronto, Frankfurt, Mexico City, plus on-site offices at each of our hotels. This department maintains files on approximately five thousand key corporate meeting planners, insurance executives, and association managers. In 1975-76 they will attend every major industry meeting, soliciting business for our hotels.

Our Travel Agency sales division consists of fifteen specialists who conduct a series of audio-visual seminars for travel agents twice annually in every major United States market, and personally contact over five thousand high volume travel agents per year. In addition, we sponsor familiarization tours to the properties for proven producers. This department also works closely with major wholesalers and the airlines in the creation of attractive packaged vacations to our hotels. This department exhibits at approximately forty major trade shows a year.

Our Agency Group and Incentive Sales division processed over forty-three thousand agent calls in the past year. They sold our hotels at approximately twenty major national group and incentive travel trade shows during the year, conducted monthly mailings to major agents, and conduct periodic telephone sales blitzes for properties during soft occupancy periods.

Our European division, with offices in London and Frankfurt, handles group, tour and agency sales throughout the U.K. and Europe. The Canadian division, in Toronto, and the Latin American division, in Mexico City, similarly cover all travel trade contacts.

PHI's Advertising Department supervises a multi-million dollar annual advertising budget, based on sound marketing objectives and strategies, and works with our advertising agencies in the United States, Mexico, Bermuda and Europe. This department also has the responsibility for market research and the preparation of all printed material and sales promotional material including brochures, rate sheets, package folders and all direct mailings.

The Public Relations Department is responsible for developing a public relations plan for each property in support of the marketing and advertising strategies. Every major publication in the United States, Canada, Mexico, U.K. and Europe has carried publicity for PHI properties.

Reservations Have Gone Worldwide

We can safely say this year that no other resort hotel company has a computerized reservations system superior to Princess Reservations Services. We consolidated our Central Reservations Office in January of 1973 with the objective of using one toll-free 800 number for reservations at all Princess Hotels. Our Director of Reservations Services is one of the most experienced in the industry, and trained our sixteen reservations agents who handle almost 300,000 telephone calls per year, with an average waiting time of no longer than five to eleven seconds.

Our system is called "CROWN" which stands for Computerized Reservations On-line Worldwide Network. The CROWN system is a shared on-line system designed by hotel experts for hotel personnel by Compass Computer Services, Incorporated in Dallas. The system utilizes highly sophisticated computer equipment including an IBM 370 and CDC 1700. PRS agents handle all transactions including information, reservations, cancellations, revisions, messages, deposits, and more on a CRT visual display terminal. One of the many unique features of our reservations system is the computerized processing of deposits and deposit information, directly on the reservations form. The system is able to hold as many as 126 different rate combinations for a particular hotel property, and offers the ability to continually close out lower rates and sell higher rated rooms during peak demand periods. Weekly and monthly management reports are produced by the computer which will run a comprehensive analysis of all reservations information and activity, including market research data which is the basis upon which our marketing department devises its advertising and media strategies.

Princess Corporate Commitment

We at Princess Hotels International are still committed to the objective of providing top quality service for our guests, professional handling of their reservations, and extremely professional marketing techniques to reach those individuals. We believe that the profitability of our operations is a direct result of the fact that we are staffed in every department with some of the industry's top people, and that the name "Princess" in the hotel industry has become synonymous with excellence.

Excerpts from a recent speech by Mr. Sommer to an investment banking group.

PRINCESS HOTELS INTERNATIONAL

U.S.A.

SIR FRANCIS DRAKE
San Francisco, Calif.

OLYMPIA PRINCESS
Oconomowoc, Wisc.

Mexico

ACAPULCO PRINCESS
Hotel & Club de Golf
Acapulco, Mexico

PIERRE MARQUES
Hotel & Club De Golf
Acapulco, Mexico

LAS HADAS
Manzanillo, Mexico

Bahamas

BAHAMAS PRINCESS
Hotel, Golf, Beach & Tennis Clubs
Freeport, Grand Bahama Island

BAHAMAS PRINCESS TOWER
Golf, Beach & Tennis Clubs
Freeport, Grand Bahama Island

XANADU PRINCESS
Yacht & Tennis Club
Freeport, Grand Bahama Island

Bermuda

SOUTHAMPTON PRINCESS
Hotel, Golf, Beach & Tennis Club
Southampton, Bermuda

THE PRINCESS
Hotel, Golf & Beach Club
Hamilton, Bermuda

Europe

HOTEL DE PARIS
Monte-Carlo, Principality of Monaco

HOTEL HERMITAGE
Monte-Carlo, Principality of Monaco

Walter Sommer, President
Arnold Chubb, Vice President & Treasurer
Michael Kiesser, Assistant to the President

William Q. Dowling, Vice President—Marketing
Marty Williams, Vice President—Sales (Convention)
Andrew Buys, Vice President—Sales (Tour and Agency)
Christine Chusano, Director of Agency Group Sales
Anton Gotsche, Director of Systems & Administration
Michael Grossman, Director of Advertising

Cy Elkins, Regional Vice President—Bermuda
Nikolaus Klotz, Regional Vice President—Mexico
Kenneth Scholl, Regional Vice President—U.S. and Bahamas

U.S. MARKETING OFFICES
Michael Hussey, Director of Sales—New York Region
Jerry Magnifico, Director of Sales (Boston)
Jack Schaedler, Director of Sales—Midwest Region (Chicago)
Myra Wigutow, Director of Sales—Los Angeles Area
Margaret Deedy, Director of Sales—San Francisco Area
Mickey DeVito, Director of Sales—Western Region (Dallas)
Karen Kelly, Director of Sales—Southern Region (Miami)

INTERNATIONAL MARKETING OFFICES
Irene Kapeluch, Director of Sales—Canada (Toronto)
Graciela Portillo, Director of Sales—Mexico (Mexico City)
Rosemary Mazzini, Director of Sales—Acapulco/Manzanillo
Patrick O'Riordan, Director of Sales—Bermuda
Robert Hickey, Director of Sales—Bahamas
Hartmut Wegener, Director of Sales—Europe (Frankfurt/London)

CENTRAL RESERVATIONS OFFICE
Pat Callocchio, Director of Central Reservations (Miami)

Please address all correspondence to: Mr. Walter Sommer, President
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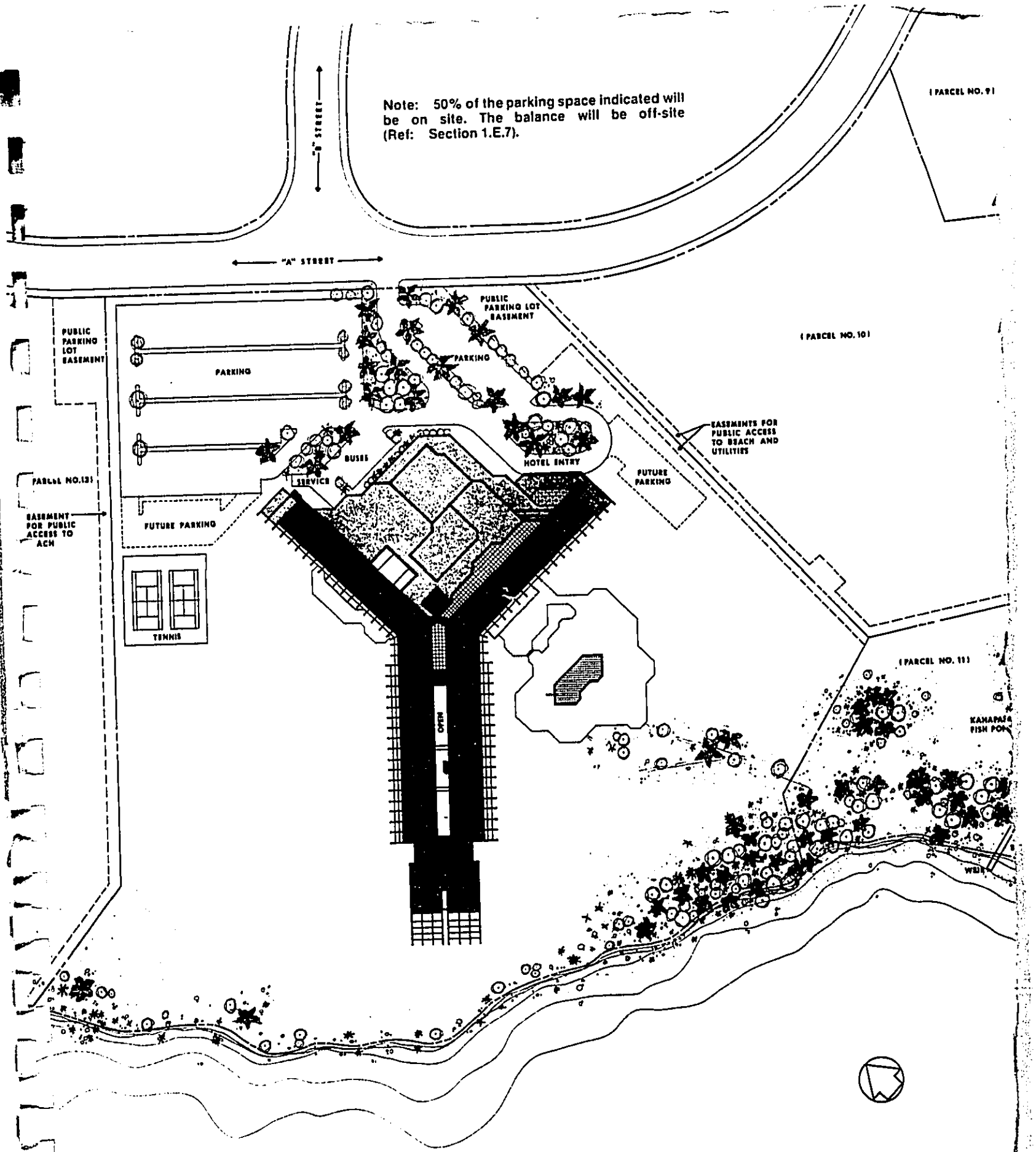
P. O. Box 1749
Hamilton 5, Bermuda



WAIKOLOA PRINCESS HOTEL

WAIKOLOA, HAWAII

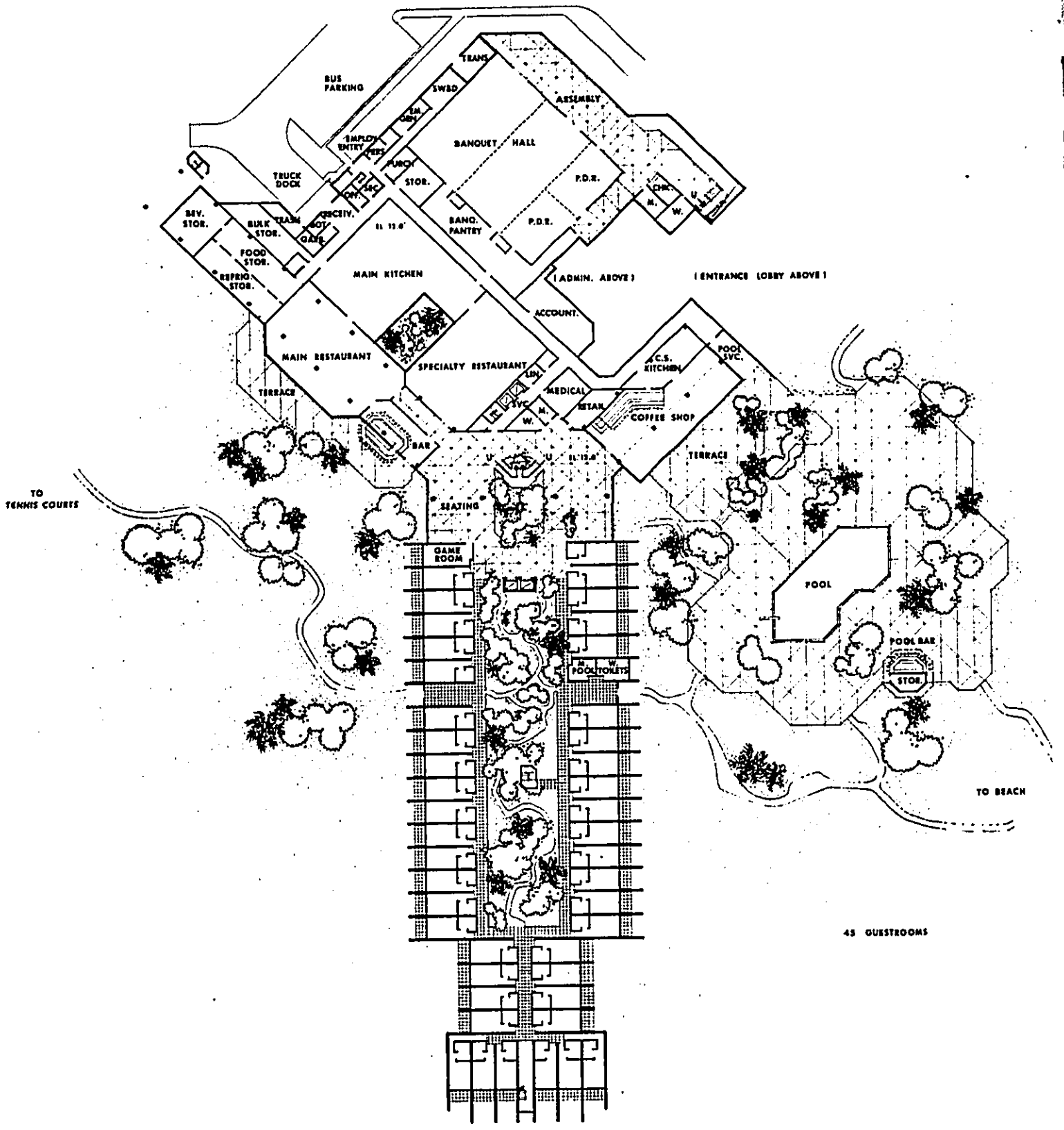
WILLIAM B. TABLER ARCHITECTS

SITE PLAN

0 20 40 60 80 100 120 140 160
scale feet

FEBRUARY 2, 1976

1



WAIKOLOA PRINCESS HOTEL

WAIKOLOA, HAWAII

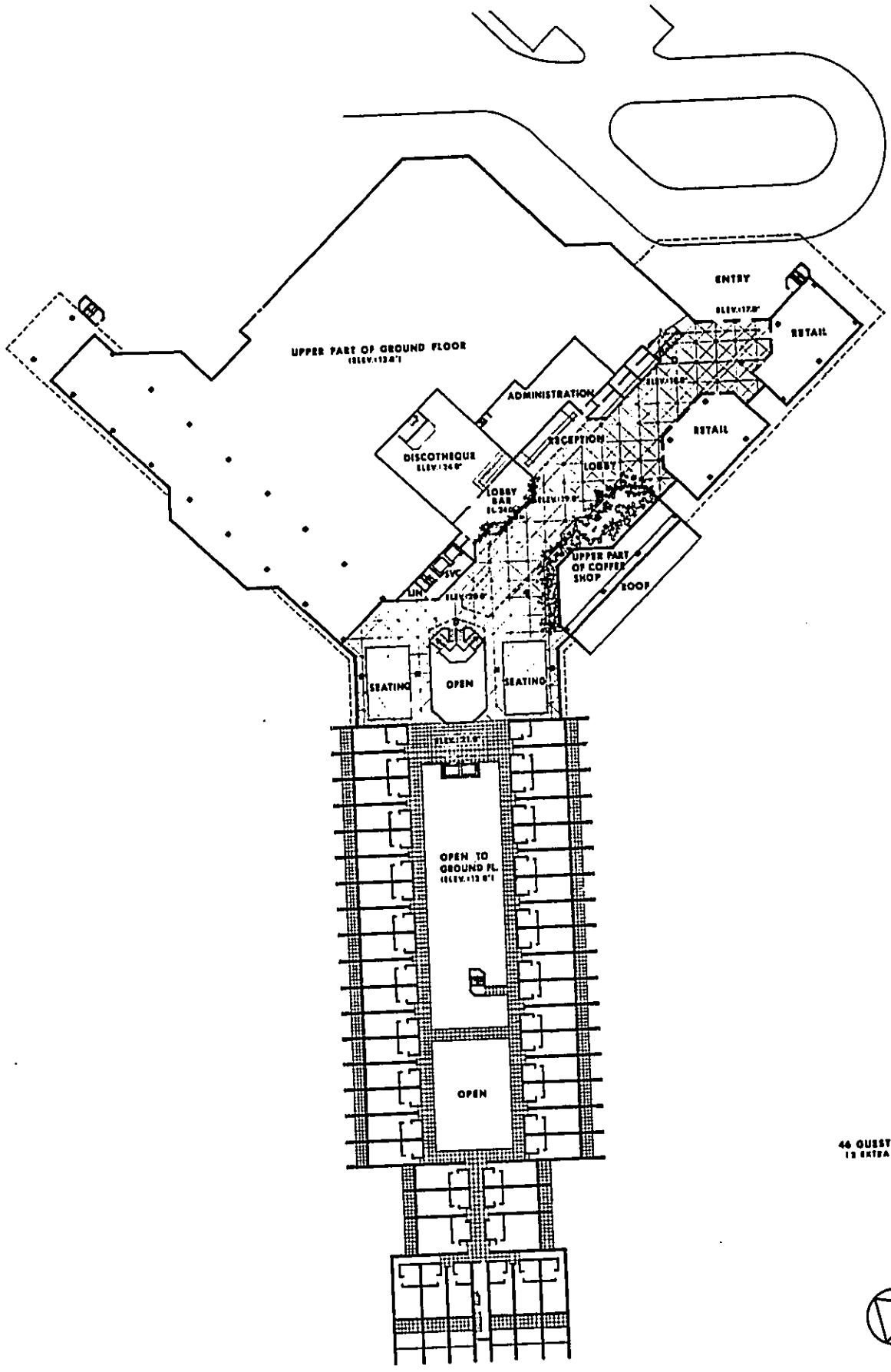
WILLIAM B. TABLER ARCHITECTS

GROUND FLOOR PLAN

5 0 5 10 20 30 40 50 60 70 80
scale feet

FEBRUARY 2, 1976

2



44 GUESTROOMS
(12 EXTRA LARGE)

WAIKOLOA PRINCESS HOTEL

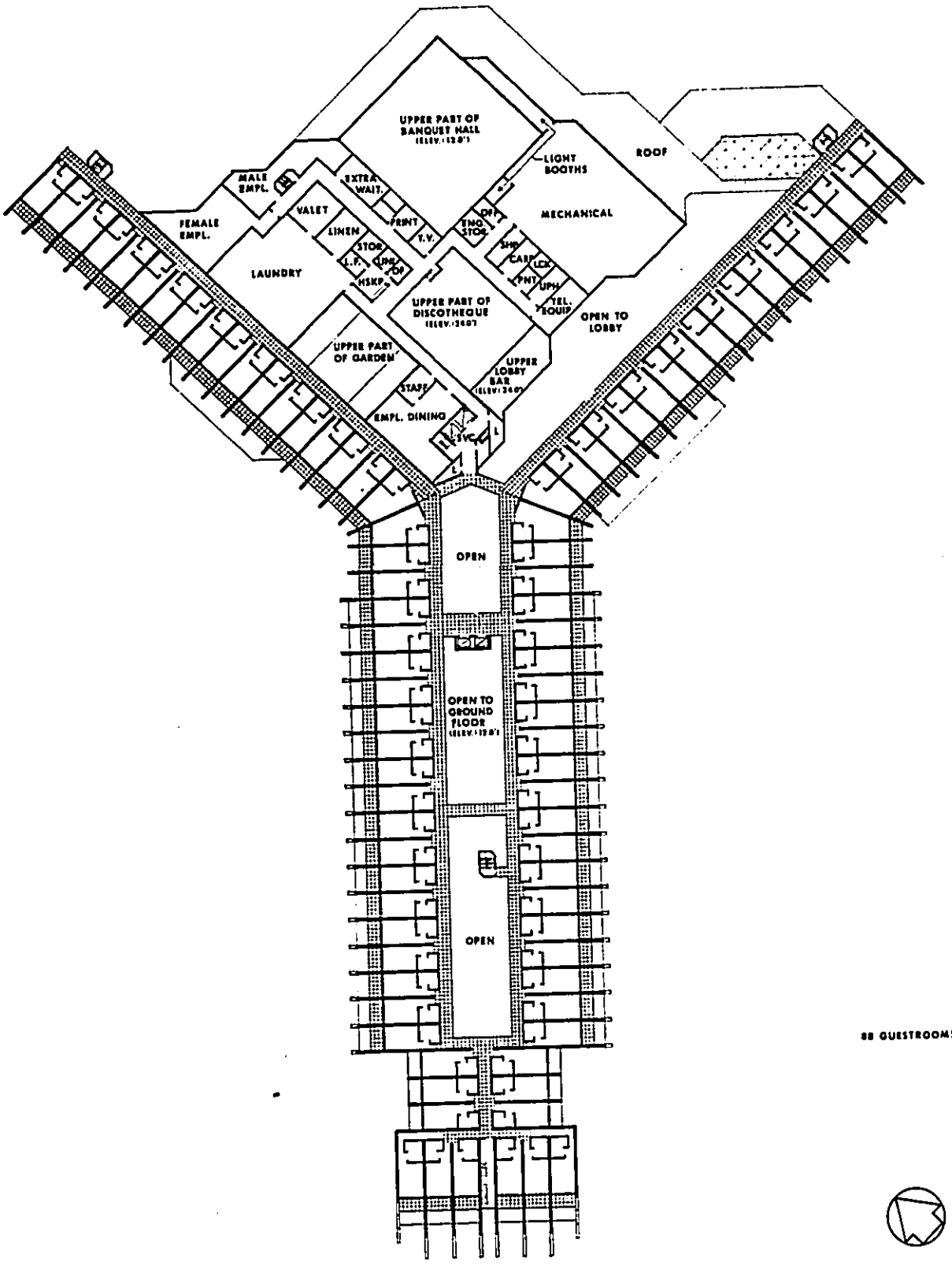
WAIKOLOA, HAWAII

WILLIAM B. TABLER ARCHITECTS

SECOND FL. PLAN (ENTRY)

FEBRUARY 2, 1976

3



WAIKOLOA PRINCESS HOTEL

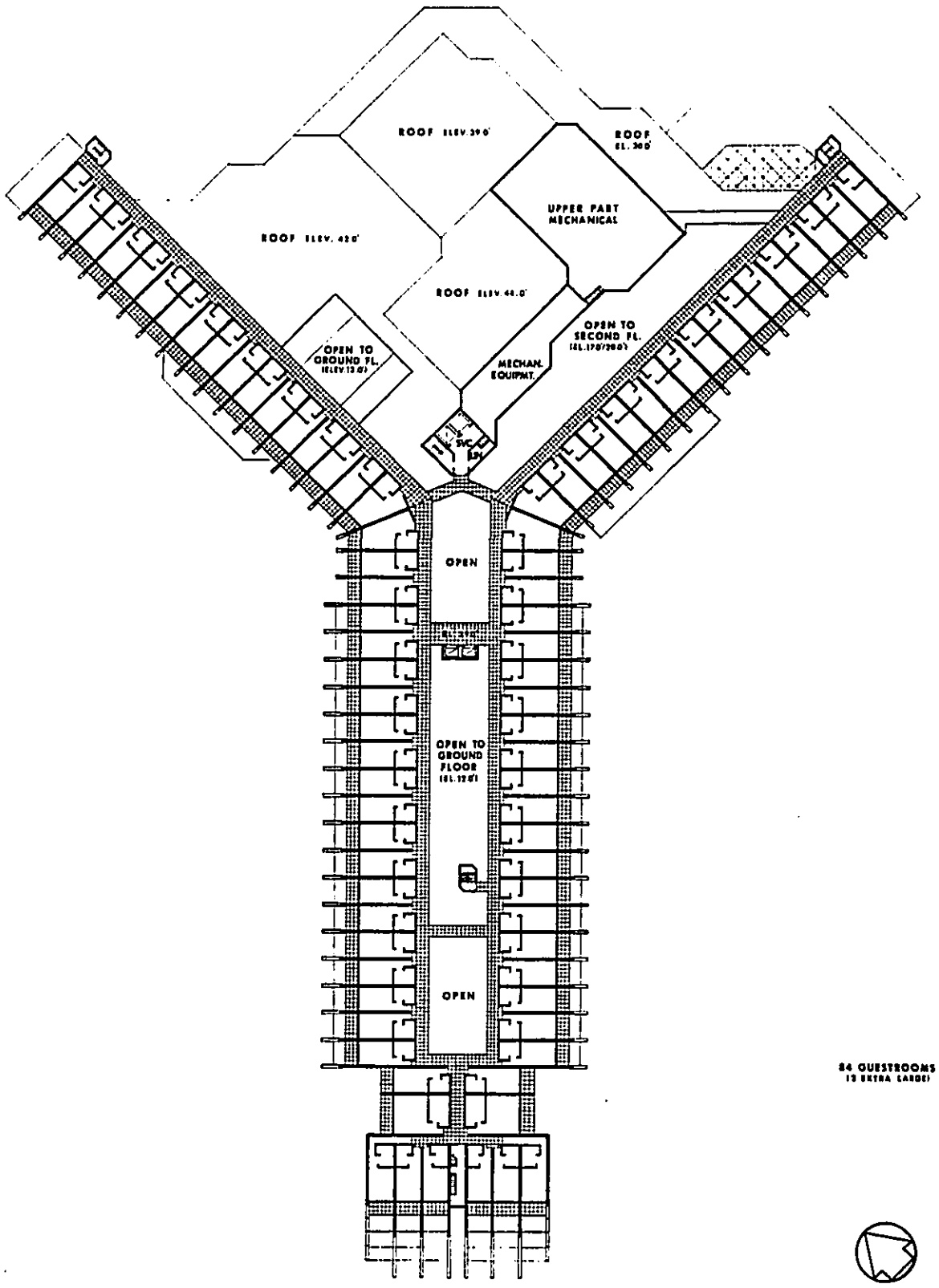
WAIKOLOA, HAWAII

WILLIAM B. TABLER ARCHITECTS

THIRD FLOOR PLAN

FEBRUARY 2, 1976

4



WAIKOLOA PRINCESS HOTEL

WAIKOLOA, HAWAII

WILLIAM B. TABLER ARCHITECTS

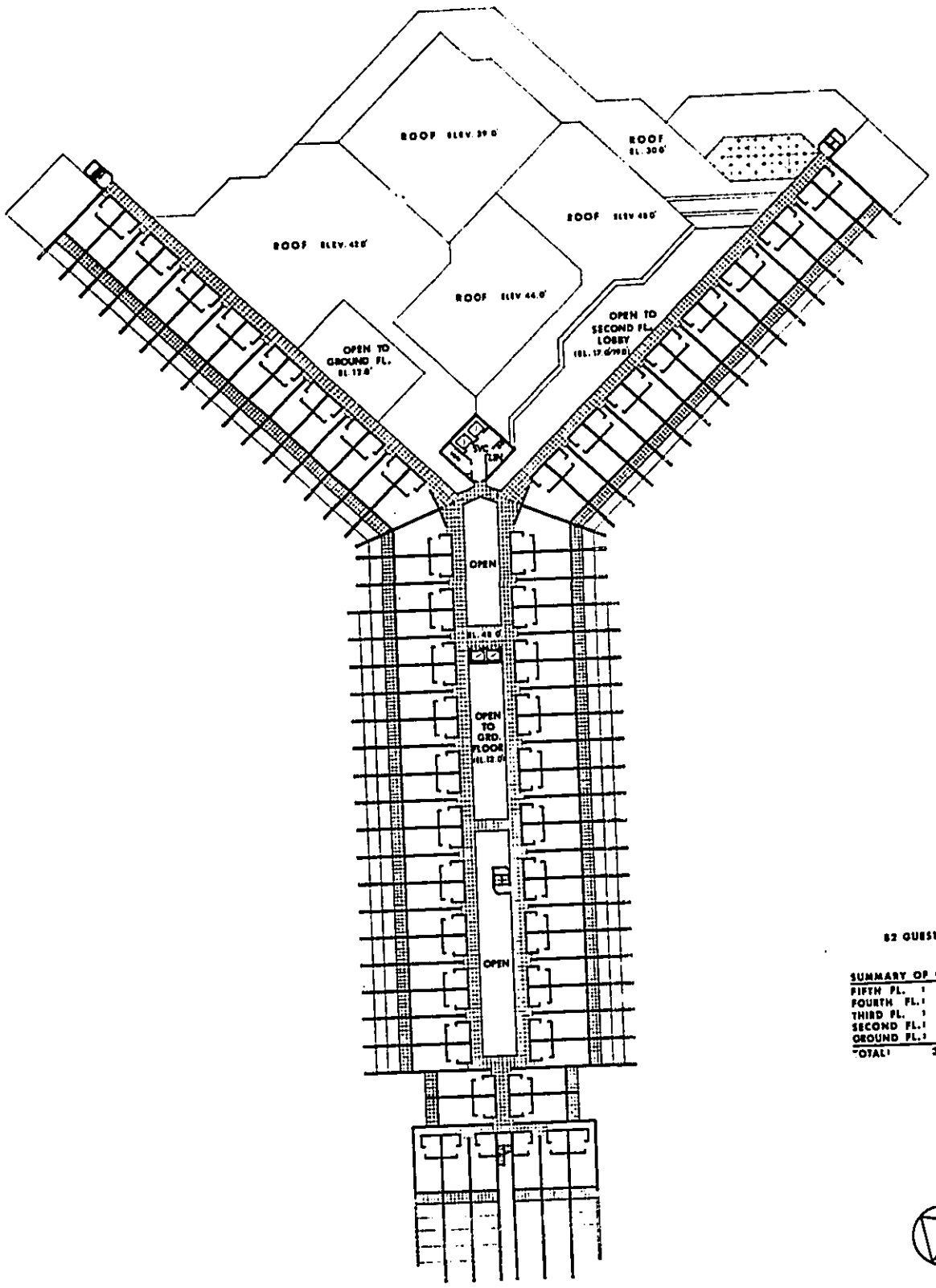
FOURTH FLOOR PLAN

5 0 5 10 20 30 40 50 60 70 80

scale feet

FEBRUARY 2, 1976

5



82 GUESTROOMS

SUMMARY OF GUESTROOMS:

FIFTH FL.	82	
FOURTH FL.	84	(3 LARGE)
THIRD FL.	88	
SECOND FL.	46	(3 LARGE)
GROUND FL.	45	
TOTAL	345	(347 EQUIV.)

WAIKOLOA PRINCESS HOTEL

WAIKOLOA, HAWAII

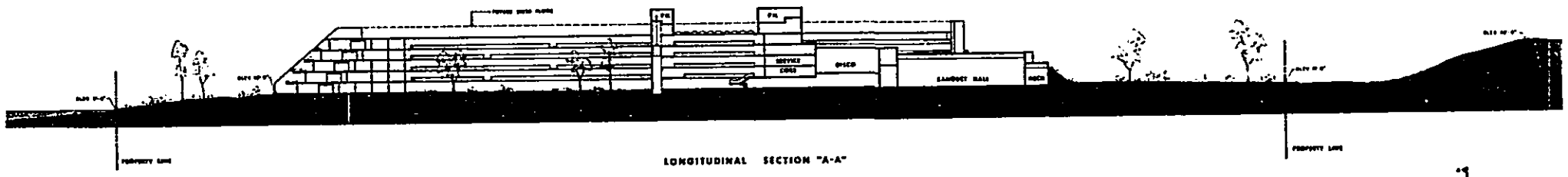
WILLIAM B. TABLER ARCHITECTS

FIFTH FLOOR PLAN

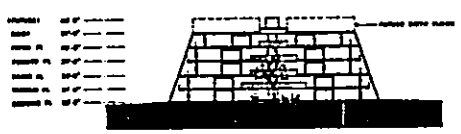
5 0 5 10 20 30 40 50 60 70 80
scale feet

FEBRUARY 2, 1976

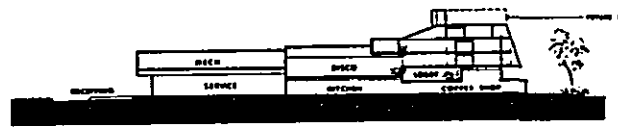
6



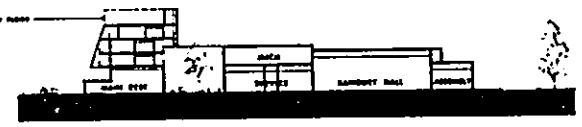
LONGITUDINAL SECTION "A-A"



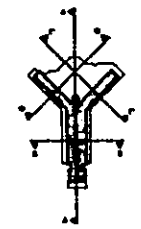
CROSS SECTION "B-B"



CROSS SECTION "C-C"



CROSS SECTION "D-D"



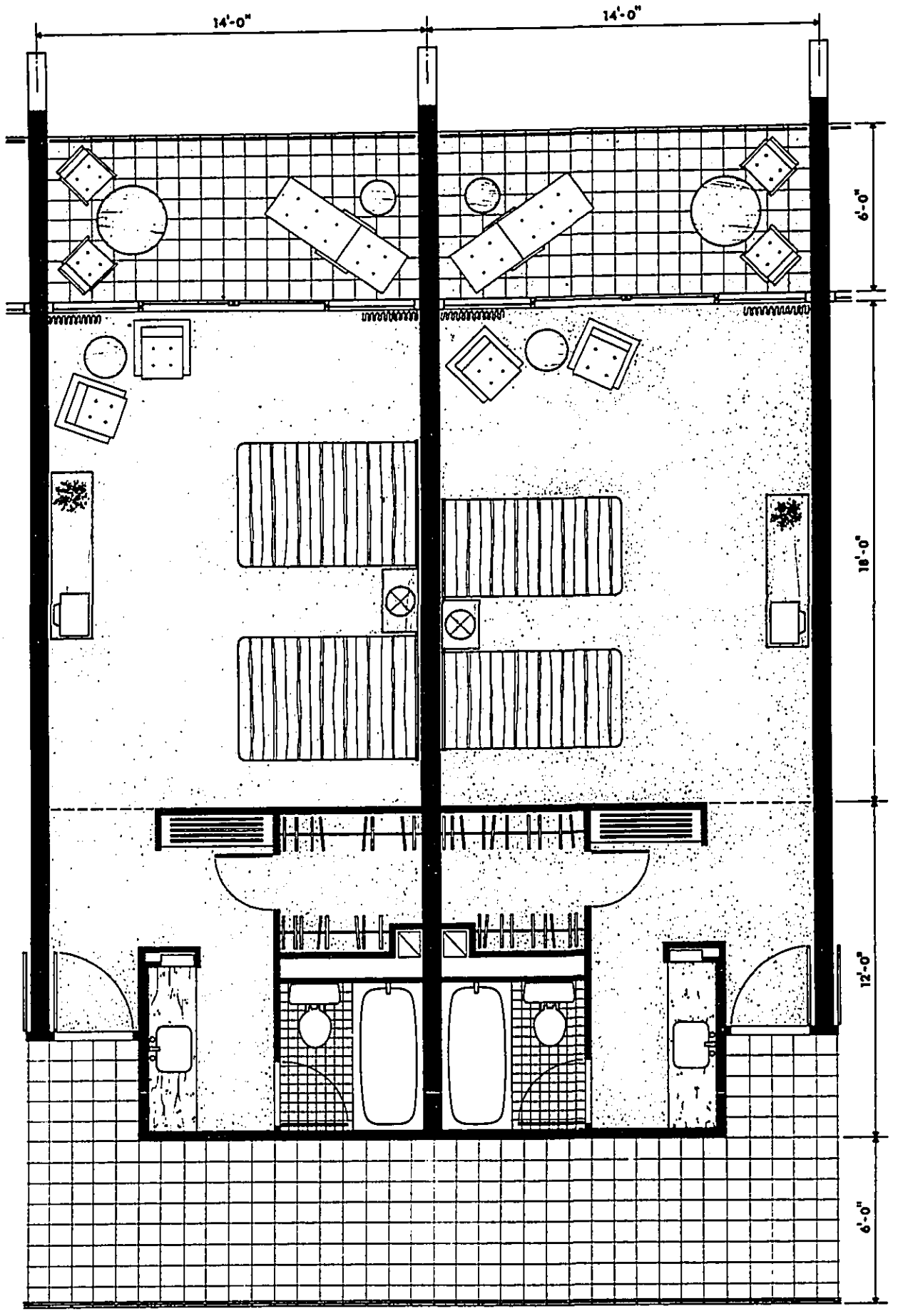
SECTIONS 7

FEBRUARY 2, 1976

WAIKOLOA PRINCESS HOTEL

WAIKOLOA, HAWAII

WILLIAM B. TABLER ARCHITECTS



WAIKOLOA PRINCESS HOTEL

WAIKOLOA , HAWAII

WILLIAM B. TABLER ARCHITECTS

TYPICAL GUESTROOM

FEBRUARY 2, 1976

8

WAIKOLOA PRINCESS HOTEL
Waikoloa Hawaii

AREA PROGRAM

Prepared by William B. Tabler Architects

February 2, 1976

A. PUBLIC ROOMS

1.	Main Restaurant	(200)	4,000 sq.ft.
2.	Specialty Restaurant (Grill)	(175)	3,500
3.	Coffee Shop	(175)	3,150
4.	Bar	(50)	900
5.	Restaurant Toilets		350
6.	Discotheque	(175)	3,000
			14,900 sq.ft.

B. FUNCTION ROOMS

1.	Banquet Hall (Div. 2)	(700)	7,000 sq.ft.
2.	Banquet Assembly		2,400
3.	Priv. Din./Meeting Rooms 2 x	(50)	1,000
4.	P.D.R./Mtg. Rm. Circulation		500
5.	Banquet Storage		700
6.	Banquet Toilets		700
7.	Banquet Checkroom		150
8.	Public Telephones		50
9.	Spotlight/Sound Control		200
			12,700 sq.ft.

C. MISCELLANEOUS PUBLIC FACILITIES

1.	Lobbies, Corridors, Foyers	7,000 sq.ft.
2.	Baggage Holding	350
3.	Public Toilets	350
4.	Newsstand/Sundries Shop	200
5.	Public Stenographer	150
6.	Barber Shop	300
7.	Beauty Shop	650
8.	Cable Office	100
9.	Card/Game Room	400
10.	Other Retail Shops	4,000
11.	Retail Shop Storage	500
		14,000 sq.ft.

D. RECREATIONAL FACILITIES

1.	Pool/Pool Deck	-
2.	Pool Bar/Snack Bar	450 sq.ft.
3.	Pool Equipment Room	200
4.	Pool Deck Storage	200
5.	Pool Lockers/Toilets	650
		1,500 sq.ft.

E. ADMINISTRATION

1.	Front Desk/Office	400 sq.ft.
2.	Reservations	150
3.	F.O. Manager	150
4.	Reception	200
5.	General Manager	250
6.	Resident/Asst. Manager	200
7.	Executive Secretaries	300
8.	Sales Manager	150
9.	Sales Office	350
10.	Banquet Manager	150
11.	Food & Bev. Manager	150
12.	P.R. Manager	150
13.	Conference Room	300
14.	General Cashier	125
15.	Auditor	125
16.	Accounting Office	650
17.	Accounting Files & Storage	100
		3,900 sq.ft.

F. RECEIVING

1.	Truck Dock, Receiving	600 sq.ft.
2.	Receiving Clerk	100
3.	Purchasing Office	200
4.	Trash Room	150
5.	Garbage Sorting/Refrigerator	350
6.	Bottle Room	100
		1,500 sq.ft.

G. FOOD SERVICE/STORAGE

1.	Main Kitchen	4,250 sq.ft.
2.	Room Service	450
3.	Banquet Pantry	1,000
4.	Coffee Shop Kitchen	1,000
5.	Chef's Office	100
6.	Food Control	200
7.	Food Storage	1,200
8.	Beverage Storage	800
9.	Refrigerated Storage	1,000
10.	Bulk Storage	1,500
		11,500 sq.ft.

H. HOUSEKEEPING

1.	Housekeeping Office	150 sq.ft.
2.	Housekeeping Workroom	350
3.	Housekeeping Storage	250
4.	Laundry	3,000
5.	Valet Shop	450
6.	Uniform Storage	200
7.	Linen Storage	500
8.	Lost & Found Storage	100
		5,000 sq.ft.

I. EMPLOYEE FACILITIES

1.	Employee Entry	200 sq.ft.
2.	Timekeeper	150
3.	Personnel Office	300
4.	Employee Lockers/Toilets - Male	900
5.	Employee Lockers/Toilets - Female	1,500
6.	Extra Waiters Lockers	350
7.	Employee Dining/Pantry	1,200
8.	Staff Dining	300
		4,900 sq.ft.

J. MISCELLANEOUS SERVICE FACILITIES

1.	Medical Suite	300 sq.ft.
2.	Telephone Switchboard	150
3.	Telephone Equipment	400
4.	Print Shop	150
5.	Security Office	150
		1,150 sq.ft.

K. ENGINEERING

1.	Mechanical Plant	6,650 sq.ft.
2.	Switchgear Room	450
3.	Emergency Generator	200
4.	Penthouse Mech./Elevator Equipment	400
5.	Engineer's Office	200
6.	Engineer's Storage	350
7.	Machine Shop	200
8.	Carpentry Shop	200
9.	Paint Shop	150
10.	Upholstery Shop	150
11.	Locksmith	100
12.	T.V. Repair	100
		9,150 sq.ft.

L. GUESTROOMS

1.	350 Rooms (525 sq.ft. gross each)	183,750 sq.ft.

SUMMARY

A.	PUBLIC ROOMS	14,900 sq.ft.	
B.	FUNCTION ROOMS	12,700	
C.	MISC. PUBLIC FACILITIES	14,000	
D.	RECREATIONAL FACILITIES	1,500	
	TOTAL PUBLIC FACILITIES (NET)		43,100 sq.ft.
E.	ADMINISTRATION	3,900 sq.ft.	
F.	RECEIVING	1,500	
G.	FOOD SERVICE	11,500	
H.	HOUSEKEEPING	5,000	
I.	EMPLOYEE FACILITIES	4,900	
J.	MISC. SERVICE FACILITIES	1,150	
K.	ENGINEERING	9,150	
	TOTAL SERVICE FACILITIES (NET)		37,100 sq.ft.
	TOTAL PUBLIC & SERVICE (NET)		80,200 sq.ft.
	20% NET/GROSS ADJUSTMENTS		16,050 sq.ft.
	TOTAL PUBLIC & SERVICE (GROSS)		96,250 sq.ft. (275 sq.ft./rm.)
L.	GUESTROOMS		183,750 sq.ft.
	TOTAL AREA:		280,000 sq.ft. (800 sq.ft./rm.)

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Selected Interviews

SELECTED INTERVIEWS

Conducted by Hastings, Martin, Hallstrom & Chew, Ltd.

Person Interviewed	Topic
Robert Holden, senior vice president, Sheraton Hotels	Parameters and format for study.
Charles McCreary, president, InterIsland Tradewind Tours	Acquaint with project and region, obtain impressions and discuss tourism characteristics
Anette Ebinger, operations vice president, Tradewind Tours of Hawai'i	Acquaint with project and region, obtain impressions and discuss tourism characteristics.
Les Holt, operations vice president, Aloha Hawaiian Travel	Acquaint with project and region, obtain impressions and discuss tourism characteristics.
Gene Wilhelm, manager Hawai'i Island Office Hawai'i Visitors Bureau	Acquaint with project and region, obtain impressions and discuss Big Island tourism characteristics.
Ernie Donehower, research analyst Hawai'i Visitors Bureau	Discuss tourism statistics and forecasts.
James Faries, general manager 'Olohana Corporation (Mauna Kea Beach Hotel)	Discusss Mauna Kea Beach Hotel activity, plans and golf course use.
Nobuo Kitsuda, vice president Mauna Loa Land, Inc.	Discuss development plans for property adjacent to 'Anaeho'omalu resort.
Guido Giacommetti, president Kamehameha Development Corporation, (Keauhou-Kona Resort Community)	Discuss activity and plans for Keauhou-Kona Resort Community and golf course.
Wai Mun Chung, controller InterIsland Resorts	Discuss operating experiences, golf course, acquaint with project and obtain impressions.
Dave Wismar, project manager Wailea Development Company	Discuss activity and plans for Wailea, golf course benefits, and obtain impressions of proposed project.

SELECTED INTERVIEWS
(continued)

Person Interviewed	Topic
Robert Anderson, professor School of Tropical Agriculture University of Hawai'i Economic consultant for Kohala Community Development Plan	Discuss economic and tourism prospects for region.
Mark Hastert, planner Larry Helber, planner Belt, Collins and Associates Planners and Planning Coordinators for Waikoloa, Mauna Loa Land, Inc., and 'Olohana Corporation	Discuss current development status in region, plans, results of prior research and analysis.
John Cavanagh, president Fawcett-McDermott-Cavanagh	Discuss promotion plans for Waikoloa and Kohala Coast Resort Region.

SELECTED INTERVIEWS
Conducted by Belt, Collins & Associates, Ltd.

Person Interviewed	Topic
Virginia Goldstein, Hawai'i County Planning Department	Historic setting and archaeological impacts
Ilima Piianaia, Hawai'i County Planning Department	Historic setting and archaeological impacts
Pat Kirch, Bishop Museum	Historic setting and archaeological impacts
Farley Watanabe, State Department of Land and Natural Resources	Historic setting and archaeological impacts
Gary Cummins, state historian	Historic setting and archaeological impacts
David Cox, archaeologist	Historic setting and archaeological impacts
Claude Jenkins, construction manager, Waikoloa	Historic setting, archaeolical impacts, water and land transformation
Stephen Bowles, consulting hydrologist	Ground surface and coastal water quality
Ronald Pulfrey, U.S. Corps of Engineers	Ground surface and coastal water quality
Robert Dole, U.S. Geological Survey	Ground surface and coastal water quality
George Takasaki, U.S. Geological Survey	Ground surface and coastal water quality
Santos Valenciano, U.S. Geological Survey	Ground surface and coastal water quality
William Sewake, County Department of Water Supply	Ground surface and coastal water quality and utilities
Godfrey Chung, botanist, Foster Gardens	Landscaping and existing vegetation
Robert J. Everett, director of marketing, Gasco, Inc.	Utilities
Edward K. Nakamoto, Hawai'i Electric Light Co., Inc.	Utilities

SELECTED INTERVIEWS
(Continued)

Person Interviewed	Topic
Robert Anderson, Evaluation Research Consultants	Area planning
Frank Brandt, Chapman, Phillips, Brandt, Reddick & Associates, Inc.	Area planning
John Cox, University of Hawai'i, School of Travel Industry Management	Area planning

SELECTED INTERVIEWS

Conducted by Hajime Tanaka,
JHK Tanaka, Inc.

Person Interviewed	Topic
Dr. James S. Kumagai, deputy director, State Department of Health	Sewerage system
Harold Sugiyama, head, Division of Sewers and Sanitation, County of Hawai'i	Sewerage system
Akira Fujimoto, managing engineer, Department of Water Supply, County of Hawai'i	Water supply
William Sewake, engineer, Department of Water Supply, County of Hawai'i	Water supply
Alva Nakamura, deputy chief engineer, Hawai'i Electric Light Co.	Electrical system
Edward K. Nakamoto, engineer, Hawai'i Electric Light Co.	Electrical system

SELECTED INTERVIEWS
Conducted by David A. Johnson
Paul, Margolis, Warner & Johnson, a Law Corporation

Person Interviewed	Topic
Masayoshi Onuma, Hawai'i County Planning Department	Types of permits and approvals required for WBR
Farley Watanabe, State Department of Land and Natural Resources	Historic sites at Waikoloa

SELECTED INTERVIEWS
Conducted by Willis H. Sanburn
Boise Cascade Home & Land Corporation

Person Interviewed	Topic
Col. Frank M. Pender, Corps of Engineers	Small tidal ponds
Gary Cummins, historic sites specialist, Department of Planning and Economic Development	Historic sites
Dr. Roland Force, Bishop Museum	Archaeological surveys
William Barrera, archaeologist	Archaeological surveys
John Farias, director, State Department of Agriculture	Agricultural opportunities in South Kohala.
John Hoag, regent, University of Hawai'i	University opportunities in South Kohala.
Dr. Fujio Matsuda, president, University of Hawai'i	University opportunities in South Kohala.
Raymond Suefuji, planning director, County of Hawai'i	Parameters of EIS
Masayoshi Onuma, Planning Department, County of Hawai'i	Planned unit development
Sidney Fuke, deputy planning director, County of Hawai'i	Planned unit development

SELECTED INTERVIEWS
Conducted by Walt Southward
Boise Cascade Home & Land Corporation

Person Interviewed	Topic
Ilima Piianaia, Planning Department, County of Hawai'i	Parameters of EIS
Ronald Okamura, Department of Recreation, County of Hawai'i	County CIP Investments, North and South Kohala
Charles Schuster, District Engineer, Department of Transportation, State of Hawai'i	State Road CIP Investments, North and South Kohala
Herbert Matayoshi, Mayor County of Hawai'i	Parameters of EIS
Nathan Cockett, manager, Waiakea Resort Village	Employment of island natives in visitor industry
William Davis, manager, Naniloa Surf Hotel	Employment of island natives in visitor industry
Fred Honda, manager, Keauhou Beach Hotel	Employment of island natives in visitor industry
William Vannatta, manager, Hawai'i Transportation Co. (Gray Line)	Employment of island natives in visitor industry