BENJAMIN J. CAYETANO
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
AIR-P
00.0704

'00 DEC 21 P2:00

OFC. OF ENVIRONMENTAL
QUALITY CONTROL

December 18, 2000

TO: GENEVIEVE SALMONSON, DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: KAZU HAYASHIDA K.H.
DIRECTOR OF TRANSPORTATION

SUBJECT: FINDING OF NO SIGNIFICANT IMPACT (FONSI)
KONA INTERNATIONAL AIRPORT AT KEAHOLE
TMK 7-2-05:07 AND 7-3-43:03, 06 THROUGH 35, 37
THROUGH 40 AND 43 THROUGH 47
NORTH KONA, HAWAII

The State of Hawaii, Department of Transportation, Airports Division has reviewed the comments received during the 30-day public comment period which began on April 23, 1999. The agency has determined that this project will not have significant environmental effects and has issued a FONSI. Please publish this notice in the January 8, 2001, Office of Environmental Quality Control (OEQC) Environmental Notice.

We have enclosed a completed OEQC Publication Form and four copies of the final environmental assessment (EA).

Please have your staff contact Lynette Kawaoka, Planner at 838-8812, to clarify any questions you may have. Thank you for your assistance in this matter.

Enclosures: OEQC Publication Form
Final EA (4 copies)

c: Keahole Associates, Inc. (M. Inouye)

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8. *Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions -*

The proposed project is not expected to have an adverse cumulative effect on the environment or require a commitment for larger actions. The area involved is situated within the existing KOA airport property. Future increments of construction are relatively flexible and will be constructed as required based on demand or need to ensure safety and efficiency of airport operations.

9. *Substantially affects a rare, threatened or endangered species or its habitat -*

There are no rare, threatened or endangered species within the project site.

There is a small anchialine wetland system located east of the southwest fence corner at the southern end of the runway that will remain in an undisturbed condition and will be monitored to ensure no negative adverse impacts are associated with development.

Currently, agricultural inspections are being conducted to reduce the potential for alien species introduction. The U.S. Department of Agriculture conducts inspections of all incoming international flights and the State of Hawaii, Department of Agriculture inspects incoming baggage and cargo for domestic flights. Additionally, the lava fields of Kona are not hospitable to many species in general.

10. *Detrimentally affects air or water quality or ambient noise levels*

Any potential impacts to air, water quality, or noise levels will be addressed by use of appropriate measures described in this document.

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

The project site does not contain any especially sensitive environmental characteristics which would detract from airport uses.

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

No adverse impacts are anticipated to the areas scenic vistas and view planes. Although construction of facilities at KOA will stand in stark contrast to the surrounding lava field, landscaping will be used to enhance the area and screen unattractive facilities. Gardens within the terminal complex will provide visual relief from the immediate airport surroundings. Some of the existing architectural design themes will be incorporated into the design of new buildings to maintain the "tropical village" design character of the airport.

13. *Requires substantial energy consumption*

Sufficient energy will be used to construct and operate the proposed KOA Master Plan. Energy will also be used during the transport of construction equipment, machinery, and personnel to the project site. None of these activities are expected to result in use of energy significantly greater than similar airport related construction projects.

Based on analysis and review of the above factors, it is expected that an Environmental Impact Statement (EIS) will not be required and that an anticipated Finding of No Significant Impact (FONSI) will be issued for this project.

SECTION 11
COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT

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OF COUNSEL
G. RICHARD GESCH

May 21, 1999

Mr. Jerry M. Matsuda, P.E.
Airports Administrator
State of Hawaii, Dept. of Transportation
Airports Division
Honolulu International Airport
400 Rodgers Blvd., Suite 700
Honolulu HI 96891-1880

Re: Comments on Draft Environmental Assessment for Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii

Dear Jerry M. Matsuda:

These comments on the Draft Environmental Assessment ("DEA") for the Kona International Airport at Keahole Master Plan Update ("the project") are timely submitted on behalf of Mr. Lawrence Mau. It would be an error of fact and law to enter a Finding of No Significant Impact ("FONSI"). Instead, it should be obvious that an Environmental Impact Statement ("EIS") Preparation Notice must be entered, for reasons including but not limited to the following:

I. INTRODUCTION

The State of Hawaii, Department of Transportation, is in the midst of a major statewide long and short term project of attempting to implement the "Hawaii Statewide Airport System Plan" which involves transforming neighbor island airports at Kahului, Lihue and Kona into international airports which can accommodate non-stop flights from locations as distant as New York City and Tokyo, Japan.

At the Kahului Airport, major portions of the airport infrastructure for the expanded airport were constructed first and then the major runway extension was proposed. Conversely, in Kona, the runway was extended first and now, through this DEA, the airport infrastructure for the expanded airport is now proposed.

An Environmental Impact Statement has been prepared for the expansion of the Kahului Airport on Maui. An Environmental Impact Statement Preparation Notice has been entered for the expansion of the Lihue Airport, on Kauai. There is absolutely no reason why Environmental Impact Statements are required to be prepared pursuant to federal and state Environmental Impact Statement laws and regulations for the Lihue and Kahului Airports but not for the Kona Airport. Many of the same kinds of significant adverse impacts upon many different types of protected resources are encountered at all three airports.

II. STANDARD OF REVIEW

An Environmental Assessment is intended to be a preliminary document prepared in the environmental review process, pursuant to federal and state environmental laws and regulations, to determine whether or not a full Environmental Impact Statement must be prepared. If a proposed project "may" have significant adverse impacts, a full EIS must be prepared. It is only if the proponent of the project can prove in a preliminary document that the project "will not" cause any significant adverse impacts that a FONSI may be entered. The DEA here contains admissions that this project "may" cause significant adverse impacts. At a minimum, the DEA does not establish that the project "will not" have significant adverse impacts such that an EIS preparation notice must be entered as a matter of fact and law.

In addition, there has been no demonstration that the tests established in various federal statutes have been satisfied including but not limited to the Transportation Act, the Endangered Species Act and the Airport and Airways Improvement Act.

III. THE SIZE AND SCOPE OF THIS PROJECT DICTATE THAT AN EIS BE PREPARED

This is a three-phased project to be implemented between 1998 and the year 2015 (and beyond), costing an approximate total of $130,780,000.

Phase I includes the following:

A. Wastewater treatment plant
B. Fuel farm site preparation
C. General aviation fuel storage system site preparation
D. Air cargo building III
E. Postal facility site preparation
F. Road "P"
G. Road "M"
H. Telecommunication system
I. Parking phase II
J. Itinerant airline aircraft parking
K. Ramp "K"
L. Overseas apron
M. Air traffic control tower

Phase II includes:

A. Overseas terminal
B. Air and water monitoring

C. Electrical distribution and emergency generator
D. Flight kitchen site preparation
E. Ground transportation lease lots
F. GA site development and hangars
G. Air tour terminal
H. Heliport phase I
I. Ramp "L"
J. FBO sewer system and lift station
K. Road "N" south
L. Quarry

Phase III involves:

A. Connecting road "L"
B. Long term parking
C. DOT/DEA administration building
D. Keahole to Kawaihae fuel corridor

The cost estimate is attached hereto as Exhibit "1". All of the components of the three phases to the Master Plan are described in more detail in Exhibit "2".

In comparison, an EIS was required for the three-phased expansion of the Kahului Airport between 1996 and the year 2016 at a cost similar to the Kona costs (without the parallel runway proposed for Phase III). The Lihue Airport expansion involves two phases between the years 2000 and 2020, with undisclosed costs.

EISs are routinely required for much smaller projects.

IV. THE INADEQUACY OF THE DEA

The DEA is inadequate. It should either be rewritten in full and resubmitted for public review or a Preparation Notice should be entered for reasons including but not limited to the following:

A. Required Studies Have Not Even Been Prepared Yet

1. No Environmental Compliance Audit

Various facilities have been identified as potential sources of hazardous wastes including (a) automobile rental companies, (b) air carriers, (c) aircraft rental and flight instruction companies, (d) helicopter tour companies, (e) aircraft fueling operations, (f) ground transportation companies, (g) HDOT/AIR support services including the baseyard and operations facility and (h) the aircraft rescue and fire fighting facility. The DEA indicates that each of these are being evaluated, however the study evaluating these has not even been prepared yet and, as such, there is no basis for determining that hazardous wastes will be managed properly at the airport.

2. No Drainage and Water Quality Studies

There is no drainage study or water quality assessment even though it is acknowledged that the coastal nearshore waters are classified "AA" according to the Water Quality Standards Map of the Island of Hawaii.

3. No Biological Assessment or Biological Opinion

There is no Biological Assessment, Biological Opinion or Alien Species Action Plan for the Kona Airport, although it has been acknowledged repeatedly in the Kahului Airport EIS that alien species interdiction measures are necessary at all of Hawaii's airports.

B. The DEA Is Too Long

If it cannot be demonstrated in a relatively brief document that there will be no significant adverse impacts, a Preparation Notice should be entered instead. See Twenty Most Asked Questions, interpreting federal regulations.

C. Natural Hazard Area

The Island of Hawaii is classified as Seismic Risk Zone 3, based on a scale of 1 to 4, with 4 being higher. In addition, an earthquake occurred recently relatively near to the airport. The DEA acknowledges that "risks to life and property are present at the airport site." The airport therefore lies in an environmentally sensitive area which dictates the preparation of an EIS through the application of the "significance criteria" found in H.A.R. §11-200-12(b)(11).

V. THE FUEL TANK FARM, AS AN EXAMPLE

A. The Description of This Project Is Inaccurate

The DEA describes an existing fuel tank farm and a proposed new fuel tank farm in another location. See Airport Layout Plan, Figure 2-5, DEA. The existing fuel tank farm is located within the footprint for the proposed overseas terminal and does not meet existing standards for above-ground fuel storage tanks. It has therefore been proposed that the following entities be allowed to construct above-ground tanks in the new area:

Entity	Fuel Tanks
HFC	2-30,000 gallon tanks (Jet-A)
Air Service Hawaii	1-30,000 gallon tank (Jet-A)
	1-12,000 gallon tank (AV GAS)
Sporty's Academy Hawaii	1-10,000 gallon tank (AV GAS)

Through public documents prepared after the DEA, the location for this new fuel tank farm has been changed. Its new location is shown in the attached Exhibit "3". The cost of this new fuel tank farm, in a different location, is estimated to be $4,433,640 with a new roadway for access, by itself costing $1,436,900. See Exhibit "3" attached hereto.

It should be obvious that the DEA could only be adequate with respect to the fuel tank farm as located in the DEA. It cannot suffice to study the impacts in this new location.

B. Description of Environmental Impacts Inadequate

The DEA on p. 7-17 frankly acknowledges that significant adverse impacts may be caused by the expanded fueling facilities:

> The impacts resulting from the expanded fueling facilities include possible contamination of ground water and coastal waters from accidental leaks and spills. In addition, increased traffic from fuel trucks will result from the need to maintain required fuel storage levels. (Emphasis added.)

As noted earlier, there is no drainage report or water quality report attached to the DEA. Neither is there a traffic study. Without these studies, it is not possible to address the extent of the adverse impacts or to fashion appropriate mitigation measures.

In addition, there is no mention in the DEA of information available to Airport Planner Ben Schlapak which he addresses in his memorandum dated July 22, 1998, attached hereto as Exhibit "4". In that memorandum he states that:

> There are many laws and regulations related to spills of hazardous substances and storm water discharge into waters of the United States. Technically, Jet-A or Jet-A-1 is not a hazardous substance unless it contains benzene, toluene, xylene or ethyl benzene (BTEX). We have been led to believe that local jet fuel has no benzene although the textbooks say otherwise. Certainly 100 octane gasoline contains BTEX. Consequently, fuel spills must be contained, absorbed, reported and minimized.

He states further:

> At Kona International Airport at Keahole, the storm drainage does not enter the ocean directly, but flows through underground fissures which eventually reach the ocean. The waters offshore at Keahole Point are Class AA, the highest DOH water quality requirements. ... Spills which seep into the pahoehoe and a'a lava cannot be tolerated.... **New fuel farms will have to involve membrane barriers which retain all spills.**

The DEA does not mention membrane barriers to retain all spills. In addition, Mr. Schlapak states:

> A three to four inch berm of asphaltic concrete around the truck fill area would be sufficient in dry conditions, but in rain, could be overtopped. Truck-fill stands on the mainland are now covered with roofs to prevent this overflow contamination. We want to incorporate this additional protection in future fuel farm designs.

A robust and frank debate is taking place outside of the DEA process about the impacts of Jet-A fuel as a hazardous substance: however none of this makes its way into the DEA and it is inadequate for this reason alone.

VI. CEDED LANDS

The DEA acknowledges that most of the land at the Kona Airport is ceded, p. 5-2. The DEA does not address in any responsible fashion the obligations of DOT under the Ceded Lands Trust and the manner in which the lands are either appropriately or inappropriately managed on behalf of the beneficiaries of the Ceded Lands Trust, including Native Hawaiians.

VII. THE ENTRY OF A FONSI HERE WOULD BE ILLEGAL

DOT-Airports reviewed the "significance criteria" with respect to the Lihue Airport expansion and found that they required the preparation of an EIS. See Exhibit "5" attached hereto. DOT-Airports reviewed these criteria with respect to the Kahului Airport expansion and found that they required the preparation of an EIS. See Exhibit "6" attached hereto. DOT-Airports reviewed the "significance criteria" for the Kona Airport expansion project and found that a FONSI could be entered. See Exhibit "7" attached hereto. The determination that an EIS was required with respect to the Lihue and Kahului Airport expansion projects was appropriate, however the determination under like circumstances with respect to the Kona Airport expansion that there would be no significant adverse impacts is arbitrary, capricious and illegal as a matter of fact and law. The paragraphs below address the particular "significance criteria" as numbered in H.A.R. §11-200-12(b).

1. Irrevocable Commitment

In Lihue, DOT-Airports found that the improvements will involve an irrevocable commitment of fuel, labor, capital and materials for construction and from the acquisition of land for the airport. In Kahului, DOT-Airports found that planned land uses may conflict with existing or planned land uses for adjacent parcels and that these conflicts would be studied in the EIS. Even though the same irrevocable commitments are involved in Kona, they are not mentioned at all.

2. Curtailing the Beneficial Use of the Environment

With respect to Lihue, DOT-Airports found that there would be a curtailment due to land acquisitions which could be mitigated. DOT-Airports does not acknowledge the same curtailment at Kona even though land acquisition is also involved.

4. Substantially Affects the Economic or Social Welfare of the Community or State

In Lihue, DOT-Airports found that there could be potential beneficial and adverse impacts in this area and that a Social Impact and Economic Impact Assessment would be conducted. DOT-Airports admits that the Kahului Airport expansion will have socio- and socio-economic impacts and promises to study these in the EIS. With Kona, DOT-Airports finds there will only be "positive benefits," however there is no Social Impact and Economic Impact Assessment attached to study both the beneficial and adverse impacts on the community, as was determined to be necessary in Lihue and Kahului.

6. Involves Substantial Secondary Impacts, Such as Population Changes, or Effects on Public Facilities

As to Lihue, DOT-Airports acknowledges that further discussion of these impacts is necessary and that further studies on population, the economy, utilities and public facilities will be provided in the Draft EIS. The Kahului Preparation Notice promises a detailed study of traffic impacts. In the Kona determination, DOT-Airports denies that there will be any adverse secondary impacts at all.

7. Involves a Substantial Degradation of Environmental Quality

Neither the Lihue or Kona determinations find any such degradation. However, it must be plain that the potential for draining hazardous materials into Class AA waters would involve a substantial degradation of environmental quality, at least with respect to Kona, which, by itself, dictates the preparation of an EIS.

8. Is Individually Limited but Cumulatively Has Considerable Effect on the Environment or Involves a Commitment for Larger Actions

The Lihue determination admits that secondary and cumulative impacts need to be further addressed in a Draft EIS. The Kona determination denies that there are any adverse cumulative effects or commitments to larger projects.

9. Substantially Affects a Rare, Threatened, or Endangered Species or Its Habitat

Both the Lihue and Kona evaluations are inadequate because they do not address the impacts of alien species introductions on endangered species on the islands as a whole, which was required on Maui. The Kahului Preparation Notice admits that the proposed improvements may result in disruption, changes, or deterioration to the existing flora and faunal habitat, or may cause an introduction of a species of plant or animal on the airport.

10. Detrimentally Affects Air or Water Quality or Ambient Noise Levels

The Lihue determination admits that noise impacts must be addressed in the EIS. The Kahului Preparation Notice admits that the proposed improvements may alter the airport's drainage patterns, and the quality, amount and rate of discharge and promises to study potential water quality impacts in the EIS. The Kona determination concludes, without any proper supporting documents or studies, that potential impacts to air, water quality or noise levels will be addressed by use of appropriate measures described in the DEA. This is absurd, particularly given the statements in the memorandum by Mr. Schlapak.

11. Effects or is likely to Suffer Damage by Being Located in an Environmentally Sensitive Area Such as a Flood Plane, Tsunami Zone, Beach, Erosion-Prone Area, Geologically Hazardous Land, Estuary, Fresh Water, or Coastal Waters

The Kona determination is inadequate and unsupported because it does not address several "environmentally sensitive areas" such as "geologically hazardous land" and "coastal waters."

13. Requires Substantial Energy Consumption

The Lihue determination finds that the expansion of the airport facilities and increase in the scale of airport operation "will lead to an increase in energy consumption." DOT-Airports finds to the contrary with respect to Kona, however no documents have been provided to show why there will be an increase in energy consumption in Lihue but not at Kona.

The determination that any one of these criteria exist compels the finding that the action "shall be determined to have a significant effect on the environment." It should be plain that more than one of these criteria have been triggered and that an EIS Preparation notice must be entered here.

VII. THE NO-ACTION LAWS

Both federal and state environmental laws include "no-action" provisions which prohibit the implementation of any of the components of the proposed project until and unless the environmental process has been lawfully concluded in compliance with these laws and regulations. No federal or state funds may be expended on any of these components. No permits or approvals may be sought or obtained for any of these components. No state or county lands may be used for any of these components. No commitments of any kind may be made to these projects. It would be illegal to purchase any lands for these projects. It would be illegal to put any of these projects out to bid.

The environmental process has not yet been concluded. In our view, it could not lawfully be concluded through the entry of a FONSI. The environmental process could only be lawfully concluded, in this instance, through the preparation and acceptance of an adequate joint federal and state EIS. Until this has occurred, none of the components of this project can be implemented in any of the forms described above.

VIII. ADEQUATE RESPONSES TO COMMENTS ARE REQUIRED

We look forward to a response which addresses our comments in the manner required by H.A.R. §11-200-22(c). Failure to do so will render the DEA inadequate and any undesired FONSI determination illegal on additional grounds.

We trust that the Department of Transportation will act responsibly here and will enter a Preparation Notice and not a FONSI. Thank you for the opportunity to comment.

Please feel free to contact me at your convenience about the foregoing. I look forward to hearing from you.

Sincerely yours,

Isaac Hall

IH/jp
cc: Mr. Gary Gill, Interim Director, Office of Environmental Quality Control, 235 S. Beretania St., Rm. 702, Honolulu HI 96813-2437
Mr. Michael Inouye, Keahole Associates, Inc., 420 Waiakamilo Rd., Suite 411, Honolulu HI 96817-4941
Lawrence Mau

BENJAMIN J. CAYETANO
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KAZU HAYASHIDA
DIRECTOR

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IN REPLY REFER TO

AIR-P
00.0445

November 22, 2000

Mr. Isaac Davis Hall
Attorney At Law
2087 Wells Street
Wailuku, Hawaii 96793

Dear Mr. Hall:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii.

1. General Response

The determination to utilize an Environmental Assessment for the review of the proposed KOA Master Plan Update is based on the following:

A) A prior Environmental Impact Statement (EIS) was completed for KOA in October 1988. The majority of Master Plan projects represented in the 1988 EIS have substantively remained the same with only minor changes to reflect new environmental, regulatory and safety requirements, and location and design changes to meet updated needs. This is the primary reason why the current project is referred to as a Master Plan Update, and not a major new Master Plan. Consequently, due to the relatively minor level and scope of changes proposed at KOA, a decision was made to develop an EA, and not an EIS.

B) The prior EIS covers the majority of projects proposed at KOA, satisfying the requirements of Hawaii Revised Statutes, Chapter 343.

C) During preparation of the Master Plan, a number of steps were taken to ensure public notice and input. It is also the Department of Transportation's (DOT) intent to comply with all required environmental laws and regulations as they relate to protection of the environment.

2. Standard of Review

Projects described in the 1988 KOA Master Plan EIS are substantively the same as proposed in the current November 1998 KOA Master Plan Update DEA. As noted in the Master Plan Update, upon which the Draft EA is based: .

"As in any master plan, there must be flexibility to adjust implementation due to unforeseen future events. The land use plan is intended to be used as a guide for placement of future facilities and activities. What is most likely to be affected in the implementation of the master plan is the timing of new facilities versus its location. It is anticipated that subsequent updates will continue to fine tune the Master Plan." (KOA Master Plan Update, November 1998).

The 1998 KOA Master Plan Update and 1999 Draft EA, therefore, are based on the previous 1988 Master Plan EIS and represent further fine tuning of projects previously and substantively identified in the Land Use Plan. This would include the development of the general aviation (GA) fuel farm you describe as well as the following:

> "Major terminal facilities proposed include an expanded interisland terminal, new overseas terminal, expanded air cargo/mail facilities, new general aviation facilities, air taxi/commuter facilities, new heliport, expanded parking facilities, car rental area, airport maintenance area, fuel storage and fixed base operator parcels."
>
> "The terminal complex is proposed to be laid out in a linear pattern which closely resembles the existing layout of major facilities. Expansion of the terminal complex, parking facilities and ground transportation extends to the north of the existing facilities. Major expansion to the

south includes general aviation facilities, heliport, fixed base operator parcels and air cargo/mail facilities." (Keahole Airport Master Plan EIS, October 1988).

Based on the prior 1988 EIS standard of review, the potential for major adverse impacts were reviewed resulting in the issuance of the Final EIS. The current EA is intended to supplement the information of the prior EIS with proposed new upgrades to KOA. This would include projects such as the new Air Traffic Control Tower necessary to meet safety requirements per FAA regulations and Fixed Base Operator Sewer System and Lift Station to provide necessary infrastructure to the GA area.

Given that the proposed standard of review has included preparation of an EIS as well as public review of the proposed projects in the current EA, an EIS was determined to be unnecessary to ensure no adverse impacts to the area environment.

3. The Size And Scope Of The Project Dictate That An EIS Be Prepared

We acknowledge the proposed scope and cost of the KOA Master Plan Update. Most of these projects have already been concluded through the 1988 KOA Master Plan and subsequent KOA Master Plan Final EIS, October 1988. Based on the addition of projects to the current KOA Master Plan Update and a review of the "significance criteria" elaborated in Hawaii Administrative Rules (HAR), Section 11-200-12(b), the proposed Master Plan Update was determined to be sufficiently represented in a project Environmental Assessment.

4. The DEA is Inadequate

A. Required Studies Have Not Been Prepared

No Environmental Compliance Audit (ECA) - According to the Draft EA, an ECA was completed in 1994 by Ogden Environmental and Energy Services, and serves as the basis for the actions cited in both the Master Plan Update and Draft EA. As part of its regular reporting

schedule, we commissioned a new ECA by Kimura International which was completed in June 1999. A summary of findings and recommendations of this document will be provided in the KOA Final EA.

No Drainage and Water Quality Studies - A prior drainage study and water quality monitoring report was completed for the KOA Master Plan. The drainage study was initially prepared and submitted as part of the construction plan approval process required by both the State and County of Hawaii. Since then, supplemental drainage studies addressing the proposed master plan projects were completed. A summary of the drainage studies indicate that sufficient capacity will be provided to handle all anticipated flows.

A water quality monitoring report was also completed in December 1998. According to the Water Quality Monitoring Program for the Keahole Airport Expansion, July 15, 1997 to June 15, 1998, "There are no significant unexpected features in the data. All values fall within expected norms." Information from this document will be included in the Final EA.

No Biological Assessment or Biological Opinion - Potential for adverse impacts to flora and fauna resources were reviewed in the 1988 Final EIS for Keahole Airport and again in a botanical survey and faunal study which were both completed in February 2000. Results of both studies indicate that potential for adverse impacts are not anticipated or expected provided that sufficient mitigation measures are utilized. The contents of the reports and proposed mitigation measures will be provided in the forthcoming Final EA.

B. The DEA is Too Long

The DEA provides sufficient information and documentation appropriate to the KOA Master Plan Update. Please note that the DEA is comprised of a single volume, whereas an EIS level document such as the Kahului Airport EIS is comprised of not less than five separate volumes.

C. Natural Hazard Area

The concern for earthquakes and potential means of mitigating impacts associated with earthquakes were raised and discussed in both the 1988 Keahole Airport Master Plan EIS, and in the current 1998 Keahole Airport Master Plan Update DEA, Section 5.3. As required by law, sufficient measures and practices will be applied to help mitigate the potential for earthquakes and related natural disasters.

5. Proposed Fuel Farm

A. The Description of the Project is Inaccurate

The proposed fuel storage facility you describe is for the GA facility in the South Ramp area. Please note that you have erroneously confused the cost of this site with the Functional Analysis Concept Design (FACD) estimate for the complete GA Site Preparation which is approximately $4.3 million. This would include construction of the aircraft parking apron, Fixed Base Operator (FBO) site, Air Tours Site, Access Roadway, and other improvements as noted in the <u>Project Definition Report for the GA Site Preparation, Kona International Airport at Keahole, State Project No. AH2046-11</u>, dated April 1999. The estimated cost for construction of the GA Fuel System Site Preparation remains at $1.86 million as noted in Table 3-2, of the DEA.

Although the Master Plan provides a general indication of the location of facilities, it may still be necessary to further fine-tune the placement of facilities within the master planned site. In the case of the relocation of the GA Fuel Storage System (GA Fuel Farm):

1) The proposed project is still part of the KOA Master Plan and is within the same general area slated for development of GA facilities. Consequently, environmental reviews conducted for development of a fuel storage facility would still apply to the project with no new adverse environmental impacts anticipated; and,

2) The relocation of the project to its new location approximately 700 feet south of the previously indicated site is based on use of a FACD design process which is intended to provide additional guidance for the final design and construction of facilities to better serve users of the facility, KOA, and service providers. In the case of the GA Fuel Farm, intended users and KOA administrators have determined that with the revised siting plan that greater operational efficiency could be achieved. At the same time, the proposed new area has already been graded, which will help to facilitate development.

B. Description of Environmental Impacts Inadequate

Per your comments, we will provide additional information from the report, <u>Water Quality Monitoring Program for the Keahole Airport Expansion, July 15, 1997 to June 15, 1998</u>. Drainage studies were also completed pursuant to the preparation of construction documents necessary for the 1988 KOA Master Plan. These drainage studies have since been incorporated into the design of the airport drainage control system. According to results of the above Water Quality Monitoring Program report, there were no major adverse findings for toxic, hazardous, or deleterious constituents in the area water column due to use of the KOA drainage control system.

Potential for impacts due to storm water runoff, and operation and handling of airport facilities including the GA Fuel Farm and Wastewater Treatment Plant are also addressed by existing regulatory requirements including the National Pollutant Discharge Elimination System (NPDES) permit program, and the newly established State Department of Hawaii, HAR, Section 11-281, Underground Storage Tanks, which was adopted on January 28, 2000. As with all DOT-Airports facilities, the operation and use of facilities are required by law to be in conformance with existing Federal, State, and County of Hawaii environmental rules and regulations.

We anticipate that the existing network of environmental reviews will continue to provide for sufficient review and evaluation of public facilities including the KOA.

6. Ceded Lands

We acknowledge that although use of the land is ceded, a public airport is a prime public use as allowed in the Statehood Act of 1959.

7. The Entry of a FONSI Would Be Illegal

For the reasons which follow, we disagree.

A. Irrevocable Commitment

The same irrevocable commitments as identified for Kahului and Lihue airport do not necessarily apply to KOA. Many commitments were reviewed in the original EIS. For example, unlike Lihue or Kahului Airport, no additional land will need to be acquired to realize the proposed KOA Master Plan. Unlike Lihue or Kahului airport, major areas of land surrounding the airport are already owned by the State and have been set aside for airport use.

B. Curtailing the Beneficial Use of the Environment

The proposed KOA Master Plan Update will not require additional land for development which would curtail beneficial uses of the environment. The KOA Land Use Plan notes that sufficient land already exists for realization of the Master Plan Update.

C. Substantially Affects the Economic or Social Welfare of the Community or State

As noted in the DEA, development of the proposed project is not anticipated to result in major adverse socioeconomic impacts to the community or region. Additional discussion concerning this item will be provided in the Final EA.

D. Involves Substantial Secondary Impacts, Such as Population Changes, or Effects on Public Facilities

We do not concur that the proposed improvements will result in substantial secondary impacts involving population change or effects to public facilities. We expect that the proposed construction projects will have the intended effect of increasing safety and

comfort for the traveling public, but will not in itself generate a long term trend for the substantial growth of the area population. Growth of the area population will have more to do with the availability of employment, and the adequate provision of public facilities and services, than the upgrading of airport facilities at KOA.

Similarly, the provision of public infrastructure, including water, wastewater, drainage, and transportation access, and related issues have been discussed in the DEA. As required, upgrades and coordination with appropriate agencies will be exercised to meet necessary regulations governing infrastructure development.

E. Involves a Substantial Degradation of Environmental Quality

The KOA Master Plan Update DEA is regulated by a number of environmental laws and regulations including the 1969 National Environmental Policy Act (NEPA), Hawaii Revised Statutes (HRS), Chapter 343, and FAA environmental guidelines. Discharge of hazardous materials into State waters classified as "AA" are regulated by the State Department of Health through HAR, Chapter 11-54, Water Quality Standards, and Chapter 11-55, Water Pollution Control. As noted in the DEA, necessary NPDES permits will be filed if there is potential for discharges to State waters.

Operation and use of other facilities such as the fuel farm you describe are similarly required to comply with regulations governing discharges or accidental spills. As noted by Mr. Ben Schlapak, DOT-Airports Division, in a memorandum regarding the Kona fuel facility, dated July 22, 1998,

"There are many laws and regulations related to spills of hazardous substances and stormwater discharge into waters of the United States...Any fuel spill greater than 25 gallons, which is more than 72 hours old is supposed to be reported to the Environmental Protection Agency (EPA) in Washington, D.C. Our stormwater permits from the State Department of Health (DOH) require that all tenants who handle fuel have current spill control and countermeasures plans. At KOA, the storm drainage does not enter the ocean directly, but flows through underground fissures which eventually reach the ocean. The waters offshore at Keahole Point are Class AA, the highest DOH water quality requirement. We have an agreement to do ground water quality measurements at KOA and have several wells from which are samples are taken. Spills which seep into the pahoehoe and a'a lava cannot be tolerated. Consequently, the floor of the existing fuel farm area should be sealed so that spills will not go down into the ground water table. Possibly, this could be done with some form of cement grout. New fuel farms will have to involve membrane barriers which retain all spills."

Based on existing soils conditions at KOA, water quality testing has been completed and has demonstrated satisfactory performance of environmental mitigation measures at the airport. The results of the water quality monitoring report will be provided in the Final EA.

F. Is Individually Limited But Cumulatively Has Considerable Effect on the Environment or Involves a Commitment to Larger Actions

The proposed improvements at KOA are the result of a master planning process which is itself designed to reduce and minimize the effects of fragmentary or disjointed planning leading to adverse cumulative impacts.

The 1988 KOA Master Plan development plan identified proposed actions in two areas: (1) Airfield Facilities; and, (2) Terminal and Airport Support Facilities. Since that time, several 1988 KOA Master Plan projects have been completed. This includes Terminal Improvements for Phases I, II and III; Aircraft Rescue and Fire Fighting Facility (ARFF); Upgrade of Utilities, Phase I, Road "N"; Peripheral Road and Parking Expansion; and, the Runway Extension and Overlay Project. The results of followup environmental reports and monitoring studies

associated with these projects indicate that no significant adverse individual or cumulative impacts have resulted from development.

The current use of followup studies and monitoring will continue to be applied to remaining projects identified in the 1988 Master Plan and the 1998 Master Plan Update. We believe that continued adherence to Federal, State, and County regulations, along with continued monitoring will demonstrate the effectiveness of this approach and result in no significant adverse cumulative impacts.

G. Substantially Affects a Rare, Threatened, or Endangered Species or its Habitat

The DEA indicates there are no rare, threatened, or endangered species within the KOA urban limits. Unlike Kahului, we do not anticipate this action to cause "disruption changes or deterioration to the existing flora and fauna habitat, or may cause an introduction of a species of plant or animal on the airport." We are in the process of evaluating an Alien Species Action Program at Kahului Airport which could influence procedures at other State airports providing domestic and international overseas service if risk analyses show that more attention is required. The inspection procedure would be commensurate with the risk analysis associated with the point of origin of the flights. The Kahului Plan is being coordinated with various agencies including, but not limited to: State Department of Land and Natural Resources; State Department of Agriculture; U.S. Fish and Wildlife Service; and U.S. Department of Agriculture. Although a pilot program is being developed for the Kahului Airport, it should be noted that the lava fields of Kona are not hospitable to many species.

H. <u>Detrimentally Affects Air or Water Quality or Ambient Noise Levels</u>

Air, water quality, and noise monitoring for the proposed project have been undertaken in the <u>Keahole Airport PM10 (Air Quality) Monitoring Report</u> for various periods from November 1996 through July 1997; in the previously referenced water quality monitoring report; and in the <u>KOA Part 150 Noise Compatibility Report</u>, 1997. The results of the Part 150 report indicate that there are no existing incompatible land uses within the 5-year Noise Exposure Map for KOA; therefore, noise mitigation measures should not be required. The findings of the air and water quality monitoring studies have similarly found no major adverse impacts associated with operations of the KOA facility. The data will be provided in the Final EA.

I. <u>Effects or is Likely to Suffer Damage by Being Located in an Environmentally Sensitive Area Such as a Flood Plain, Tsunami Zone, Beach, Erosion-Prone Area, Geologically Hazardous Land, Estuary, Fresh Water, or Coastal Waters</u>

Additional information to substantiate the determination of no adverse effect is provided in the following:

Flood Plain - As noted in the DEA, "The airport is located outside of any floodway or flood fringe zones as described by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM)."

Tsunami Zone - Also noted in the DEA, the terminal building area is located outside the tsunami evacuation zone with the boundary of the tsunami zone west of the existing runway.

Beach, Erosion-Prone Area - There is no erosion hazard at KOA, as the underlying geology of the airport is comprised of a'a and pahoehoe lava.

Geologically Hazardous Land - Earthquakes at KOA and on the island of Hawaii cannot be avoided, but must be overcome by appropriate construction practices and administration of facilities. As noted in the DEA, the County of Hawaii has adopted the uniform building code to reduce the potential for adverse impacts. Volcanic hazards are a similar problem, although the potential for hazards can be somewhat overcome through careful siting of facilities. In the case of KOA, the most immediate potential problem is the location of Hualalai, which is technically an active volcano. According to the KOA Master Plan Update, 1998, KOA lies within lava flow hazard Zone 4, with Zone 1 having the highest level of hazard and Zone 9, the least. The location of KOA is within an area of moderate hazard.

Estuary and Fresh Water - There are no estuarine or fresh water resource sites (e.g., wells, streams, rivers) at KOA as the project site is located within a lava field. Additional discussion on potential anchialine resources will be provided in the Final EA.

Coastal Waters - KOA is located within Class "AA" waters according to the State Department of Health, which also regulates coastal water quality. As previously stated, an NPDES permit will need to be filed if there is potential for discharges to coastal waters.

8. No-Action Laws

We acknowledge that no further projects may be constructed until sufficient review through the HRS, Chapter 343 process is completed. This limitation, however, cannot extend to projects previously identified in the 1988 KOA Master Plan EIS.

AIR-P
00.0445

Thank you for this opportunity to respond to your comments. Please contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

Stephen K. Yamashiro
Mayor

County of Hawaii

PLANNING DEPARTMENT
25 Aupuni Street, Room 109 • Hilo, Hawaii 96720-4252
(808) 961-8288 • Fax (808) 961-8742

Virginia Goldstein
Director

Russell Kokubun
Deputy Director

April 30, 1999

Mr. Jerry M. Matsuda, P. E.
Airports Administrator
State Department of Transportation
Airports Division
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, HI 96819-1880

Dear Mr Matsuda:

Draft Environmental Assessment (EA)
Kona International Airport at Keahole
Master Plan Update
TMK (3)7-3-043:033 North Kona, Hawaii

We have reviewed the Draft EA prepared for the Kona International Airport at Keahole Master Plan Update. We have the following comments:

1. Names for Road "P" and Road "N" are proposed as "Kole Road" and "Ulua Road" respectively. These names do not conform to the County's Street Naming Policy as they are already used as street names on the Island of Hawaii. These streets and all other streets should be named in accordance with the County's Street Naming Policy. Street Names need to be approved by the County Council; please initiate the naming through the Planning Department.

2. The Overseas Terminal Improvements should be expedited. We recommend moving up these Improvements to Phase I. Permanent Federal Inspection Services (FIS) facilities should be constructed in conjunction with the Overseas Terminal.

3. Figure 1-3 as well as others illustrate Commercial/Industrial Use north and south of the Airport Access Road at its intersection with Queen Kaahumanu Highway. Currently,

these sites are zoned Open by the County and Commercial/Industrial Uses would not be permitted. The planning and construction of infrastructural improvements in anticipation of Commercial/Industrial Uses may be premature.

Currently, the adjoining parcels south of Keahole Airport under the authority of the Natural Energy Laboratory Hawaii Authority (NELHA) and commonly referred to as the Hawaii Ocean & Science Technology (HOST) Park are already zoned for Industrial Use and infrastructural improvements connecting Keahole Airport to HOST Park by extending Road N to the NELH Access Road may provide the same results.

The County's Kailua to Keahole Plan discusses a graded interchange on Queen Kaahumanu Highway in the vicinity of the existing Airport Access Road. Coordination with DOT-Highways should be initiated.

4. Currently the traffic circulation makai of Queen Kaahumanu Highway within the Airport mixes service vehicles with passenger vehicles. Roads need to be constructed to minimize this mix as well as to improve the vehicular flow of arriving and departing passengers.

Thank you for the opportunity to comment. Should you have any questions, please feel free to contact us.

Sincerely,

VIRGINIA GOLDSTEIN
Planning Director

RKN:gp

cc: West Hawaii Office
Research & Development

BENJAMIN J. CAYETANO
GOVERNOR

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-P
00.0434

August 15, 2000

Ms. Virginia Goldstein
Planning Director
County of Hawaii
Planning Department
25 Aupuni Street, Room 109
Hilo, Hawaii 96720-4252

Dear Ms. Goldstein:

This is in response to your comments for the Draft Environmental Assessment (DEA), Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii.

1. The Department of Transportation, Airports Division (DOT-A) recently completed the requirements for the County of Hawaii, Street Naming Policy. This process has resulted in selection of the following road names:

New Street Name	Replaces
Halalū Street	Lease Lot Access Road
A'u lepe Street	Lease Lot Access Road
Keāhole Street	Airport Access Road
'O'opu Street	Maintenance Baseyard Access Road
Ū'ū Street	Cargo Road
Kūpīpī Street	Peripheral Road
Hāpu'upu'u Street	Taxiway Access Road
Pāo'o Street	Road "N"

As required, we will coordinate the naming of future airport access roads with the Planning Department.

2. Although it is the desire of DOT-A to expedite construction of the new Overseas Terminal (OST) and related Federal Inspection Services (FIS) facilities, our current schedule

requires that we prioritize development to meet safety and efficiency objectives within a limited budget. Should additional funding become available prior to the scheduled development of these facilities during the Phase II, 2004 timeframe, we will seriously consider an accelerated schedule which will be coordinated with all required parties.

3. There are no plans for immediate development of the proposed commercial/industrial use areas north and south of the Airport Access Road intersection with Queen Kaahumanu Highway. These areas are in the County of Hawaii's, open zoning designation and would require a change of zone or variance before development. Therefore, future realization of this area will require coordination with appropriate government agencies including the County of Hawaii, Department of Planning, as well as the general public.

4. The following airport traffic circulation improvements have been proposed in the KOA Master Plan to reduce the mixing of service vehicles with passenger vehicles:

Phase I Projects (FY 1998 - 2003)

Road "P" - This project calls for construction of a new airport road providing restricted access to Queen Kaahumanu Highway for vehicles serving proposed new fuel, postal and flight kitchen facilities. Road "P" will be located north of the existing airport access road.

Road "M" - This project calls for construction of a new access road along the general aviation area to relieve traffic congestion along the terminal loop road from large fuel tankers and cargo vehicles.

Phase III Projects (FY 2010 - 2015+)

Connecting Road "L" - This project involves the construction of a direct access road from the main airport access road to the general aviation and fixed base operator area.

We appreciate your review of the DEA and allowing us the opportunity to respond. Please have your staff contact Ben Schlapak, Head Planning Engineer at (808) 838-8821 to clarify any questions you may have.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Director of Transportation

c: Keahole Associates, Inc. (M. Inouye)

BENJAMIN J. CAYETANO
Governor

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512

JAMES J. NAKATANI
Chairperson, Board of Agriculture

LETITIA N. UYEHARA
Deputy to the Chairperson

Mailing Address:
P.O. Box 22159
Honolulu, Hawaii 96823-2159

Fax (808) 973-9613

May 4, 1999

Mr. Jerry M. Matsuda, P.E.
Airports Administrator
Hawaii Department of Transportation
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

Dear Mr. Matsuda:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
KONA INTERNATIONAL AIRPORT AT KEAHOLE
MASTER PLAN UPDATE
NORTH KONA, HAWAII

The Department of Agriculture (DOA) has reviewed the subject Draft Environmental Assessment (Draft EA) for the Kona International Airport (KOA) and is pleased to submit the following comments for your consideration:

The DOA is a participant with the DOT-Airports in the Alien Species Action Plan (ASAP) for the proposed runway extension and related improvements for Kahului Airport. We note that no alien species mitigation measures have been proposed in the Draft EA for KOA. Alien species interdiction measures at Kahului Airport could set a precedence for similar measures for other airports in the state and consideration should be given to develop a similar plan for KOA. However, a Wildlife Hazard Management Plan prepared by the FAA to address the potential for bird/aircraft collisions has been included in the Appendix.

If the passenger and cargo volume projections for KOA are close to being correct and if alien species interdiction measures are required, the DOA will require additional personnel to adequately inspect and clear the increased volumes being projected. Consideration should be given to providing canine detector dog teams to assist in this effort.

We noted that no provisions were made for office space in the proposed overseas terminal building for the DOA. We request that the DOA be consulted as planning and design proceed so that adequate inspection areas, quarantine displays, equipment, communication needs for our staff and with Federal inspection agencies can be addressed.

Please contact Earl Yamamoto, Planner, at 973-9466 and/or Myron Isherwood, Plant Quarantine Program Manager, at 586-0846 if you have any questions.

Sincerely,

JAMES J. NAKATANI
Chairperson, Board of Agriculture

JJN:MOI:jb
1572/PDCQ

c: Mr. Gary Gill
Mr. Michael Inouye

BENJAMIN J. CAYETANO
GOVERNOR

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-P
00.0436

August 15, 2000

TO: JAMES J. NAKATANI, CHAIRPERSON
DEPARTMENT OF AGRICULTURE

FROM: KAZU HAYASHIDA
DIRECTOR OF TRANSPORTATION

This is in response to your comments for the Draft Environmental Assessment (DEA), Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii.

We acknowledge our joint participation with you in developing a Alien Species Action Program (ASAP) at Kahului Airport. We are currently in the process of evaluating an ASAP at Kahului Airport which could influence procedures at other State airports providing domestic and international overseas service, if risk analyses show that more attention is required. The inspection procedure would be commensurate with the risk analysis associated with the point of origin of the flights. The Kahului Plan is being coordinated with various agencies including, but not limited to, State Department of Land and Natural Resources; State Department of Agriculture; U.S. Fish and Wildlife Service; and U.S. Department of Agriculture. Although a pilot program is being developed for the Kahului Airport, it should be noted that the lava fields of Kona are not hospitable to many species. We believe that the procedures in place at Honolulu International Airport are adequate and form the basis for a State standard. We will continue our close coordination with your department on this issue.

Design input from the Department of Agriculture to identify space requirements in the Overseas Terminal (OST) will be solicited through coordination which will include use of the Functional Analysis Concept Design (FACD) process. We anticipate this to occur as funding is provided.

We appreciate your review of the DEA and allowing us the opportunity to respond. Please have your staff contact Ben Schlapak, Head Planning Engineer of the Airports Division, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

Stephen K. Yamashiro
Mayor

Diane S. Quitiquit
Director

County of Hawaii
DEPARTMENT OF RESEARCH AND DEVELOPMENT
25 Aupuni Street, Room 219 • Hilo, Hawaii 96720-4252
HILO (808) 961-8366 • Fax (808) 935-1205 - KONA (808) 329-5226 • Fax (808) 326-5663
E-mail: chrisdev@interpac.net

May 6, 1999

Mr. Jerry M. Matsuda P.E.,
Airports Administrator
State Department of Transportation
Airports Division
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

Dear Mr. Matsuda:

Re: Kona International Airport at Keahole Master Plan Update

Our comments on the referenced document are as follows:

1. We remain concerned about the schedule for construction of the Overseas Terminal to service overseas and international flights and to provide a permanent solution to the use of temporary federal inspection and customs facilities. Per Section 3.1.2.A. of the Master Plan Update, this is planned for year 2004. The temporary facilities presently in use were completed early in 1996 with an expected life of 3 to 4 years. In an increasingly competitive environment in the worldwide tourist industry, there is a compelling need to make every aspect of the visitor experience as favorable as possible. Continued use of the temporary OST facilities at KIT for another five years does not comport with our sustained efforts to market the Big Island experience. We urge that construction of the new OST be included in Phase I of the Master Plan with completion in year 2002.

2. In Section 1.9.5, Electrical and Communication System, the current capacity of the HELCO system is quoted as 127 MW with peak demand reaching 102 MW. While these figures do not materially affect the Draft EA, they are in error and should read more like 205 MW and 170 MW respectively. Clearly, HELCO can provide accurate numbers.

3. In Table 3-1, the amount of $2.28 million is shown for the Keahole to Kawaihae Fuel Corridor. A brief mention should be made of the facilities to be funded by this amount.

We thank you for the opportunity to comment.

Sincerely,

Raymond Carr

Raymond Carr,
Economic Development Specialist

cc: Virginia Goldstein, Planning Department
Diane Quitiquit, Director

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII [illegible]

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1959 2000+

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:

AIR-P
00.0437

August 15, 2000

Mr. Raymond Carr
Economic Development Specialist
County of Hawaii
Department of Research and Development
25 Aupuni Street, Room 219
Hilo, Hawaii 96720-4252

Dear Mr. Carr:

This is in response to your comments for the Draft Environmental Assessment (DEA), Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii.

1) Although it is the desire of the Department of Transportation, Airports Division, to replace the existing temporary Overseas Terminal with a permanent solution prior to the proposed Phase II schedule, our current schedule requires that we prioritize development to meet safety and efficiency objectives within a limited budget. Should additional funding become available prior to the 2004 timeframe, we will seriously consider coordinating an accelerated schedule with all required parties;

2) We appreciate your point of clarification regarding Hawaii Electric Light Company, Inc. (HELCO) system capacity. We will review this information with HELCO and revise our data accordingly; and,

3) The configuration for the proposed fuel corridor has yet to be determined due to the preliminary status of the project. We note that a number of environmental and regulatory reviews with government agencies and the general public will also need to be completed before the facility can be realized. We; therefore, expect that as information becomes available, that it will be provided in future KOA Master Plans.

We appreciate your review of the DEA. Please have your staff contact Ben Schlapak, *Head Planning Engineer*, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

for JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

1215

BENJAMIN J. CAYETANO, GOVERNOR
SEIJI F. NAYA, DIRECTOR
BRADLEY J. MOSSMAN, DEPUTY DIRECTOR
David W. Blane, DIRECTOR OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
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Ref. No. P-8070

May 10, 1999

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
MAY 13 9 00 AM '99

To: Kazu Hayashida, Director
Department of Transportation

From: David W. Blane
Director, Office of Planning

Subject: Draft Environmental Assessment (EA)
Kona International Airport at Keahole, Master Plan Update
North Kona, Hawaii

We do not have objections to the proposed project. Our interest is in ensuring that it is designed and carried out in compliance with the Coastal Zone Management (CZM) objectives and policies as required by Chapter 205A, Hawaii Revised Statutes. In this regard, we have the following comments on the draft environmental assessment.

Section 1.9.3 states that "A program of groundwater monitoring and coastal water quality may be executed prior to WWTP development to ensure compliance with applicable water quality standards and to establish baseline data on water quality." We wish to emphasize that groundwater monitoring to ensure coastal water quality *should* be executed prior to, during and after the project. With the enactment of S.B. 560, S.D. 1, H.D. 1, C.D. 1, such monitoring will be mandatory. Please note that the bill also defines "substantial adverse environmental or ecological effect" as:

1. Irrevocable damage, degradation to, or loss of a resource found in an ahupua'a; or

2. A statistically significant persistent increase to the baseline in levels of any of the water pollutants, water quality parameters . . . as identified in administrative rules.

In addition, we also wish to validate section 8.4, which states that various construction projects for FAA navigational aids and related structures may require individual CZM federal consistency permits.

If there are any questions or concerns, please contact Lynn Nakagawa of our CZM Program at 587-2898.

BENJAMIN J. CAYETANO, GOVERNOR

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

KAZU HAYASHIDA, DIRECTOR
DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-P
00.0438

August 17, 2000

TO: DAVID W. BLANE, DIRECTOR
OFFICE OF PLANNING
DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT AND TOURISM

FROM: KAZU HAYASHIDA
DIRECTOR OF TRANSPORTATION

SUBJECT: RESPONSE TO COMMENTS FOR DRAFT
ENVIRONMENTAL ASSESSMENT
KONA INTERNATIONAL AIRPORT AT KEAHOLE
MASTER PLAN UPDATE
NORTH KONA, HAWAII

This is in response to your comments for the subject above. We acknowledge you have no objections to the proposed KOA Master Plan Update and wish to provide the following additional response to your comments:

1) Water quality monitoring at KOA has been completed in the document, Water Quality Monitoring Program for the Keahole Airport Expansion, December 1998. The results of the water quality monitoring indicate that there were no significant unexpected features in the data. All values recorded fell within expected water quality norms for the region and vicinity.

2) We acknowledge requirements per Chapter 205A, Section 8.4, which states that various construction projects for the Federal Aviation Administration (FAA) navigational aids and related structures may require individual CZM Federal Consistency Determination permits from your office. We intend to continue to coordinate this requirement with you.

AIR-P
00.0438

We appreciate your review of the DEA. Please have your staff contact Ben Schlapak, Head Planning Engineer of the Airports Division, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
MEMORANDUM

AIR-P
00.0439

TO: HWY DATE: 08-17-00

FROM: AIR (JERRY M. MATSUDA)

SUBJECT: RESPONSE TO COMMENTS FOR DRAFT ENVIRONMENTAL ASSESSMENT, KONA INTERNATIONAL AIRPORT AT KEAHOLE MASTER PLAN UPDATE NORTH KONA, HAWAII

Thank you for your comments dated May 12, 1999, relating to the Kona International Airport at Keahole, Draft Environmental Assessment. We have prepared the following response to your comments:

1) We will continue to coordinate the proposed widening of Queen Kaahumanu Highway from two to four lanes with the Highways Division; and,

2) We acknowledge your requirement for additional setback at the intersection of the proposed Road "P" with Queen Kaahumanu Highway for construction of a future highway interchange. Your setback requirements will be coordinated with our master planning efforts.

We appreciate your review of the Draft Environmental Assessment. Please have your staff contact Ben Schlapak, Head Planning Engineer, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

1302

State of Hawaii
Department of Transportation
Highways Division

MEMORANDUM

HWY-PS
2.3774

TO: AIR 05/12/99

FROM: PERICLES MANTHOS, HWY P. Manthos

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT, KONA INTERNATIONAL AIRPORT AT KEAHOLE, MASTER PLAN UPDATE, NORTH KONA, HAWAII

We have the following comments:

1. Airports should continue to coordinate this airport master plan update with the Highways Division. Currently, we have a design project to widen Queen Kaahumanu Highway (from 2 to 4 lanes) between Keahole and Kailua.

2. In the distant future, we plan to convert Queen Kaahumanu Highway into a freeway with access permitted only at grade-separated interchanges. One of these future interchanges is located where Road P intersects Queen Kaahumanu Highway. Development of the land adjacent to the Road P/Queen Kaahumanu Highway intersection should be sufficiently set back to allow for construction of a future highway interchange.

c: HWY-DD, -PA, -PS

FC/RFT:gf

BENJAMIN J. CAYETANO
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

May 17, 1999

Mr. Jerry Matsuda
Airports Division
Department of Transportation
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819

Dear Mr. Matsuda:

Subject: Draft Environmental Assessment (DEA) for the Kona International Airport at Keahole Master Plan Update, Keahole, North Kona, Hawaii

We have reviewed the subject DEA and offer the following comments:

1) We confirm that the airport property, as represented on Figure 5-4, is designated within the State Land Use Urban and Conservation Districts. We note that the State land use district boundaries depicted in Figure 5-4 are outdated. In particular, the map does not depict the approximately 2,610 acres immediately mauka of the Queen Kaahumanu Highway which were reclassified from the Agricultural and Conservation Districts to the Urban District for University, residential, commercial, industrial, public facility, and open space uses under LUC Docket No. BR92-685/Office of State Planning. The Final EA should include an updated map of the district boundaries for the area.

   We also note that the legend in Figure 5-4 and page 5-8, section 5.2.3, incorrectly reference the Agricultural District as the "Agriculture" District.

2) There have been several Commission dockets which have resulted in the urbanization of portions of the airport property. These include:

   i) Docket No. A77-430/DOT which involved the reclassification of approximately 822.660 acres of land for the future expansion of the airfield and terminal building complex, as well as the development of general aviation facilities, airline maintenance and service areas, crash/ fire rescue facilities, and airport service facilities at Keahole Airport. Two additional aircraft parking spots, a new fire and rescue building and a Hawaii Air National Guard complex were also planned. Also proposed under the docket was the establishment of the present Natural Energy Laboratory of Hawaii facility at Keahole Point. There were no conditions of approval imposed in this docket.

   ii) Docket No. A81-518/DPED which involved the reclassification of approximately 190.237 acres of land for airport improvements in two phases. Phase I involved the construction of new access roads and utilities, nine acres of aprons and taxiways, a new T-Hangar, two new air cargo buildings with loading docks, a new maintenance baseyard facility, and the relocation of the existing T-Hangar. Phase II involved additional taxiways and aprons, expansion of T-Hangars and Air Cargo, additional commuter airline terminals, airport administrative facilities, airport concessions, helipads, additional roads and facilities, and airport security fencing. Construction of both phases was expected to be completed before 1990. There were no conditions of approval imposed in this docket.

   iii) Docket No. A89-641/DOT which involved the reclassification of approximately 548.160 acres of land for the expansion of Keahole Airport on three parcels of land. Parcel A was proposed for the future heliport facility, future leases, and reserve space for future airport use. Parcel B was proposed for ground transportation facilities (e.g., car rentals). Parcel C was proposed for the extension of the runway and related taxiways, holding aprons, additional terminal space, parking, and other facilities. There were seven conditions of approval imposed in this docket, all with which Petitioner DOT must comply.

   The Final EA should include a discussion of the status of these various improvements within the context of the Keahole Master Plan Update.

We have no further comments to offer at this time. Should you have any questions, please feel free to call me or Bert Saruwatari of our office at 587-3822.

Sincerely,

ESTHER UEDA
Executive Officer

EU:aa

cc: Keahole Associates, Inc.
OEQC

BENJAMIN J. CAYETANO
GOVERNOR

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-P
00.0440

August 17, 2000

TO: ESTHER UEDA, EXECUTIVE OFFICER
LAND USE COMMISSION
DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT AND TOURISM

FROM: KAZU HAYASHIDA
DIRECTOR OF TRANSPORTATION

SUBJECT: RESPONSE TO COMMENTS FOR DRAFT
ENVIRONMENTAL ASSESSMENT
KONA INTERNATIONAL AIRPORT AT KEAHOLE
MASTER PLAN UPDATE
NORTH KONA, HAWAII

Thank you for your comments regarding the subject relating to the Kona International Airport at Keahole (KOA), Draft Environmental Assessment (DEA). We have prepared the following response to your comments:

1) We acknowledge the revised boundary reclassification of the 2,610 acres to the Urban District under LUC Docket No. BR92-685, Office of State Planning;

2) The following is an update of the Land Use Commission (LUC) dockets you indicated:

i) LUC Docket No. A77-430/DOT - Involving the Reclassification of 822.660 acres: According to the KOA Master Plan Update, Runway 17-35 remains at 11,000 feet in length. A new second parallel runway is not proposed at this time.

The previously proposed terminal complex incorporating the Overseas Terminal has been revised as indicated in the Master Plan Update. This facility is scheduled for construction as part of Phase II, in the FY 2004 to FY 2009 timeframe.

General aviation, airline maintenance and support, and airport support facilities are proposed as part of the current Master Plan Update into the following: General Aviation Site Development; General Aviation Fuel Storage System Site Preparation; Itinerant Aircraft Parking; Ground Transportation Lease Lots; Air Tours Terminal, etc. Existing Air Rescue and Fire Fighting (ARFF) facilities comprised of an ARFF Station and ARFF Training Facility remain located respectively, south of the Interisland Terminal, and at the north end of existing Service Road "H".

The planned Hawaii Air National Guard facility has not yet been constructed and there are no current plans to do so. The Natural Energy Laboratory of Hawaii, as you indicated, has been completed and is located at the tip of Keahole Point, adjacent to the U.S. Coast Guard facility.

ii) LUC Docket No. A81-518/DPED - Involving the Reclassification of 190.237 acres: The current airport access roads and utilities have been largely completed. New airfield aprons, taxiways, T-hangars and two air cargo buildings are also configured as noted in the current Airport Layout Plan (ALP). Airport administrative facilities (two administrative buildings) have been constructed immediately north of the Interisland Terminals and are also noted in the ALP. In accordance with Docket A81-518, these facilities were completed prior to 1990.

iii) LUC Docket No. A89-641/DOT - Involving the Reclassification of 548.160 acres: The proposed heliport is planned to be reconfigured to an area immediately north of the general aviation area. The heliport site is expected to have improved access. The ground transportation area remains at its current location, east of the Interisland Terminal area. The current 11,000 foot runway is not slated for further extension as the existing facility is expected to be sufficient for forecasted growth to the year 2015. No other runway improvements are planned beyond those described in the KOA Master Plan Update ALP.

Conditions imposed upon the project have been complied with as follows:

Condition 1 - There shall be no residential construction on any portion of the property subject to noise levels greater than 60 Ldn - no residential development has been, or shall be permitted by DOT within the project site.

Condition 2 - Petitioner shall participate in an air quality monitoring program as specified by the Department of Health (DOH) - Air quality monitoring has been implemented at KOA. The results of the air quality monitoring reports will be included in the Final EA document.

Condition 3 - Petitioner shall monitor the vehicular traffic attributable to the development proposed in the petition area at on-site and off-site locations, and shall undertake subsequent mitigation measures that may be required in coordination with the Department of Transportation (DOT) - According to the DEA the existing airport access road is adequate to support the current volume of traffic at the airport. Improvements to the access road and interior road system to meet future requirements will be undertaken on a phased approach as delineated in the DEA.

Condition 4 - Petitioner shall prevent contaminants resulting from construction activities from impacting coastal waters, especially near the Natural Energy Laboratory of Hawaii (NELH) and the Hawaii Ocean Science and Technology (HOST) Park - According to the report, Water Quality Monitoring Program for the Keahole Airport Expansion, July 15, 1997 to June 15, 1998, there were no major adverse findings for toxic, hazardous, or deleterious constituents in the water column due to project activities at KOA. Use of existing State and County regulations governing construction activities will continue to be used at KOA to ensure no adverse impacts to water quality.

Condition 5 - Petitioner shall participate in a groundwater and coastal water quality monitoring program with NELH and HOST Park - The Water Quality Monitoring Program for the Keahole Airport Expansion,

July 15, 1997 to June 15, 1998, was completed in 1998 under the joint participation of DOT-A, NELH, and the HOST Park. As noted above, there were no significant adverse findings for water quality.

Condition 6 - Petitioner shall provide wastewater treatment and transmission facilities as may be required by the State DOH - DOT-A has been and continues to work with DOH to ensure adherence to Federal, State, and County of Hawaii rules and regulations governing wastewater treatment and transmission.

Condition 7 - Petitioner shall preserve and protect such archaeological sites as may be required by the State's Historic Sites Section. Petitioner shall immediately stop work on the impacted area and contact the State's Historic Sites Section should any archaeological resources such as artifacts, shell, bones, or charcoal deposits, human burial, or rock or coral alignments, paving or walls of historic or prehistoric significance be encountered during the development in the petition area - A recent archaeological survey of sites at KOA was completed in April 2000. The results of the survey which confirms "no effect" to historic sites will be provided in the Final EA document.

We appreciate your review of the DEA. Please have your staff contact Ben Schlapak, Head Planning Engineer of the Airports Division, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

HAWAII LEEWARD PLANNING CONFERENCE

P.O. BOX 635 • KAILUA-KONA, HAWAII

1242

May 18, 1999

Mr. Jerry M. Matsuda, P. E.
Airports Administrator
State Department of Transportation
Airports Division
Honolulu International Airport
400 Rodgers Boulevard Suite 700
Honolulu, HI 96819-1880

Dear Mr. Matsuda:

RE: DRAFT ENVIRONMENTAL ASSESSMENT (EA)
KONA INTERNATIONAL AIRPORT AT KEAHOLE

Thank you for the opportunity to comment.

1. Our main concern is the temporary status and future funding timetable of the overseas facilities. As you are aware, the existing structure is only permitted on a temporary basis. Until a permanent facility can be funded, we would like to request your consideration of minor upgrades to the existing building to satisfy County Codes and remove the vulnerability of having to deal with the Board of Appeals process. Perhaps inexpensive aesthetic improvements could also be incorporated, such as bamboo or fabric screens. Of course, anything to expedite funding of a permanent facility would be welcome.

2. In Table 3-1 we request clarification of the facilities to be funded for the Keahole to Kawaihae Fuel Corridor – Budget $2.28 million.

Sincerely,

JBR

John B. Ray
President

JBR/ba

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 16, 2000

IN REPLY REFER TO:
AIR-P
00.0441

Mr. John B. Ray
President
Hawaii Leeward Planning Conference
P. O. Box 635
Kailua-Kona, Hawaii 96745-0635

Dear Mr. Ray:

This is in response to your comments for the Draft Environmental Assessment (DEA), Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii.

1. We acknowledge your request to consider minor upgrades to the temporary Federal Inspection Services (FIS) facility. The Department of Transportation (DOT) has requested an extension of the current variance for the structure.

   Although it is the desire of DOT, Airports Division to replace the existing temporary FIS facility with a permanent Overseas Terminal/FIS solution prior to the proposed Phase II schedule, our current schedule requires that we prioritize development to meet safety and efficiency objectives within a limited budget. Should additional funding become available prior to the 2004 timeframe, we will seriously consider coordinating an accelerated schedule with all required parties;

2. The configuration for the proposed fuel corridor has yet to be determined. We note that a number of environmental and regulatory reviews with government agencies and the general public will need to be completed before the facility can be realized. We, therefore, expect that as information becomes available that it will be provided in a future KOA Master Plan.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

1374

157-C Hokulani Street
Hilo HI 96720

May 19, 1999

Airports Division
Department of Transportation
400 Rodgers Blvd., Suite 700
Honolulu HI 96819

Attention: Jerry Matsuda

Subject: Comments on Draft EA for Kona International Airport Master Plan Update

Dear Sir or Madam:

Thank you for allowing me the opportunity to review the Draft Environmental Assessment for the Kona airport master plan update. I have the following comments.

1. Lack of discussion of a no-action alternative. I believe that the discussion of no-action alternatives is required by the National Environmental Policy Act, with which this document must comply. Section 4 of the DEA describes the several alternatives considered; none of this is a no-action alternative.

2. The wastewater treatment plant. It is not clear where exactly the new wastewater treatment plant will be sited. Since the area to the north of the terminal abuts a state park, it is important that odors, noises, and visual impact of the WWTP on the park be minimized. There needs to be additional discussion of the potential impact of the WWTP on the park. Also, if the WWTP is to be developed in the Conservation District area of the airport property, mention should be made of the need to comply with Conservation District rules administered by the Department of Land and Natural Resources.

3. Passenger projections. There is no clear discussion of passenger traffic projections at KOA in this document. On page 1-27, there is the statement that visitor arrivals at KOA are anticipated to increase at a rate of 1.7 percent a year, a rate "significantly lower than was previously projected in the early 1990s." In a lengthier discussion of visitor projections in section 6 (pages 6-6 through 6-13), this statement is repeated, with the source given as an October 1994 study by Aries Consultants. This 1994 study is said to include actual figures from 1997, both in the text (page 6-12) and in Table 6-11 (page 6-13). It is not clear to me how a 1994 study can provide "actual" figures from 1997. Also, table 6-9, which shows visitor projections from 1985 to 2015, contains a forecast for 1995. By now, surely actual numbers are available and must be included.

   Also, there is no meaningful discussion of the projected resident growth in the region served by KOA and how this *might impact traffic at the facility. Instead, Table 6-4* provides projections from a 1982 Kona Regional Plan, showing three differing scenarios for years 1980 to 2000 in five-year increments. *The fact that "actual" figures should be available for four of the five periods displayed on the chart* makes the chart virtually useless. Which of these three scenarios is closest to actual build-out and population figures? And how do these population figures translate into inter-island traffic forecasts? In addition, there should be some projection of residential population through at least the year 2015, given the planning frame for this master plan. In a similar vein, tables 6-5, 6-6, 6-7, and 6-8 are all but useless in terms of the discussion in the text.

   Finally, on page 6-14, there is the sentence: "If planned developments are any indication of future tourism growth in Hawaii, then the development market is planning to meet the expected growth demand." English is my mother tongue and I write for a living. For the life of me, I cannot figure out what meaning this sentence is intended to convey. I suggest it is unhelpful and should be eliminated if no better phrasing of the author's intent can be found.

4. Potable water supply. On page 1-29, in the executive summary, the statement is made that the North Kohala Consortium will replace an existing municipal water line. This is repeated on page 7-10. I did not know that the plans for a "North Kohala Consortium" were so far developed as to allow the project to be referred to in such definite terms. It is my understanding that this project has yet to find a source of financing and is far from a firm project that can be counted on as a potable water source for KOA.

5. Solid waste. The discussion of solid waste is limited to one paragraph on page 2-35. It is apparent from this that the only plan that the Department of Transportation has to deal with solid waste is to continue to truck it to the landfill. Elsewhere around the country, efforts are being made at airports to recycle a large portion of solid waste generated by passengers, including aluminum cans, glass bottles, newspapers and magazines. Why cannot this be done here – or at least considered? Also, there should be consideration of requiring airport vendors to develop their own waste reduction plans, which could include such elements as use of reusable durable goods (i.e., have restaurants use china and glassware for eat-in customers), or aggressive recycling programs. The fact that this draft EA gives such short shrift to recycling, especially in light of what is occurring at airport facilities elsewhere in the country, is simply unconscionable.

6. Discussion of space requirements. Table 2-2 discusses terminal building space "requirements." From the year 2000 to 2005, "requirements" are projected to double – from 16,000 square feet to 32,000 square feet. There is no justification provided in this draft EA for such a dramatic increase. Indeed, should visitor traffic grow at the 1.7 percent rate forecast by Aries Consultants, the increase in visitor traffic over this period would be barely 10 percent – not 100 percent.

7. Impact of alien species. As the DOT should be aware, the impact of unwanted species of plants and animals, with a potential to harm unique Hawai'i biota, increases with every arrival of an international flight. This has been one of the most controversial points in efforts to expand the Kahului airport to accommodate increasing numbers of overseas flights. I do not understand why there is no mention whatsoever of potential impacts of alien species nor discussion of any mitigation measures that might be needed to head off such impacts.

It is not clear to me whether elements of the various phases will themselves require preparation of a draft EA. For example, would the construction of the fuel farm or the overseas terminal be subject to separate review under Chapter 343 of Hawai'i Revised Statutes or NEPA, or would they be developed without further opportunity for public comment should the anticipated FONSI for this master plan be accepted?

In light of the deficient analysis of traffic projections, solid waste, water, space requirements, and other flaws mentioned above, I would urge the DOT at the very least to prepare a revised draft EA, subject to de novo comment from the public.

But in light of the vast scope of the improvements anticipated, I believe the finding of no significant impact is unwarranted and the DOT is required to prepare a full Environmental Impact Statement to comply with terms of applicable state and federal laws.

Thank you for your attention to my concerns. I look forward to hearing from you.

Best wishes,

Patricia Tummons

BENJAMIN J. CAYETANO
GOVERNOR

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:

August 17, 2000

AIR-P
00.0442

Ms. Patricia Tummons
187-C Hokulani Street
Hilo, Hawaii 96720

Dear Ms. Tummons:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii. We have prepared the following response to your comments:

1. No Action Alternative - Further discussion of the "no action" alternative will be provided in the forthcoming final environmental document for this project;

2. Wastewater Treatment Plant (WWTP) - The general location of the proposed WWTP is noted in the KOA DEA and has not markedly changed since it was identified in the 1988 KOA Master Plan Final Environmental Impact Statement. The WWTP will be on urban zoned land and will be designed to produce Class I reclaimed water (R-1), which is the highest quality effluent available for reuse with minimal restrictions on use. Consequently we anticipate no negative adverse impacts on the area environment, including the park which you describe.

3. Passenger/Population Data -

   A. Table 6-9: State of Hawaii Visitor Projections, identifies the historical as well as forecast projections for visitors to the State in five year increments. The visitor projections provided in this table are designed to reflect long term trends rather than recent and cyclic passenger upturns and downturns due to economic, political and social crises such as the Gulf War. The long term averages presented, therefore, may not necessarily represent current marketplace events.

   B. Table 6-11: Air Passenger Forecasts for KOA includes 1997 data for actual passenger enplanements and deplanements as well as the 1994 data previously assembled by Aries. We will provide a notation to Table 6-11 to indicate the 1997 data is from the Department of Transportation, Airports Division (DOT-A).

   C. The KOA DEA notes that the basis for evaluating traffic impacts due to developments such as KOA have also been assessed in the Queen Kaahumanu Highway Widening Environmental Assessment (EA), DOT, May 1996. The EA indicates that forecast traffic from KOA as well as surrounding developments will necessitate the upgrading of Queen Kaahumanu Highway from a two to four lane facility. The intersection connecting the airport access road with the highway will require a three legged intersection which was completed in 1997. Internal traffic circulation within KOA will be handled by the existing network of access roads and proposed new roads as represented in the KOA DEA. Construction of the proposed highway widening project is expected to be forthcoming pending a revised implementation schedule.

   D. Descriptive data you describe in Tables 6-4 through 6-8 will be revised as required.

   E. Your comment regarding page 6-14 is noted.

4. North Kohala Consortium - The organization identified in the DEA will be amended. The correct reference should read, "North Kona consortium." The "consortium" is not a registered entity, but represents parties in principal to a memorandum of understanding calling on joint support to develop water resources for the North Kona region of Hawaii. The efforts of this group has led to development of the North Kona Water Master Plan, 1995 which recommends improvements to the County water system to meet demands to the year 2015. The North Kona Water Master Plan identifies required source and transmission projects to support future development of new and existing projects such as KOA.

5. Solid Waste - Additional information regarding waste management will be provided.

6. Space Requirements for Terminal Facilities - The requirement for increased terminal space is based on the need to provide relief from current congestion in the terminal area due to mixing of interisland and overseas passengers which have different space requirements. The terminal facilities were initially designed for only two carriers while the current space operates with two interisland and three overseas carriers (JAL, United, and TWA). This creates operational inefficiency, congestion, and reduced safety for users at KOA.

7. Impact of Alien Species - We are in the process of evaluating an Alien Species Action Program at Kahului Airport which could influence procedures at other State airports providing domestic and international overseas service if risk analyses show that more attention is required. The inspection procedure would be commensurate with the risk analysis associated with the point of origin of the flights. The Kahului Plan is being coordinated with various agencies including, but not limited to: State Department of Land and Natural Resources; State Department of Agriculture; U.S. Fish and Wildlife Service; and U.S. Department of Agriculture. Although a pilot program is being developed for the Kahului Airport, it should be noted that the lava fields of Kona are not hospitable to many species.

8. Preparation of an EIS - The DEA for the subject project was prepared based on Hawaii Revised Statutes (HRS), Chapter 343, governing preparation of Environmental Impact Statements. The determination to utilize an EA for the review of the proposed KOA Master Plan Update is based on the following:

A) A prior EIS was completed for KOA in October 1988. The majority of Master Plan projects represented in the 1988 EIS have substantively remained the same with only minor changes to reflect new environmental, regulatory, and safety requirements, and location and design changes to meet updated needs. This is the primary reason why the current project is referred to as a Master Plan Update, and not a major new Master Plan. Consequently, due to the relatively minor level and scope of changes proposed at KOA, a decision was made to develop an EA and not an EIS;

B) The prior EIS describes the majority of projects proposed at KOA. The EIS, therefore, already addresses the requirements of HRS, Chapter 343; and,

C) During preparation of the Master Plan a number of steps were taken to ensure public notice and input. It is also our intent to comply with all required environmental laws and regulations as it relates to protection of the environment.

9. Opportunity for Public Input - In addition to the data presented in the DEA, DOT-A solicited a number of government agency and public reviews through the KOA Technical Advisory Committee (Table 1-1, DEA); Public informational meetings; KOA Part 150, Noise Compatibility Program, December 1997; and various Functional Analysis Concept Design (FACD) meetings for KOA projects. The current DEA represents part of this ongoing effort to ensure sufficient public review and input.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

Jerry M. Matsuda

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
PO BOX 621
HONOLULU, HAWAII 96809

MAY 20 1999

Ref:PS:EH

Mr. Jerry M. Matsuda, P.E., Airports Administrator
Airports Division
Department of Transportation
State of Hawaii
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

Dear Mr. Matsuda:

Subject: Draft Environmental Assessment (DEA)
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

We have reviewed the subject DEA document and offer the following comments for your consideration.

Specific comments on the proposed project submitted by the Engineering Branch of the Land Division are attached.

Land Division, Planning Section:

We note that the subject report identifies that future development of a parallel runway west of the existing runway will eventually require an amendment to the State Conservation Land Use designation as well as a change in County zoning.

Our understanding is that the DLNR Historic Preservation Division will respond directly to you on the proposed project.

In order for us to distribute the final document to our Land Division Hawaii District Office and the Engineering Branch we request that three copies be transmitted to the department.

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

Should you have any questions or require further assistance, please contact staff planner Ed Henry at 587-0380.

Very truly yours,

for TIMOTHY E. JOHNS
Chairperson

Attachment

c.c. OEQC
Keahole Associates
Atten: Michael Inouye
HPD
Engineering Branch
HDLO

ENGINEERING BRANCH

COMMENTS

Section 2.4.6.1 Potable Water System:

The description of the potable water system should include an explanation of the source development and the expansion of the existing water system, as stated in the North Kona Water Master Plan dated June 1995 (prepared by Fukunaga and Associates).

Although the existing 12-inch main along Queen Kaahumanu Highway may be adequate to convey the ultimate flows for the airport and other proposed Keahole area developments the other water system components may not be adequate. The North Kona Water Master Plan recommends the following improvements to the County water system to meet the water demands for Year 2015:

1. Development of the Kona high-level aquifer, well sources Mauka of Mamalahoa Highway between Kalaoa and Holualoa.
2. Transmission mains along Mamalahoa Highway from Keopu to Kaloko.
3. Transmission mains and reservoirs along Hina Lani Drive from Mamalahoa Highway to Queen Kaahumanu Highway.
4. 1.0 MG reservoir adjacent to the existing Keahole 0.5 MG reservoir.

The transmission mains would permit water from high level well sources to be transmitted by gravity to the existing 12-inch main along Queen Kaahumanu Highway and to the Keahole area.

For your information the Engineering Branch Land Division is designing a portion of the transmission main along Hina Lani Drive in accordance with the Phase I North Kona Water Master Plan improvements. The approximately 3,000 Lineal Feet of 24-inch transmission line is tentatively scheduled to be completed by September 2000. Also, the construction of the 1.0 MG Keahole Reservoir is scheduled to be completed by October 1999.

A description of the basis of calculation for the current average daily demand (ADD) and future ADD should also be included.

Provide quantities and possible implementation schedule for effluent reuse for irrigation.

5.3 Natural Hazards:

The proposed project site, according to FEMA Community Panel Map No. 155166 0680 C, is located in Zone X. This is an area determined to be outside the 500-year flood plain. Therefore, we confirm that the site is located outside of any floodway or flood fringe zones.

BENJAMIN J. CAYETANO
GOVERNOR

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-P
00.0443

August 17, 2000

TO: TIMOTHY E. JOHNS, CHAIRPERSON
DEPARTMENT OF LAND AND NATURAL RESOURCES

FROM: KAZU HAYASHIDA
DIRECTOR OF TRANSPORTATION

SUBJECT: RESPONSE TO COMMENTS FOR DRAFT ENVIRONMENTAL ASSESSMENT
KONA INTERNATIONAL AIRPORT AT KEAHOLE
MASTER PLAN UPDATE
NORTH KONA, HAWAII

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii.

1. Future requirements for the potable water system were obtained from the Memorandum of Understanding (MOU) for State Water Development and Water System Improvements to Support State Projects, North Kona, Hawaii. The MOU was approved on January 29, 1993, by several parties including: Department of Land and Natural Resources; Housing Finance and Development Corporation; Board of Agriculture; Department of Transportation; Natural Energy Laboratory of Hawaii Authority; University of Hawaii; and County of Hawaii Department of Water Supply. Under the MOU, 6.47 mgd average daily demand (or 9.70 mgd maximum daily demand, which is defined as 1.5 times average daily demand) of water is required in the next 20 years for projects planned by the six State agencies participating in the MOU. KOA is one of the six projects covered by the MOU. KOA, which is operated

by the State Department of Transportation, Airports Division, provides air transportation service to the West Hawaii Region. In 1991, the airport accommodated 2,118,777 passenger enplanements and deplanements. Upgrading the existing water facilities are proposed to accommodate both present and future water needs.

2. The average daily demand (ADD) represents a long-term average amount (demand) used by a water system. KOA's current and future ADD remains at 0.33 mgd.

3. The wastewater treatment plant will be capable of producing R-1 water for irrigation. In the initial phase approximately 40,000 gpd will be available to irrigate 3.95 acres of airport land. The future phase of development will make available approximately 60,000 gpd for the irrigation of 5.74 acres of airport land.

We appreciate your review of the DEA and acknowledge your request for three copies of the final environmental document for this project. Please have your staff contact Ben Schlapak, Head Planning Engineer of the Airports Division, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

May 21, 1999

Mr. Jerry M. Matsuda, Airports Division
State of Hawai'i Department of Transportation
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawai'i 96819

Dear Mr. Matsuda:

We have reviewed the draft environmental assessment for the *Kona International Airport at Keahole Master Plan Update*, and submit the following comments for your consideration and response.

A. ENVIRONMENTAL SETTING

In the context of environmental assessment, the environmental setting provides the backdrop for an analysis of impacts and alternatives and the formulation of possible mitigative measures. Fragmented or incomplete discussion of the elements in the environmental setting may lead to impacts not being properly identified and assessed. We believe that several elements of the environmental setting for the project must be disclosed in order to thoroughly identify and mitigate direct, indirect and cumulative effects of the Master Plan update on the environment. We have numbered these items below, along with our reasons why these need to be disclosed.

A.1 Groundwater Resources

Section 5.9 of the DEA does not adequately describe groundwater in the region. We believe that this is important since activities brought about by the master plan implementation may constitute a source of pollution (either through air or water). The groundwater gradient is the vehicle which eventually allows water to migrate to the ocean. Therefore, what happens to groundwater in the region may impact surface waters (such as the anchialine ponds discussed below), and nearshore water quality. We request that you discuss the source and flow patterns of groundwater, and the location of groundwater monitoring wells in the region.

A.2 Anchialine Pond Resources

Anchialine pond systems are land-locked bodies of water with no surface connection to the ocean having measurable salinity (0.5 to 30 parts per million) and tidal fluctuations. Larger areas are habitat for rare Hawaiian shrimps (e.g. 'opae 'ula, *Halocaridina rubra* among others) and endangered waterbirds. Anchialine pools are recent geological features and subject to obliteration by lava flows and accumulation of organic and mineral deposits, and to damage by humans. [1]

[1] Charles P. Stone, and Danielle B. Stone (editors), *Conservation Biology in Hawai'i*, Cooperative National Park Resources Study Unit, University of Hawai'i at Manoa, Honolulu. 1989, p. 231.

The island of Hawaii has the largest number of anchialine ponds, estimated at about 600-650 anchialine ponds. The majority of these ponds occurs along the coast from Kawaihae to Kailua-Kona. In a 1985 study, Dr. Richard Brock noted that about 420 ponds have been surveyed in this area along with an estimated 45 unsampled ponds. Anchialine ponds also provide habitat for endangered waterbirds such as: the aeo or Hawaiian stilt (*Himantopus mexicanus knudseni*); the alae ke'oke'o or Hawaiian coot (*Fulica alai*); and the koloa or Hawaiian duck (*Anas wyvilliana*). [2]

Page 5-30 of the draft environmental assessment notes that there are 79 anchialine ponds with 29 of "exceptional natural value" south of the airport near Wawahiwa Point. We have enclosed a copy of Dr. Brock's paper with this letter. Anchialine ponds are also present and being monitored by the Natural Energy Laboratory of Hawaii. [3] We recommend that your agency consult with Dr. Brock (telephone 956-8191) on the potential impacts of the project to nearby anchialine pond resources.

Include a discussion in the final environmental assessment of nearby anchialine ponds, and reassess direct, indirect and cumulative effects (e.g., surface/subsurface contaminant migration from runoff at the Airport, noise, nutrient loading into anchialine ponds, etc.) and of implementing the master plan update for Kona International Airport, alternatives and possible mitigative measures.

A.3 Makalawena Marsh National Historic Landmark; Kaloko-Honokohau National Historical Park

Describe the natural, physical, historical and cultural resources of the Makalawena Marsh National Historical Landmark and describe possible direct, indirect and cumulative effects of the project on these sites.

A.4 Mamalahoa Trail and the Ala Kahakai

A portion of the Mamalahoa Trail traverses the airport property. An EIS and Record of Decision for the 175-mile Ala Kahakai trail was prepared by the National Park Service in 1998. [4] The trail begins in North Kohala, traverses the South Kohala, Kona, Ka'u and Puna coastlines. We recommend that you consult with the Na Ala Hele program of the Department of Land and Natural Resources and the National Park Service and discuss the impacts of the proposed project on users of this trail.

[2] Dr. Richard E. Brock, *An Assessment of the Conditions and Future of the Anchialine Pond Resources of the Hawaiian Islands*, prepared for Transcontinental Development Company, August 2, 1985, page 2, in *Final Environmental Impact Statement for U.S. Department of the Army Permit Application (File No. PODCO-O 1812-SD), Waikoloa Beach Resort, Waikoloa, South Kohala District, Island of Hawai'i, State of Hawai'i*, U.S. Army Engineer District, Honolulu, September 1985.

[3] Telephone conversation of Leslie Segundo with Dr. Richard Brock, May 18, 1999.

[4] U. S. Department of the Interior, National Park Service, Pacific West Region, Pacific Great Basin Support Office, *Ala Kahakai, National Trail Study and Final Environmental Impact Statement*, San Francisco, Cal'

A.5 Ceded Lands

We recommend that you consult with the Office of Hawaiian Affairs and identify any ceded lands in the final environmental assessment.

A.6 Cultural Resources

A brief review of Appendix A (a 1987 study which makes mention of various Hawaiian medicinal herbs such as noni (*Morinda citrofolia*) and uhaloa (*Waltheria indica* var. *americana*)) and Sections 5.12 and 6 (which contain discussions of historic and archaeological resources along with discussions of the socioeconomic consequences of the project) suggests that the region may have native gathering and cultural practices. We recommend that you consult with the Office of Hawaiian Affairs and native Hawaiian organizations as to the existence of culturally significant resources and gathering practices. A copy of the Environmental Council's 1997 guidance on Cultural Impact Assessment is enclosed for your information.

B. IMPACTS AND MITIGATIVE MEASURES

We now have comments pertaining to the discussion of impacts/mitigation applicable to various sections of the DEA.

B.1 Nocturnal Fauna

We recommend that you consult with the Department of Land and Natural Resources, Division of Forestry and Wildlife, and the U.S. Fish and Wildlife Service as to whether nocturnal fauna (e.g., the Hawaiian owl, pueo (*Asio flammeus sandwichensis*); Newell's Shearwater (*Puffinus puffinus newelli*); and others frequent the region. We ask this since airport lighting can disorient nocturnal birds and curtail their feeding ranges; we also note that the 1987 faunal survey found in Appendix B was conducted in August between the daylight hours of 6:30 A.M. and 5:30 P.M.

We request that you include a discussion in the final environmental assessment a discussion of nocturnal fauna, and if present, a discussion of the project's impacts (such as the impact of bright lights on night foraging and travelling by various birds, etc.) should be included. We also request that you discuss specific mitigative measures that will be applied to minimize spillover, glare and other lighting impacts. You may wish to consider designing the lighting using the Department of Land and Natural Resources' guidelines entitled "*The Newell's Shearwater Light Attraction Problem, A Guide for Architects, Planners, and Resort Managers*."

B.2 Wastewater Treatment Plant Upgrade and Underground Injection Wells

We request that you discuss the indirect and cumulative effects (nutrient loading) of the Wastewater Treatment Plant upgrade, wastewater Pump Station, and use of underground injection wells on the quality of surface water, groundwater and nearshore waters.

B.3 Solid Waste Mitigation

Page 2-35 mentions that solid waste volume, for eventual disposal at the Pu'uanahulu landfill is expected to "increase dramatically," yet no mitigative measures are discussed. We recommend that you consult with the Office of Solid Waste Management of the Department of Health and discuss measures to reduce or

recycle solid waste to reduce future environmental impacts from landfilling.

B.4 Phase III Keahole-Kawaihae Fuel Corridor

Page 2-36 discusses that Hawaii Fueling Facilities Corporation is proposing a fuel farm (bulk storage facility) to supply air carrier fuel needs northeast of the terminal area. The DEA also discusses a second fuel storage area adjacent to the general aviation area. We request that you discuss the direct, indirect and cumulative effects of such a fuel corridor on resources identified in the environmental setting of the revised environmental assessment.

B.5 Xerophagic Native Flora in Landscaping

There are a number of plants native to Hawai'i that are drought tolerant. You may wish to consider using these in landscaping to conserve water and to preserve and perpetuate native species. Photographs and planting technique descriptions of some of these plants can be found at our native Hawaiian garden website at www.hawaii.gov/health/oeqc/eloeqc00.htm.

B.6 Green Building Guidelines

Consider applying sustainable building techniques as presented in the enclosed draft "*Guidelines for Sustainable Building Design in Hawaii*." In the environmental assessment include a description of any of the techniques you will implement.

C. ALIEN SPECIES ACTION PLAN

We believe that implementation of the Master Plan Updates at the Kona International Airport has the potential to increase the likelihood that alien pest species will enter the Big Island. More aircraft from further distances will be able to fly into Kona. The Big Island has a major national park and many other pristine native areas. To protect these resources from degradation we recommend that the Department of Transportation prepare an "Alien Species Action Plan" similar to that prepared from the Kahului Airport on Maui.

Thank you for the opportunity to comment. If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist at 586-4185.

Sincerely,

Genevieve Salmonson

GENEVIEVE SALMONSON
Director

Enclosures

c: Mr. Frank Scapel, Keahole Associates, Inc.

BENJAMIN J. CAYETANO
GOVERNOR

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-P
00.0444

August 17, 2000

TO: GENEVIEVE SALMONSON, DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: KAZU HAYASHIDA
DIRECTOR OF TRANSPORTATION

SUBJECT: RESPONSE TO COMMENTS FOR DRAFT
ENVIRONMENTAL ASSESSMENT
KONA INTERNATIONAL AIRPORT AT KEAHOLE
MASTER PLAN UPDATE
NORTH KONA, HAWAII

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii.

1. Groundwater Resources - The results of the Water Quality Monitoring Program for the Keahole Airport Expansion, July 15, 1997 to June 15, 1998, will be incorporated into the Final Environmental Assessment. According to the results of the study, "There are no significant unexpected features in the data. All values fall within expected norms."

2. Anchialine Pond Resources - We have discussed your concerns regarding anchialine ponds with Dr. Richard Brock on June 8, 1999. Based on our discussion, the following assessment can be made:

   - There has been no adverse impacts to anchialine ponds due to development related pollutants. Dr. Richard Brock has noted that there are no records

   to date of pond losses due to nearby use of herbicides, pesticides, or fertilizers. Anchialine ponds at the Kaloko-Honokohau National Historic Park (NHP) have also remained unaffected by the nearby landfill and Kaloko Industrial Park mauka of Queen Kaahumanu Highway;

   - The only confirmed ponds to date at Keahole include a group of eight to nine ponds located makai of the NELH access road in the vicinity of the public rest stop and the south end of the KOA runway. These few ponds are under active management by NELH and have remained relatively unaffected to date;

   - The greatest threat to anchialine ponds are from introduction of alien species including tilapia (e.g., *Oreochromis mossambicus*) and topminnows (e.g., *Gambusia affinis*). Most of these species are introduced by visitors or residents depositing unwanted aquarium fish into the ponds. Native pond species, in particular shrimps, become forage and soon avoid the pond altogether by escape through lava cracks and crevices;

   - It is possible for Queen Kaahumanu Highway and KOA to pose environmental hazards to the NELH ponds. This could occur due to a possible fuel or oil spill by tanker trucks in transit to Kailua-Kona or within the airport property. Cadmium, contained in the tire rubber of both automobiles and aircraft, could also eventually migrate to the ponds from both the highway and the airport runway. To date, however, there has been no data collected to confirm this possibility; and,

   - It is possible for development and anchialine ponds to coexist within close proximity to one another. This has been demonstrated at the Waikoloa Resort where there are several ponds on exhibit for resort guests and the general public. Protection of the ponds at NELH will require continued active management. This would involve both regular inspection of the ponds to keep alien species from becoming established as well as regular adherence to existing laws and regulations to prevent and mitigate potential impacts from oil/fuel spills.

3. Makalawena Marsh National Historic Landmark/Kaloko-Honokohau National Historic Park - We have reviewed the document,

General Management Plan/Environmental Impact Statement, Kaloko-Honokohau National Historical Park, Hawaii, July 1994. The proposed KOA Master Plan Update is not anticipated to adversely impact park resources. The northern boundary of the park is approximately 2.5 miles south of KOA. A review of the Kaloko-Honokohau document with the Keahole-Kona International Airport Part 150 Noise Compatibility Program Report, December 1997, also indicates that the northernmost point of the park boundary, Wawahiwaa Point, is located outside of the airport's 55 DNL noise contour.

4. Mamalahoa Trail and Ala Kahakai - We have reviewed the document, Ala Kahakai, National Trail Study and Final Environmental Impact Statement, 1998. KOA is not expected to adversely impact portions of the proposed trail which lie adjacent to KOA. Be advised, however, that portions of the trail remain within the current and future 65 DNL noise contour as identified in the Keahole-Kona International Airport Part 150 Noise Compatibility Program Report, December 1997.

5. Ceded Lands - We acknowledge that although most of the land at Keahole is ceded, a public airport is a prime public use as allowed in the Statehood act of 1959. The Puukala ahupuaa is non-ceded.

6. Cultural Resources - We have recently completed an Archaeological Update and PASH (Public Access Shoreline Hawaii) Rights Interviews for Kona International Airport at Keahole, April 2000. A summary of the findings of this study will be incorporated into the Final Environmental Assessment for this project. Based on our review of this document we believe the proposed action will have no significant adverse impact on cultural resources at Keahole.

7. Nocturnal Fauna - We note your concern regarding potential impacts to nocturnal fauna. The results of a recently completed faunal study at KOA will be included in the Final Environmental Assessment for this project.

8. Wastewater Treatment Plant Upgrade and Underground Injection Wells - According to results of the Water Quality Monitoring Program for the Keahole Airport Expansion, July 15, 1997 to June 15, 1998, we anticipate that the planned upgrade of the wastewater treatment system will have no further adverse environmental impacts on the performance of the existing

injection wells. This is because the proposed treatment system will use an effluent reuse system for irrigation of the airport. This reuse of treated wastewater will reduce reliance on existing injection wells, as well as potable resources in the region.

9. Solid Waste Mitigation - We expect to continue to work with sister State agencies and the County of Hawaii in managing its solid waste disposal requirements. At this time, however, there are no economically feasible options which would significantly reduce the need for refuse disposal in a landfill. It is expected, however, that as emerging technologies and practices are developed to increase the feasibility of refuse recycling and reduction, that they will be more readily accepted and adopted.

10. Phase III Keahole - Kawaihae Fuel Corridor - The development of this resource will require further study and research, as well as consultation with the general public. Further detail concerning this project is not available. It is included in Phase III because it needs to be considered as a potentially viable option to the current practice of delivering fuel to KOA by tanker trucks from Hilo.

We expect that because the proposed project will extend beyond the airport affecting the entire North Kona region, that further agency review and public input will be obtained when the project is subject to the reporting requirements of Chapter 343, Hawaii Revised Statutes, as well as applicable laws and regulations of the State, County of Hawaii, and Federal government.

11. Xerigraphic Native Flora in Landscaping - Your concern regarding use of xerigraphic landscaping has been noted. The Department of Transportation is already developing an effluent reuse irrigation system to reduce reliance on existing potable supplies.

12. Green Building Guidelines - Your concern regarding use of sustainable building design has been noted.

13. Alien Species Action Plan - We are in the process of evaluating an Alien Species Action Program at Kahului Airport which could influence procedures at other State airports providing domestic and international overseas service, if risk analyses show that more attention is required. The inspection procedure would be commensurate

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with the risk analysis associated with the point of origin of the flights. The Kahului Plan is being coordinated with various agencies including, but not limited to: State Department of Land and Natural Resources; State Department of Agriculture; U.S. Fish and Wildlife Service; and U.S. Department of Agriculture. Although a pilot program is being developed for the Kahului Airport, it should be noted that the lava fields of Kona are not hospitable to many species.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer of the Airports Division, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JANET E. KAWELO

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

1467

May 21, 1999

LOG NO: 23364
DOC NO: 9905PM08

MEMORANDUM

TO: Jerry Matsuda, Airports Administrator
Department of Transportation

FROM: Don Hibbard, Administrator
Historic Preservation Division

SUBJECT: Draft Environmental Assessment (DEA) for Kona International Airport at Keahole Master Plan Update Keahole, North Kona, Hawaii Island
TMK: 7-2-05:07 and 7-3-43:03, 06 through 35, 37, through 40 and 43 through 47

The DEA indicates that there are only two significant historic sites remaining at KOA--the Mamalahoa Trail and a petroglyph site. Six other sites had been previously identified during a 1987 archaeological survey at KOA. Three of the six sites (10675, 10676 and 10680) were sufficiently well documented during the survey that no further work is needed. They are regarded as "no longer significant." Data recovery took place at the other three sites (10677, 10678 and 10679) which are also regarded as "no longer significant."

It appears to us that the Mamalahoa Trail and the petroglyph site (both of which are to be preserved) are located outside of the proposed southeast development area, but this is not entirely clear since neither site is plotted on a map. Some clarification is needed on this point. The Final EA should contain a map showing the locations of these sites in relation to the proposed developments and some new wording in the text that makes it clear that neither site will be adversely affected.

NM lpf

c Ed Henry, Land Division

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

1959 2000

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO
AIR-P
00.0446

TO: DON HIBBARD, ADMINISTRATOR
STATE HISTORIC PRESERVATION DIVISION
DEPARTMENT OF LAND AND NATURAL RESOURCES

FROM: JERRY M. MATSUDA, P.E.
AIRPORTS ADMINISTRATOR

SUBJECT: RESPONSE TO COMMENTS FOR DRAFT ENVIRONMENTAL ASSESSMENT
KONA INTERNATIONAL AIRPORT AT KEAHOLE
MASTER PLAN UPDATE
NORTH KONA, HAWAII

This is in response to your comments for the subject above. We have completed an Archaeological Update and PASH (Public Access Shoreline Hawaii) Rights Interviews for Kona International Airport at Keahole, April 2000, which provides additional information to ensure that there will be "no effect" to the Mamalahoa Trail and petroglyph site. This information shall be provided in the Final Environmental Assessment (EA).

We appreciated your review of the Draft EA and providing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

Hana Like Na Ke Ala Aloha

1439

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

May 24, 1999

Department Of Transportation
State of Hawaii
Airports Division, Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

Attention: Mr. Jerry Matsuda

Gentlemen:

SUBJECT: Keahole International Airport - Master Plan Draft EA

Thank you for the opportunity to comment on the subject master plan. The following is Hawaii Electric Light Company Inc's (HELCO's) comments:

Section 1.9.5 & 2.4.6.5 – Electrical and Communications Systems (Page 1-31 & 2-35):

1. The current capacity of the HELCO system is 196.8 megawatts (MW) and the system peak is 169.6 MW on December 7, 1998. HELCO anticipates adequate generation to meet the projected load additions.

2. The main underground distribution feeders from HELCO's existing Airport Substation to the Airport have been upgraded to serve the projected new loads per the "Road N" and "Upgrading of Utilities" projects.

3. To improve reliability to the Keahole Airport loads, approval for an alternate 12KV tie line from HOST Park substation is requested. This tie line will be underbuilt on the existing 69KV pole line from HOST Park substation to Keahole Airport substation and will provide an alternate source of power in the event the Keahole Airport substation fails or when the Keahole Airport substation must be de-energized for maintenance purposes. Approval is required from the State Department of Transportation – Highways Division for the underbuilt 12KV tie project to proceed.

4. The Airport loads are currently served from our HELCO Keahole Airport 1.5MVA substation and this substation may need to be upgraded to serve some of the Phase I loads. Please have your electrical consultant provide HELCO with the projected loads and schedule for Phase I and Phase II. Based on load information received from Keahole Associates in 1992, the Keahole Airport substation needed to be upgraded to 10 MVA to serve the new Overseas Terminal load.

5. HELCO recommends that energy efficient and conservation features suitable to reduce the peak electrical demand be part of the development's plans and requirements.

If you have any questions, please contact H. Kamigaki at 969-0322.

Sincerely,

Clyde H. Nagata

Clyde H. Nagata, Manager
Engineering Department

CC: H. Kamigaki

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO:

AIR-P
00.0447

Mr. Clyde H. Nagata
Manager
Hawaii Electric Light Company
P. O. Box 1027
Hilo, Hawaii 96721-1027

Dear Mr. Nagata:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan, Update North Kona, Hawaii.

We acknowledge the capacity of your system at 196.8 megawatts (MW) with a system peak of 169.6 MW which occurred on December 7, 1998. We also concur with you concerning the need for coordination to ensure continued and uninterrupted service. This will require that we coordinate the following:

1. Hawaii Electric Light Company (HELCO) will require authorization from DOT, Highways Division, for the construction of an alternate 12 kilovolt (KV) line from the HOST Park substation. The purpose of this line will be to provide an alternate power corridor in the event of a line or transmission outage;

2. Existing and planned upgrades to KOA will eventually require an upgrade of the HELCO Keahole Airport substation from its existing 1.5 MVA to 10 MVA; and,

3. Energy efficiency and conservation measures should be included in forthcoming plans and specifications for future KOA Master Plan projects.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

Jerry M. Matsuda

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

KA' MAKANI 'O KOHALA OHANA INCORPORATED
DBA KAKO'O
P.O. BOX 520, HAWI HAWAI'I 96719
PHONE/FAX (808) 889-5553

May 24, 1999

Airports Division
Department of Transportation
400 Rodgers Blvd., Suite 700
Honolulu, HI 96819

Attention: Jerry Matsuda

Subject: Comments on Draft EA for Kona International Airport Master Plan Update

Dear Mr. Matsuda,

Thank you for the opportunity to comment on the Draft EA for the Kona International Airport Master Plan. I have the following comments.

1. *On May 20, 1999, I called Mr. Michael Inouye, the project manager for this project.* My question was ,I thought, very simple for the project manager to answer. I asked Mr. Inouye what he could tell me about the North Kohala Consortium, referenced in the Executive summary (p I-29). I asked him specifically who were the officers in this 'consortium' or who are its principals and is it a registered corporation in the state of Hawaii. Since this consortium is allegedly from North Kohala or at least uses the name North Kohala Consortium, I was curious as to why no one I spoke with in North Kohala has ever heard of it. Mr. Inouye said he would have to get back to me and asked me for my fax number. Due to the deadline for comments (I did not hear back from Mr. Inouye and was unable to reach Mr. Inouye today (5-24-990)and lacking necessary information and facts I am forced to ask questions instead of make comments.

2. Since the Consortium uses the name North Kohala and it is stated that this consortium will replace the existing municipal waterline & supply potable water, I must assume that they plan to get their water from North Kohala. If this is the case, how is it that no EA was submitted locally for review and comments as is required by Chapter 343 HRS. Identifying the source of this water would clear this matter up one way or the other.

3. The public has a right to know who the principals/officers of the North Kohala Consortium are and what legal right do they have to promise water originating in North Kohala (if such is the case) to North Kona ?

4. Is this Consortium in partnership or joint venture with the Hawaii County Dept. of Water Supply ?

5. This consortium is not registered with the State Dept. of Commerce & Consumer Affairs and is unknown to them. Is it registered anywhere ?

6. I was also curious why a "no-action alternative" was not present in the section on alternatives.

6. Full disclosure of all of the above questions needs to be addressed in any future documents relating to the Kona International Airport Master Plan.

I look forward to hearing from you regarding my concerns.

Cordially,

Richard Boyd

Richard Boyd-President KAKO'O

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
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1959 2000+

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO:
AIR-P
00.0448

Mr. Richard Boyd
President
Ka' Makani 'O Kohala Ohana Inc.
dba Kako'o
P. O. Box 520
Hawi, Hawaii 96719

Dear Mr. Boyd:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii

1. The organization identified in the DEA will be amended. The correct reference should read, "North Kona consortium."

2. The "consortium" is based on, "Memorandum of Understanding for State Water Development and Water System Improvements to Support State Projects, North Kona, Hawaii, September 24, 1992. This 1992 document was signed by the State Department of Land and Natural Resources, Housing Finance and Development Corporation, Board of Agriculture, Department of Transportation, Natural Energy Laboratory of Hawaii, University of Hawaii, and the County of Hawaii, Department of Water Supply.

3. The "consortium" is not a registered entity, but represents parties in principal to a memorandum of understanding calling on joint support to develop water resources for the North Kona region of Hawaii. The preliminary efforts of this group have led to development of the North Kona Water Master Plan, 1995, which recommends improvements to the County water system to meet demands to the year 2015. The North Kona Water Master Plan identifies required source and transmission projects to support future developments of new and existing projects, such as KOA.

4. A further discussion of the "no action" alternative will be provided in the forthcoming final environmental document for this project.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

Jerry M. Matsuda

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

1400

janice palma-glennie
p.o. box 4849
kailua-kona, hawai'i 96745
telephone#808-325-3416

FAX TO: Jerry Matsuda, Airports Division, Department of Transportation
May 24, 1999

<u>RE: COMMENTS ON DRAFT EA FOR KONA INTERNATIONAL AIRPORT MASTER PLAN UPDATE</u>

Aloha, Mr. Matsuda:

Due to the unavoidable lateness of my testimony regarding the EA for Kona International Airport expansion, I must limit myself to saying that I feel the <u>EA is vastly insufficient</u> (possibly illegal under federal law) and allows for expansion at the behest of :od sense and sound planning. The allowances made by the Draft EA Master Plan allows for negative suprises for the residents and environment of Hawai'i Island being based upon unsound and unscientific premises (i.e., projections of local growth, which have proven to be consistently incorrect over the last twenty years).

I believe discussion and expansion of the Kona International Airport demands an in depth Environmental Impact Statement.

Sincerely,
Janice Palma-Glennie

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO:

AIR-P
00.0449

Ms. Janice Palma-Glennie
P. O. Box 4849
Kailua-Kona, Hawaii 96745

Dear Ms. Palma-Glennie:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii

1. The DEA for KOA was prepared based on Hawaii Revised Statutes (HRS), Chapter 343, governing preparation of Environmental Impact Statements. The determination to utilize an Environmental Assessment for the review of the proposed KOA Master Plan Update is based on the following:

   A) A prior Environmental Impact Statement (EIS) was completed for KOA in October 1988. The majority of Master Plan projects represented in the 1988 EIS have substantively remained the same with only minor changes to reflect new environmental, regulatory and safety requirements, and location and design changes to meet updated needs. This is the primary reason why the current project is referred to as a Master Plan Update and not a major new Master Plan. Consequently, due to the relatively minor level and scope of changes proposed at KOA, a decision was made to develop an EA, and not an EIS;

   B) The prior EIS describes the majority of projects proposed at KOA. The EIS, therefore, already addresses the requirements of HRS, Chapter 343; and,

   C) During preparation of the Master Plan, a number of steps were taken to ensure public notice and input. It is also our intent to comply with all required environmental laws and regulations as it relates to protection of the environment.

2. The DEA is based on updated projections for population and economic growth statewide, and for the Kona region. The projections used in the KOA DEA have attempted to take into account the current downturn in the economy. The DEA notes that tourism growth will continue to grow, although at "A rate that is significantly lower than was previously projected in the 1990s. According to Aries Consultants, Ltd., visitor arrivals to KOA are similarly anticipated to increase, but at a slightly lower average rate of 1.7% per year."

   This anticipated decline in the rate of growth is a major reason why there are no current plans at KOA to otherwise extend or construct a dual runway. At the same time, uses proposed at KOA are based on the need to serve an increasingly broad mix of users including current overseas arrivals, general aviation needs, cargo, and interisland service.

3. In addition to the data presented in the DEA, we solicited a number of government agency and public reviews through the KOA Technical Advisory Committee (Table 1-1, DEA); Public informational meetings; KOA Part 150, Noise Compatibility Program, December 1997; and various Functional Analysis Concept Design (FACD) meetings for KOA projects. The current DEA represents part of this ongoing effort to ensure sufficient public review and input.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer at (808) 838-8821 to clarify any questions you may have.

Sincerely,

Jerry M. Matsuda

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

May 24, 1999

Mr. Jerry M. Matsuda, P.E., Airports Administrator
State of Hawaii, Department of Transportation
Airports Division
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii, 96819-1880

EIS (99) 295

Re: Draft Environmental Assessment for the Kona International Airport at Keahole, Master Plan Update, North Kona, Hawai'i, TMK: 7-2-05:07 and 7-3-43:03, 06 through 35, 37 through 40 and 43 through 47

Dear Mr. Matsuda:

Thank you for the opportunity to review the Kona International Airport at Keahole, Master Plan Update. The Office of Hawaiian Affairs has the following concerns.

If this document is meant to provide updated information on the expansion plans for the Keahole Airport it is flawed at its most basic level. While the document provides updated information on the construction plans there is no current information on the flora, fauna, or historical resources found within the project area. Instead, the proponents have reproduced reports prepared in 1987. This is inappropriate for several reasons.

First, floral and faunal resources are not static. They change. Simply because a report prepared twelve years ago did not find any resources in the area at that time does not mean that the same situation exists today. Given the relatively undeveloped condition of the lands surrounding the airport it is quite likely that re-vegetation of native or endangered plants could have taken place in the intervening twelve years. The same is true for fauna. Twelve years is a long time. For authenticity, a current report on flora and fauna should be commissioned and included in the DEA.

We also urge the preparers to do a new archaeological study. In the intervening twelve years between the original report and the present document, much new information on Native Hawaiian culture and resources has been learned. Objects which may not have seemed important in 1987 today might be considered critical. More importantly, it appears that the 1987 report did not include certain sites known to exist such at the Mamalahoa trail which runs through the airport property. Because the original report appears to be inadequate and because of the new understanding of Native Hawaiian culture it would be prudent to obtain the most current information.

Without the essential and most current information outlined above it would be disingenuous to declare a Finding of No Significant Impact on this project.

If you have any questions, please contact Lynn Lee, EIS Planner at 594-1936.

Sincerely,

Colin Kippen, Jr.
Deputy Administrator

C. Sebastian Aloot
Land and Natural Resources Division Officer

cc: Board of Trustees
Office of Environmental Quality Control
Michael Inouye, Keahole Associates, Inc.

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO:

AIR-P
00.0450

TO: COLIN KIPPEN, JR., DEPUTY ADMINISTRATOR
C. SEBASTIAN ALOOT, LAND AND NATURAL RESOURCES DIVISION OFFICER
OFFICE OF HAWAIIAN AFFAIRS

FROM: JERRY M. MATSUDA, P.E.
AIRPORTS ADMINISTRATOR

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii.

1. Updated flora and faunal studies of the airport environs were completed in February 2000. The results of these studies will be incorporated into the Final EA for this project; and,

2. A new archaeological update report including Public Access Shoreline Hawaii (PASH) issues was similarly completed in April 2000. The results of this report will also be incorporated into the subject Final EA for this project.

Based on our review of these documents, we believe the proposed action will have no significant adverse impact on flora, fauna, archaeological and cultural resources at the Kona International Airport at Keahole.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please have your staff contact Ben Schlapak, Head Planning Engineer, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

Hana Like Na Ke Ala Aloha
Working Together to Provide Gateways of Aloha

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
PO BOX 3378
HONOLULU, HAWAII 96801

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

May 27, 1999

99-070/epo

Mr. Jerry M. Matsuda, P.E.
Airports Administrator
Airports Division
Department of Transportation
400 Rogers Boulevard, Suite 700
Honolulu, Hawaii 96819-1880

Dear Mr. Matsuda:

Subject: Draft Environmental Assessment (DEA)
Kona International Airport at Keahole
Master Plan Update
TMK: 7-2-5: 7

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

Underground Storage Tanks (USTs)

1. As mentioned in section 5.8 (*Hazardous Materials*), there are existing underground storage tanks (USTs) at the Airport which must comply with federal and state UST requirements, whether they are owned by the Department of Transportation (DOT) or by DOT tenants. We are working with DOT and its tenants to ensure compliance with applicable UST requirements.

2. We also note that in section 5.8, the list of modifications appears to be incomplete. The list goes from item #1 (USTs and ASTs) to item #3 (Hazardous Materials) with no item #2 in between. Judging from the context, it appears that a discussion of "hazardous wastes and used oil" has been inadvertently omitted.

3. Although none are mentioned, additional underground storage tanks (USTs) may be installed at the Airport to store vehicular fuel, used motor oil, emergency power generator fuel, or other types of petroleum or hazardous substances. DOT should note that USTs are subject to federal and state requirements. Owners of newly installed USTs must notify our Underground Storage Tank Section of the existence of such USTs within 30 days of installation. In addition, our Underground Storage Tank Section is developing new state administrative rules on USTs which, when finalized, will require permits for all new USTs. Finally, permits must be obtained from the applicable building and fire safety authorities before installation of any USTs.

Should you have any questions regarding these comments, please contact Eric Sadoyama of our Solid and Hazardous Waste Branch, Underground Storage Tank Section at (808) 586-4226.

Wastewater

Since the existing wastewater treatment plant (WWTP) is at or near capacity, we are pleased and concur with the plans to construct a new secondary treatment lagoon-type facility to treat an average daily flow of 0.13 million gallons per day (mgd) with a peak treatment capacity of 1.25 mgd. Reclamation of the effluent is strongly encouraged.

We do look forward to reviewing the final plans to insure they conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems."

Should you have any questions on these comments, please contact the Planning/Design Section of the Wastewater Branch at (808) 586-4294.

Fugitive Dust

There is a significant potential for fugitive dust to be generated during construction and landscaping activities due to the arid climatic conditions that exist in the area. Implementation of adequate dust control measures during all phases of the project is warranted. Construction activities must comply with the provisions of Hawaii Administrative Rules, Chapter 11-60.1, section 11-60.1-33 on Fugitive Dust.

The contractor should provide adequate means to control dust from road areas and during the various phases of construction activities. These means include, but are not limited to:

a. planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing material transfer points and on-site vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. providing an adequate water source at site prior to start-up of construction activities;

c. landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. controlling of dust from shoulders, project entrances, and access roads; and

e. providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities.

If you have any questions regarding fugitive dust, please contact Mr. Timothy Carvalho of the Clean Air Branch at 586-4200.

Sincerely,

GARY GILL
Deputy Director for
Environmental Health

c: SHWB
WWB
OEQC
Keahole Associates
HDHO
CAB

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO

AIR-P
00.0452

TO: GARY GILL, DEPUTY DIRECTOR
ENVIRONMENTAL HEALTH
DEPARTMENT OF HEALTH

FROM: JERRY MATSUDA, P.E.
AIRPORTS ADMINISTRATOR

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii.

Underground Storage Tanks (USTs)

1. A brief portion of Item No. 2 - Hazardous Wastes and Used Oil was inadvertently omitted. This will be restored in the Final EA.

2. We acknowledge that the Department of Health (DOH) has adopted Hawaii Administrative Rules (HAR), Section 11-281, Underground Storage Tanks. The rules provide for the issuance of permits by DOH for the installation and operation of all new USTs. The rules provide for the Underground Storage Tank Section to be notified within 30 days of installing any new UST, and require that permits also be obtained from applicable building and fire safety authorities before installation of any UST.

Wastewater

We have forwarded final plans to DOH for the proposed wastewater treatment plant (WWTP) in conformance with Hawaii Administrative Rules (HAR), Section 11-62, "Wastewater Systems." As instructed by DOH, necessary revisions have been incorporated into the proposed wastewater treatment plant.

Fugitive Dust

Control of fugitive dust will also be addressed per HAR, Chapter 11-60.1-33, relating to Fugitive Dust.

We appreciate your review of the DEA and providing us with this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at 838-8821 to clarify any questions you may have.

c: Keahole Associates, Inc. (M. Inouye)

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
2550 Campus Road • Crawford 317 • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

May 24, 1999
RE:0187

Mr. Jerry M. Matsuda, Airports Division
Department of Transportation
Honolulu International Airport
400 Rodgers Boulevard, Suite 700
Honolulu, Hawaii 96819

Dear Mr. Matsuda:

Draft Environmental Assessment
Kona International Airport
Keahole Master Plan Update

We have briefly reviewed the above cited Draft EA for the Kona International Airport at Keahole Master Plan Update. Unfortunately, time has not permitted us to circulate this document in accordance with our usual review procedures, however, our staff has called attention to the following areas that should receive attention when the EIS is prepared. An EIS is certainly required, since the proposed actions will definitely have significant effects on land use, highway construction needs, drainage, water quality, energy use, and traffic to name but a few of the more obvious impacts.

Drainage: The DEA does not adequately discuss the ramifications of the additional runoff to both ground waters and adjacent shorelines. Oil, grease, lead, cadmium, and other trace metals are likely to be present on the runway surfaces and hence carried to receiving waters and drainage ditches. The potential impacts of these contaminants should be discussed more fully.

Traffic Impacts: We note (pg 1-28) that certain upgrades to the access roads will be needed. These upgrades should be addressed in the EIS prepared for this project so that "piece mealing" of the project can be avoided in accordance with the EIS regulations.

Wastewater Treatment: The EA notes that the capacity of the existing wastewater treatment plant is currently exceeded and that it is inadequate for present terminal demands. Again, the location, volume, and treatment practices of this plant should be fully disclosed in the EIS for this project as it is a required component of the Airport expansion plans being proposed. Discharges from this plant must be fully evaluated to assure that both groundwaters and nearby coastal waters are not compromised.

Electrical and Communications Systems: The document notes that additional lighting will be required to meet the expanded airport operations. However, it does not indicate if the current power capacity will be sufficient or if additional power generation will be required. This is another example of the need for a full disclosure of the impacts and ramifications of the expanded airport in an EIS.

Fueling System: The EA identifies many of the potential impacts of the expanded fueling system that will be required. These potential impacts are clearly significant and need to be fully addressed in an EIS.

We appreciate the opportunity to provide these brief comments and look forward to reviewing the Draft EIS when it is prepared.

Sincerely,

Jacquelin N. Miller

Jacquelin N. Miller Ph.D.
Associate Environmental Coordinator

Cc: OEQC
Keahole Associates, Inc. ✓

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

1959 2000

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO
AIR-P
00.0451

Jacquelin N. Miller, Ph.D.
Associate Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
2550 Campus Road
Crawford 317
Honolulu, Hawaii 96822

Dear Dr. Miller:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole (KOA) Master Plan Update, North Kona, Hawaii.

Preparation of Environmental Assessment (EA)

The determination to utilize an EA for the review of the proposed KOA Master Plan Update is based on the following:

A) A prior Environmental Impact Statement (EIS) was completed for KOA in October 1988. The majority of Master Plan projects represented in the 1988 EIS have substantively remained the same with only minor changes to reflect new environmental, regulatory and safety requirements, and location and design changes to meet updated needs. This is the primary reason why the current project is referred to as a Master Plan Update and not a major new Master Plan. Consequently, due to the relatively minor level and scope of changes proposed at KOA, a decision was made to develop an EA, and not an EIS;

B) The prior EIS describes the majority of projects proposed at KOA. The EIS, therefore, already addresses the requirements of Hawaii Revised Statutes, Chapter 343, regarding the preparation of EISs; and,

C) During preparation of the Master Plan, a number of steps were taken to ensure public notice and input. It is also our intent to comply with all required environmental laws and regulations as it relates to protection of the environment.

Drainage

We acknowledge the increase in impervious area that will result with construction of projects associated with the KOA Master Plan Update. The terminal and airfield facilities have been designed to handle 5-year storm intensities. The existing drainage system has also been designed to accommodate future planned growth of KOA, consistent with the proposed Master Plan Update.

Water quality monitoring to assess the potential for pollutants in runoff have been completed in the document Water Quality Monitoring Program for the Keahole Airport Expansion, December 1998. The results of the water quality monitoring report indicated there were no adverse impacts to the environment. As required, water quality monitoring associated with the proposed Wastewater Treatment Plant will be undertaken as part of the environmental review process governing startup and operation of the facility.

Potential for discharges of petroleum, oils and lubricants (POLs), and hazardous wastes in stormwater and wastewater will be addressed by adherence to regulatory requirements associated with industrial facilities such as the fuel farms, wastewater treatment plant, lease lots, and associated airport facilities. In addition to meeting permitting requirements such as the Section 402, Clean Water Act, National Pollutant Discharge Elimination System (NPDES) permits, we commissioned an Environmental Compliance Audit (ECA) in 1999 to assist with management of industrial activities involving the storage, use, and disposal of waste materials. The ECA evaluates and recommends mitigation measures to ensure continued protection of the environment by adherence to existing laws and regulations governing use of POLs and hazardous materials.

Traffic Impacts

The potential for future regional traffic impacts due to developments such as KOA and adjoining residential and commercial developments were assessed in the Queen Kaahumanu Highway Widening Environmental Assessment, which was completed by the Department of Transportation (DOT) in May 1996. The project EA indicated that due to forecast traffic from KOA as well as surrounding developments, that it will be necessary to eventually upgrade the Queen Kaahumanu Highway from a two to four lane facility. The intersection connecting the airport access road with the highway will require a three legged intersection. Internal traffic circulation within KOA will be handled by the existing network of KOA access roads and proposed new roads as represented in the KOA Master Plan Update DEA.

Construction of the proposed highway widening project is expected to be forthcoming pending a revised implementation schedule.

Wastewater Treatment

Location of the project site - The general location of the proposed Wastewater Treatment Plant (WWTP) has not markedly changed since it was identified in the 1988 KOA Master Plan Final EIS.

Volume of WWTP - The estimated volume of the WWTP will be 0.13 million gallons per day (MGD) average daily flow, with a peak flow of 1.25 MGD. This information is also provided in the KOA Master Plan Update DEA.

Treatment Practices - The proposed design of the WWTP has changed from a lagoon type treatment facility to an effluent filtration (tertiary) system capable of producing Class I reclaimed water (R-1), which is the highest quality effluent available for reuse with minimal restrictions on use.

Regulatory and Environmental Compliance - The proposed WWTP will be constructed and operated in accordance with rules and regulations of Hawaii Administrative Rules, Chapter 11-62, governing Wastewater Treatment Systems, and the Guidelines for the Treatment and Use of Reclaimed Water, published by the State Department of Health on November 22, 1993.

Electrical and Communications System

According to Hawaii Electric Light Company (HELCO) (letter dated May 24, 1999), the current capacity of the HELCO system is 196.8 megawatts (MW) with a system peak of 169.6 MW which occurred on December 7, 1998. HELCO anticipates there is adequate generation capacity to meet anticipated needs at KOA.

Fueling System

The proposed fuel farms (general aviation and commercial carriers fuel farm) have been evaluated in the prior 1988 KOA Master Plan EIS. The Final EIS was approved, completed, and published in October 1988. The proposed fuel farm facilities described in the KOA Master Plan Update DEA are substantively the same as represented in the prior EIS.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please contact Ben Schlapak, Head Planning Engineer, at 838-8821 to clarify any questions you may have.

Sincerely,

Jerry M. Matsuda

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

Stephen K. Yamashiro
Mayor

County of Hawaii
POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2702

Wayne G. Carvalho
Police Chief

James S. Correa
Deputy Police Chief

May 4, 1999

Mr. Jerry M. Matsuda
Airports Administrator
Department of Transportation
Airports Division
400 Rodgers Boulevard, Suite 700
Honolulu, HI 96819-1880

Dear Mr. Matsuda:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (EA)
KONA INTERNATIONAL AIRPORT
MASTER PLAN UPDATE

Staff has reviewed the Environmental Assessment (EA) for the proposed project. The EA adequately addresses public safety and traffic concerns.

Thank you for the opportunity to comment.

Sincerely,

WAYNE G. CARVALHO
POLICE CHIEF

JAMES S. CORREA
DEPUTY POLICE CHIEF
ACTING POLICE CHIEF

DAF:lk

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

LEADING HAWAII INTO THE NEW MILLENNIUM
1959 2000

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 15, 2000

IN REPLY REFER TO:
AIR-P
00.0435

Chief Wayne G. Carvalho
Police Chief
County of Hawaii
Police Department
349 Kapiolani Street
Hilo, Hawaii 96720-3998

Dear Chief Carvalho:

This is in response to your comments for the Draft Environmental Assessment (DEA), Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii.

We acknowledge your comment that the DEA adequately addresses public safety and traffic concerns.

We appreciate your review of the DEA. Please have your staff contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

1209

phen K. Yamashiro
Mayor

Jiro A. Sumada
Deputy Chief Engineer

County of Hawaii
DEPARTMENT OF PUBLIC WORKS
25 Aupuni Street, Room 202 • Hilo, Hawaii 96720-4252
(808) 961-8321 • Fax (808) 961-8630

April 28, 1999

Jerry M. Matsuda, P.E., Airports Administrator
State of Hawaii, Dept. Of Trans., Airports Division
400 Rodgers Blvd., Ste. 700
Honolulu, HI 96819-1880

SUBJECT: Draft Environmental Assessment (EA)
Kona International Airport at Keahole
Master Plan Update
Location: North Kona, Hawaii
TMK: 7-2-05: 07 and 7-3-43:03, 06 through 35, 37 through 40 and 43 through 47

We have reviewed the Draft Environmental Assessment for the Kona International Airport at Keahole Master Plan Update and have no comments on the proposed project.

Galen Kuba, Division Chief
Engineering Division

TWP swa

cc: Engineering-Hilo
Engineering-Kona

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

LEADING HAWAII INTO THE NEW MILLENNIUM
1959 2000+

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

August 17, 2000

IN REPLY REFER TO:
AIR-P
00.0433

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

Dear Mr. Kuba:

This is in response to your comments for the Draft Environmental Assessment (DEA) Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii. We acknowledge that you have no comments to the proposed project.

We appreciate your review of the DEA. Please have your staff contact Ben Schlapak, Head Planning Engineer, at (808) 838-8821 to clarify any questions you may have.

Sincerely,

Jerry M. Matsuda

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

Na Ke Ala Aloha
Hawaii Gateways of Aloha

1575

U S Department of Transportation
Federal Aviation Administration

Western-Pacific Region
Airports District Office

300 Ala Moana Blvd., Room 7-128
Honolulu, Hawaii 96813
MAIL: Box 50244
Honolulu, Hawaii 96850-0001
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FAX: (808) 541-3462

June 10, 1999

Mr. Jerry M. Matsuda
Airports Administrator
DOT, State of Hawaii
400 Rodgers Blvd., Suite 700
Honolulu, Hawaii 96819-1880

Dear Mr. Matsuda:

We have reviewed the Draft Environmental Assessment (EA) for Kona International Airport dated March 1999. Our review has determined that the Phase I projects are Categorically Excluded from the requirement for a formal environmental assessment in accordance with Paragraph 23 of FAA Order 5050.4A. Therefore, FAA processing of this EA culminating in the preparation of a Finding of No Significant Impact (FONSI) is not required.

We have enclosed several comments on the enclosed pages to assist in the State's Chapter 343 processing of the EA.

If you have any questions regarding this schedule, please call David Welhouse at 541-1243.

Sincerely,

Daniel S. Matsumoto

Daniel S. Matsumoto
Civil Engineer

Enclosure

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
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Leading Hawaii Into The New Millennium
1959 2000+

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:

AIR-P
00.0454

August 15, 2000

Mr. Daniel S. Matsumoto
Acting Airports District Manager
Federal Aviation Administration
Western-Pacific Region
P. O. Box 50244
Honolulu, Hawaii 96850-0001

Dear Mr. Matsumoto:

This is in response to your comments for the Draft Environmental Assessment (DEA), Kona International Airport at Keahole Master Plan Update, North Kona, Hawaii.

1. We acknowledge your review of the subject DEA and your determination that Phase I projects are categorically excluded from the requirement for a formal environmental assessment. You have also determined that the Federal Aviation Administration (FAA) processing of this project with a Finding of No Significant Impact (FONSI) is not required.

2. We will use your comments to assist in preparation of the final environmental document for this project.

We appreciate your review of the DEA and allowing us this opportunity to respond. Please have your staff contact Ben Schlapak, Head Planning Engineer, at 838-8821 to clarify any questions you may have.

Sincerely,

JERRY M. MATSUDA, P.E.
Airports Administrator

c: Keahole Associates, Inc. (M. Inouye)

SECTION 12
LIST OF PREPARERS

Keahole Associates	Frank Sanpei, Principal Michael Inouye, Project Manager
R. M. Towill Corporation	Chester Koga, Project Manager Brian Takeda, Senior Planner Tomo Murata, Planner Martin Nakasone, Civil Engineer
Aries Consultants, Ltd. Air Passenger Forecasts	John Sanders, President
Winona Char and Associates - *Botanical Studies*	Winona Char, Principal
Rana Productions, Ltd. Faunal Studies	Reginald E. David
Y. Ebisu and Associates - Noise Compatibility Program Report	Yoichi Ebisu, Principal
International Archaeological Research Institute, Inc.- Archaeology	Thomas S. Dye, Archaeologist
Social Research Pacific, Inc. Archaeology	Usha Prasad, Archaeologist
Chiniago, Inc. Archaeology	William Barrera, President
J.W. Morrow Environmental Mgmt. Consultant Air Quality Study	James W. Morrow

SECTION 13
REFERENCES

(Listed in Chronological Order)

1. Edward K. Noda and Associates, Inc., Rana Productions, Ltd., February 2000. *Faunal Survey of Avian and Mammalian Species, Kona International Airport at Keahole, North Kona, Hawaii.*

2. Edward K. Noda and Associates, Inc., Char and Associates, February 2000. *Botanical Survey, Kona International Airport at Keahole, North Kona, Hawaii.*

3. Department of Transportation, Airports Division, Kimura International, Inc., June 1999. *Environmental Compliance Audit, Hawaii County Airports.*

4. Department of Transportation, Airports Division, The Natural Energy Laboratory of Hawaii Authority, Analytical Laboratory, December 1998. *Final Report: Year One, July 15, 1997 - June 15, 1998 for the Water Quality Monitoring Program for the Keahole Airport Expansion.*

5. R. M. Towill Corporation, and State of Hawaii, Department of Transportation, 1998. *Statewide Airport System Plan (SASP).*

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APPENDIX A
Botanical Survey

BOTANICAL SURVEY
KONA INTERNATIONAL AIRPORT AT KEAHOLE
NORTH KONA, HAWAI'I

by

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February 2000

SUMMARY

A botanical survey of the undeveloped portions of the Urban designated lands was made for the Kona International Airport at Keahole on 20 and 21 November 1999. Fountain grass/scrub vegetation covers large parts of the undeveloped lands, while ruderal or weedy vegetation occurs on areas which have been graded or disturbed. A total of 67 plant species were found. Of these, 52 (78%) are introduced; 2 (3%) are originally of Polynesian introduction; and 13 (19%) are native. Ten of the native species are indigenous (native to the Hawaiian Islands and elsewhere), while three are endemic (native only to the Hawaiian Islands). None of the plants is a threatened and endangered species. Two of the endemic plants, the maiapilo or native caper (<u>Capparis sandwichiana</u>) and <u>Fimbristylis hawaiiensis</u>, are considered species of concern, but these are not high priority species of concern and the populations number in the thousands.

The proposed uses for the undeveloped portions of the Urban designated lands are not expected to have a significant negative impact on the botanical resources as the majority of the plants which occur on the site are introduced species. There are no sensitive, native plant-dominated vegetation types or threatened and endangered species on the project site. All of the native plants can be found in similar dry lowland areas on Hawai'i island and the other islands.

It is recommended that whenever and wherever possible, native plants be used for landscaping the new facilities. Plants native to the West Hawai'i region are adapted to the lava substrate and low rainfall; they would require less water, soil, and maintenance. An anchialine pond bordering the Urban designated lands, just outside the runway fence line on the south end of the runway, should be avoided if any future use is planned for this area.

BOTANICAL SURVEY
KONA INTERNATIONAL AIRPORT AT KEAHOLE
NORTH KONA, HAWAI'I

INTRODUCTION

An updated study of the botanical resources was made for the Kona International Airport at Keahole, North Kona District, Hawai'i. The study area included all the Urban designated lands and consists of approximately 1,300 acres. Most of the Urban lands have already been developed and support structures and runways as well as landscaped, maintained areas. The present study focused on the unmaintained areas, especially those sites proposed for development in Phases I and II in the Draft Environmental Assessment (Keahole Associates, Inc. 1999).

Field studies to assess the botanical resources found on the Keahole site were made on 20 and 21 November 1999; a team of two botanists was used to conduct the survey. The primary objectives of the field studies were to:

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

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topographic maps as well as a recent, colored aerial photograph were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, disturbances, drainage, exposure, topography, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium, and for comparison with the recent taxonomic literature. The survey focused on the unmaintained areas within the Urban designated lands, especially on the areas with more weathered lava flows. These areas were more likely to harbor native plant communities and, perhaps, rare plants.

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

PREVIOUS STUDIES

In 1987, a botanical survey (Linney 1987) was conducted for three parcels proposed for the Keahole airport expansion. Sparsely vegetated lava fields dominated by fountain grass (*Pennisetum setaceum*), 'uhaloa (*Waltheria indica*), and maiapilo (*Capparis sandwichiana*) characterized the vegetation on the three parcels and the adjacent undeveloped lands. A total of 46 plant species were found during the 1987 study. None of the plants was considered rare, threatened, or endangered.

The three parcels surveyed in 1987 have since been largely developed. The first parcel, about 250 acres located mostly on the 1801 lava flow, supports the present runway and runway perimeter fencing (runway protection zone). The second parcel, about 15 acres, was used for expansion of the car-rental facilities. Portions of the 130-acre third parcel have been developed; this includes part of Road "N" and a fuel storage facility.

Studies of the botanical resources for the Natural Energy Laboratory of Hawaii (NELH), Hawaii Ocean Science and Technology (HOST) Park, and the 'O'oma II lands (Char 1985, 1986) have recorded similar findings for the lava field areas. No rare, threatened, or endangered species of plants were found.

DESCRIPTION OF THE VEGETATION

A short description of the vegetation on the landscaped portions of the airport is presented; the names of the cultivated plants follow St. John (1973), for the most part. However, most of the discussion which follows covers the unmaintained, undeveloped portions of the Urban designated lands since native plants are more likely to occur on these areas. Two vegetation types are recognized on the undeveloped portions of the study site. Fountain grass/scrub vegetation is found on those areas which have not been disturbed or graded, while ruderal vegetation occurs on those areas which have been recently disturbed such as alongside roads, on old bulldozer tracks, construction storage areas, etc.

An inventory of all the plants found on the undeveloped portions of the project site is presented at the end of the report.

Maintained/Landscaped Areas

At the aiport entrance, there is a planting of coconut trees (Cocos nucifera). Wiliwili haole or tigers claw trees (Erythrina variegata) and Bougainvillea shrubs with a variety of flower colors line the airport access road. Around the terminal buildings, there are lawn areas planted primarily with Bermuda grass hybrids (Cynodon dactylon) and plantings of various ornamental tree, shrub, and ground cover species which include coconut, monkeypod (Samanea saman), sea grape (Coccoloba uvifera), be-still tree (Csacabela thevetia), oleander (Nerium oleander), Plumeria hybrids, tiare or Tahitian gardenia (Gardenia taitensis), Bougainvillea, ice flower (Lampranthes glomerata), wedelia (Spagneticola trilobata), Hibiscus hybrids, etc.

Three native species are used extensively in some locations. These are the low, mat-forming type of 'ilima or 'ilima papa (Sida fallax), naupaka shrubs (Scaevola sericea), and 'akia shrubs (Wikstroemia uva-ursi). A few plants which were originally brought to the islands by the early Polynesian settlers also have been incorporated into the landscaping. Besides the coconut trees, these include kou (Cordia subcordata) and kamani (Calophyllum inophyllum).

Fountain Grass/Scrub Vegetation

This vegetation type occurs on the areas which have not been bulldozed and is typical of the natural vegetation on the adjacent lands. The amount of plant cover varies among the different aged lava flows with the older, weathered, deeply oxidized flows being more heavily vegetated. On the southeast portion of the study site, plant cover on the older, weathered pahoehoe flow is about 20 to 30%. The grasses, herbs, and smaller shrubs are from 1 to 2 feet tall and form scattered clumps over the flow. Fountain grass (Pennisetum setaceum), a course bunch grass native to northern Africa, is the most abundant plant.

Other grasses found here are Natal redtop grass (Melinis repens) and pili grass (Heteropogon contortus), which can become locally abundant. 'Uhaloa (Waltheria indica), a small native shrub, is also abundant, occurring in about the same numbers as the fountain grass. Pockets of shallow soil in swales or low lying areas support a number of the smaller herbaceous species such as coat-buttons (Tridax procumbens), hairy spurge (Chamaesyce hirta), pigweed (Portulaca oleracea), and Fimbristylis hawaiiensis, a diminutive native sedge.

Taller shrubs, 3 to 8 feet high, are found scattered throughout the fountain grass/scrub vegetation. Maiapilo or native caper (Capparis sandwichiana) with its large, fragrant, white, showy flowers is present in fairly large numbers. Noni shrubs (Morinda citrifolia) are occasionally encountered, often occurring in small clusters. Other shrubs found here in smaller numbers include Christmas berry (Schinus terebinthifolius), koa haole (Leucaena leucocephala), lantana (Lantana camara), and sourbush (Pluchea carolinensis).

A large lava tube system is found on the pahoehoe flow on the southeast portion of the study site. Where the roof or side of the lava tube has collapsed, a few plants which prefer a shadier, more protected, and somewhat moister habitat are found; these include the hairy swordfern (Nephrolepis multiflora), laua'e (Phymatosorus scolopendria), moa (Psilotum nudum), spurflower (Plectranthus parviflorus), and scarlet sage (Salvia coccinea).

On the makai and northern portion of the Urban designated lands, the 1801 lava flow covers large sections. This geologically recent flow is primarily pahoehoe although there may be smaller outcroppings of 'a'a lava. Plant cover is 1% or less. The very sparsely vegetated flow supports primarily fountain grass and smaller amounts of 'uhaloa and a few maiapilo shrubs.

Ruderal Vegetation

Ruderal or weedy vegetation which is associated with disturbed areas can be found throughout the study site. The more recently bulldozed parcel bordering the southeast side of the runway fence is largely barren, hardpacked gravel. Plant cover varies from 3 to 5% and consists of fountain grass and 'uhaloa. A few small, rounded, pale green clumps of *Heliotropium procumbens* can also be found here; this species is a recently introduced plant first collected on O'ahu in 1975 (Wagner *et al*. 1990).

Two unpaved roads cross the southeast portion of the study site, passing through fountain grass/scrub vegetation. Along a part of the road which connects to Road "N" South, there are piles of soil and green waste from the landscaped areas. Weedy, mostly annual plants, are abundant here because of the soil and organic material. These include wild bittermelon (*Momordica charantia*), wiregrass (*Eleusine indica*), hairy spurge, crabgrass (*Digitaria* sp.), Spanish needle (*Bidens pilosa*), swollen fingergrass (*Chloris barbata*), pigweed, spiny amaranth (*Amaranthus spinosus*), castor bean (*Ricinus communis*), etc. The fountain grass forms more robust, greener clumps in these disturbed areas. Some of the plant material used in landscaping the terminal and dumped on this site have rooted or sprouted and established small populations. These are portulaca (*Portulaca grandiflora*), seedlings of monkeypod, and ice plant or 'akulikuli-lei.

Between Road "N" and the runway fence, in the area of the existing overseas terminal, there are piles of soil, asphalt, and concrete. This disturbed site which has been graded also is used to store construction material and equipment. Portions of this site are proposed for the new overseas terminal, more public parking, and post office.

Plant cover is about 3 to 5% with fountain grass the most abundant plant. The weedy plants tend to occur on the piles of soil and rocks. Some of the landscape material which has established here are doing quite well. There are scattered small stands of kou, 5 to 12 feet tall, and young monkeypod, 3 to 7 feet tall, as well as thick mats of Bermuda grass and *Phyla nodiflora*, a creeping herb used for ground cover.

DISCUSSION AND RECOMMENDATIONS

The developed and landscaped portions of the airport support various ornamental species and Bermuda grass lawns. In places, native plant material such as 'ilima papa, naupaka, and 'akia has been extensively planted. The unmaintained portions of the Urban designated lands which have not been disturbed support fountain grass/scrub vegetation dominated by fountain grass and shrubs of 'uhaloa and maiapilo. Plant cover is low and open, varying from 1 to 30% cover, depending on the age and weathering of the lava substrate. On areas which have been bulldozed or disturbed, the vegetation consists of scattered clumps of fountain grass as well as several weedy species. A few of the plants used for landscaping the terminal have established themselves on piles of soil and rubble stored on some of the disturbed sites.

Introduced or alien species such as fountain grass are the most commonly encountered plants throughout the study area. Introduced plants are all those plants which were brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is, Cook's discovery of the islands in 1778. An inventory of the unmaintained portions of the Urban designated lands found 67 plant species. Of these, 52 (78%) are introduced; 2 (3%) are originally of early Polynesian introduction; and 13 (19%) are native. Ten of the native plants are indigenous, that is, they are native to the Hawaiian Islands and elsewhere. These indigenous species are: moa (Psilotum nudum), koali 'awa (Ipomoea indica), naupaka (Scaevola sericea), spurflower or 'ala'ala wai nui pua ki (Plectranthus parviflorus), 'ilima (Sida fallax), 'a'ali'i (Dodonaea viscosa), naio (Myoporum sandwicense), 'uhaloa (Waltheria indica), Fimbristylis cymosa, and pili grass (Heteropogon contortus). Three plants are endemic, that is, they are native only to the Hawaiian Islands; these are the nehe (Lipochaeta lavarum), maiapilo (Capparis sandwichiana), and Fimbristylis hawaiiensis.

None of the plants observed during the field studies is a threatened and endangered species (U.S. Fish and Wildlife Service 1999). The maiapilo and Fimbristylis hawaiiensis are considered species of concern. Species of concern generally means that there is a need for more biological and/or taxonomic information regarding whether a plant might require conservation actions in the future. Species of concern do not receive legal protection under the Federal and State Endangered Species laws. The maiapilo and Fimbristylis are not considered high priority candidates for listing as threatened or endangered plants (U.S. Fish and Wildlife Service 1999). Maiapilo occurs on all the main Hawaiian Islands as well as a few of the northwest or leeward islands (Midway, Pearl and Hermes Atoll, and Laysan). Fimbristylis is found primarily on weathered pahoehoe flows from West Hawai'i to Puna. The number of individual plants for the two species number in the thousands.

The proposed uses for the undeveloped portions of the Urban designated lands should not have a significant negative impact on the botanical resources. The majority of the plants found during the field studies are introduced species. The native plants which do occur on the site can be found in similar lowland environments on Hawai'i and the other islands.

As in the earlier botanical study (Linney 1987), it is recommended that native plants be used for landscaping the new facilities whenever possible. Lowland species native to West Hawai'i are adapted to the low rainfall conditions and rugged lava substrate. Suitable species already found in the fountain grass/scrub vegetation on the site include:

Maiapilo (Capparis sandwichiana): a bushy shrub with attractive and fragrant flowers.

Nehe (Lipochaeta lavarum): a small, sprawling shrub with silver gray leaves and large, yellow, daisy-type flowers.

Naio (Myoporum sandwicense): a large shrub to small tree with glossy green, almost succulent leaves and white to pinkish, fragrant flowers. Also known as false sandalwood because of its fragrant wood.

'A'ali'i (Dodonaea viscosa): a rounded shrub with glossy yellow-green leaves; the fruit is a showy, reddish-brown, papery capsule often used in lei making.

Other plants found in the West Hawai'i region such as the loulu palm (Pritchardia affinis), hala pepe (Pleomele hawaiiensis), and 'ohe (Reynoldsia sandwicensis) could also be planted. The Kona Outdoor Circle and the Amy Greenwell Ethnobotanical Garden make extensive use of native plants for landscaping and should be contacted for more planting suggestions and planting material.

While surveying the area along the runway fence line, an anchialine pond was found near the southwest corner of the fence on Conservation zoned land (see map attached). This pond area should be avoided if future development is planned for this section. The anchialine pond supports a large population of 'opae'ula, a rare native shrimp.

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PLANT SPECIES LIST -- Kona International Airport at Keahole

The following checklist is an inventory of all the plants observed during the field studies; no survey was made of the landscaped areas. The plant names are arranged alphabetically by families within each of three groups: Ferns and Fern Allies, Dicots, and Monocots. The taxonomy and nomenclature of the Ferns and Fern Allies follow Lamoureux (1988), while the flowering plants, Dicots and Monocots, are in accordance with Wagner et al. (1990). The few recent name changes for the flowering plants follow those reported in the Hawaii Biological Survey series (Evenhuis and Miller, editors, 1995-1999).

For each species, the following information is provided:

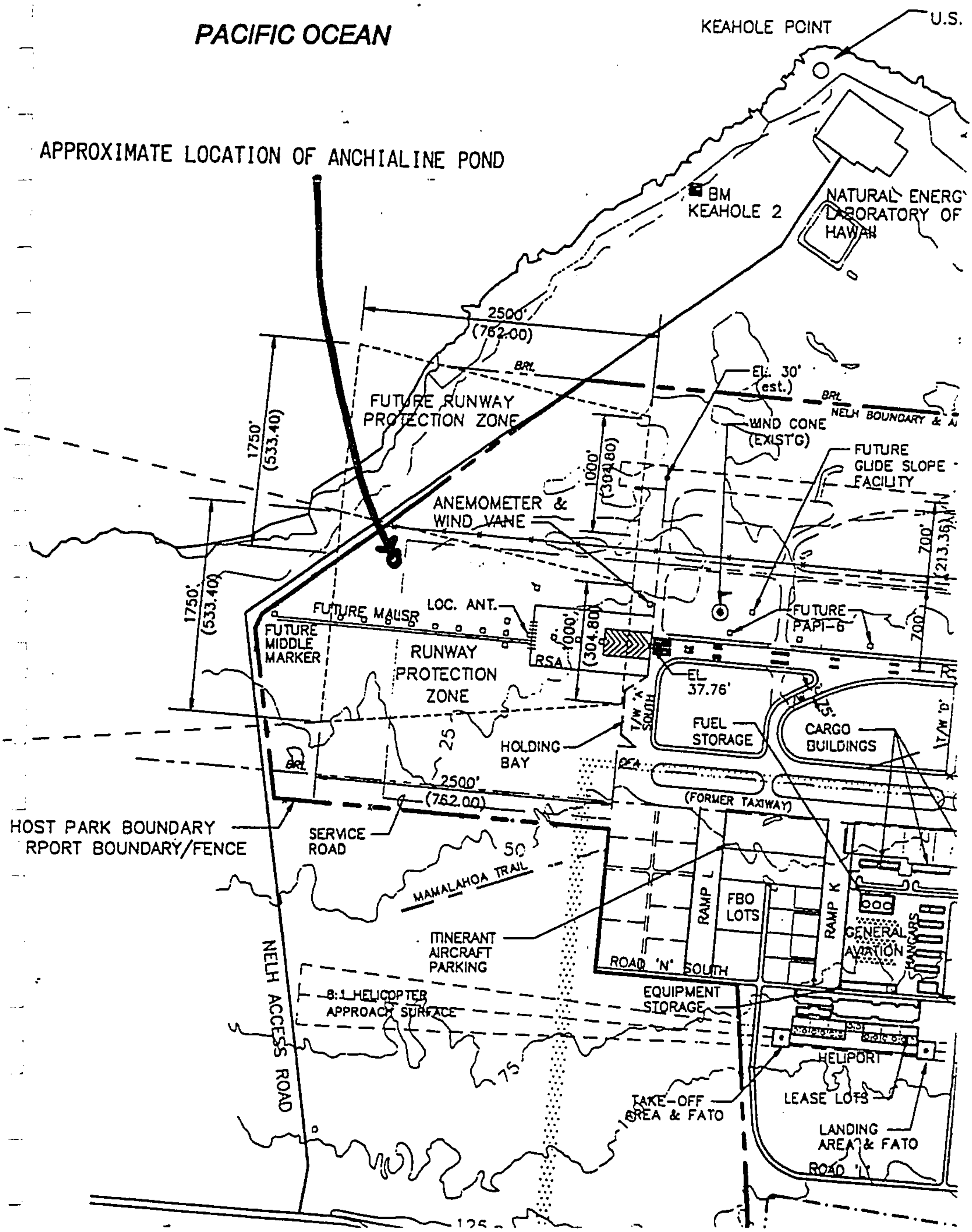
1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands.
   - I = indigenous = native to the Hawaiian Islands and also elsewhere.
   - I? = questionably indigenous = data not clear if dispersal by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.
   - P = Polynesian = plants originally of Polynesian introduction prior to Western contact, that is Cook's discovery of the islands in 1778.
   - X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact.
4. Presence (+) or absence (-) of a particular species within each of two vegetation types recognized on the project site (see text for discussion):
   - f = Fountain Grass/Scrub Vegetation
   - r = Ruderal Vegetation

Scientific name	Common name	Status	Vegetation type f	Vegetation type r
FERNS & FERN ALLIES				
NEPHROLEPIDACEAE (Swordfern family)				
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy swordfern, 'okupukupu	X	+	–
POLYPODIACEAE (Common fern family)				
Phymatosorus scolopendria (Burm.) Pic.-Ser.	laua'e, lauwa'e	X	+	–
PSILOTACEAE (Whisk fern family)				
Psilotum nudum (L.) Beauv.	moa, moa nahele, pipi	I	+	–
FLOWERING PLANTS — DICOTS				
AIZOACEAE (Fir-marigold family)				
Lampranthus glomerata (L.) N.E. Br.	ice flower, 'akulikuli	X	–	+
AMARANTHACEAE (Amaranth family)				
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X	–	+
ANACARDIACEAE (Mango family)				
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X	+	–
ASTERACEAE (Daisy family)				
Bidens pilosa L.	Spanish needle, ki, ki nehe	X	–	+
Lipochaeta lavarum (Gaud.) DC	nehe	E	+	–
Pluchea carolinensis (Jacq.) G. Don	sourbush, pluchea	X	+	+
Sonchus oleraceus L.	sowthistle, pualele	X	–	+
Tridax procumbens L.	coat buttons	X	+	+
BORAGINACEAE (Heliotrope family)				
Cordia subcordata Lam.	kou	P	–	+
Heliotropium procumbens var. depressum (Cham.) Fosb.		X	–	+

Scientific name	Common name	Status	Vegetation type f	Vegetation type r
CACTACEAE (Cactus family)				
Opuntia ficus-indica (L.) Mill.	panini, papipi	X	+	-
CAPPARACEAE (Cactus family)				
Capparis sandwichiana DC	maiapilo, pilo, pua pilo	E	+	+
Cleome gynandra L.	wild spider flower, hohohina	X	-	+
CONVOLVULACEAE (Morning glory family)				
Ipomoea indica (J. Burm.) Merr.	koali 'awa, koali 'awahia	I	+	-
CUCURBITACEAE (Gourd family)				
Coccinia grandis (L.) Voigt	ivy gourd, coccinia	X	-	+
Momordica charantia L.	wild bittermelon	X	-	+
EUPHORBIACEAE (Spurge family)				
Chamaesyce hirta (L.) Millsp.	hairy spurge	X	+	+
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	-	+
Chamaesyce prostrata (Aiton) Small	prostrate spurge	X	-	+
Phyllanthus debilis Klein ex Willd.	niruri	X	-	+
Ricinus communis L.	castor bean, koli, pa'aila	X	-	+
FABACEAE (Pea family)				
Acacia farnesiana (L.) Willd.	klu	X	+	+
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X	+	+
Crotalaria incana L.	fuzzy rattlepod, kukaehoki	X	-	+
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	X	-	+
Desmodium tortuosum (Sw.) DC	Florida beggarweed	X	+	+
Indigofera suffruticosa Mill.	indigo, 'iniko	X	+	-
Leucaena leucocephala (Lam.) de Wit	kao haole, ekoa	X	+	+
Macroptilium latyroides (L.) Urb.	wild bean, cow pea	X	-	+
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X	+	-
Samanea saman (Jacq.) Merr.	monkeypod	X	-	+

Scientific name	Common name	Status	Vegetation type f	Vegetation type r
GOODENIACEAE (Goodenia family)				
Scaevola sericea Vahl	naupaka, naupaka kahakai, beach naupaka	I	–	+
LAMIACEAE (Mint family)				
Leonotis nepetifolia (L.) R. Br.	lion's ear	X	–	+
Plectranthus parviflorus Willd.	'ala'ala wai nui pua ki, spurflower	I	+	–
Salvia coccinea Etl.	scarlet sage, lililehua	X	+	–
MALVACEAE (Mallow family)				
Malvastrum coromandelianum (L.) Garcke	false mallow	X	–	+
Sida fallax Walp.	'ilima	I	+	+
MYOPORACEAE (Naio family)				
Myoporum sandwicense A. Gray	naio	I	+	–
NYCTAGINACEAE (Four-o'clock family)				
Boerhavia coccinea Mill.		X	–	+
Bougainvillea glabra Choisy	bougainvillea, puka nawila	X	–	+
PORTULACACEAE (Purslane family)				
Portulaca grandiflora Hppk.	portulaca	X	–	+
Portulaca oleracea L.	pigweed, 'akulikuli kula, 'ihi	X	+	+
Portulaca pilosa L.		X	–	+
RUBIACEAE (Coffee family)				
Morinda citrifolia L.	noni	P	+	+
SAPINDACEAE (Soapberry family)				
Dodonaea viscosa Jacq.	'a'ali'i	I	+	–
SOLANACEAE (Nightshade family)				
Solanum lycopersicum var. cerasiforme (Dunal) Spooner, Anderson & Jansen	currant tomato, wild tomato	X	–	+

Scientific name	Common name	Status	Vegetation type f	r
STERCULIACEAE (Cacao family)				
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?	+	+
VERBENACEAE (Verbena family)				
Lantana camara L.	lantana, lakana	X	+	–
Phyla nodiflora (L.) Greene		X	–	+
ZYGOPHYLLACEAE (Creosote bush family)				
Tribulus terrestris L.	puncture vine, goat head	X	–	+
FLOWERING PLANTS — MONOCOTS				
AGAVACEAE (Sisal family)				
Furcraea foetida (L.) Haw.	Mauritius hemp	X	+	–
CYPERACEAE (Sedge family)				
Cyperus rotundus L.	nutgrass, nut sedge	X	–	+
Fimbristylis cymosa R. Br.		I	+	–
Fimbristylis hawaiiensis Hillebr.		E	+	–
POACEAE (Grass family)				
Cenchrus ciliaris L.	buffelgrass	X	–	+
Cenchrus echinatus L.	common sandbur, 'ume 'alu	X	–	+
Chloris barbata (L.) Sw.	swollen fingergrass, mau'u lei	X	–	+
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	–	+
Digitaria sp.	crabgrass	X	–	+
Eleusine indica (L.) Gaertn.	wiregrass, goosegrass	X	–	+
Eragrostis amabilis (L.) Wight & Arnott	lovegrass	X	–	+
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili, pili grass	I?	+	–
Melinis repens (Willd.) Zizka	Natal redtop, Natal grass	X	+	+
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X	+	+



PACIFIC OCEAN
KEAHOLE POINT
U.S.
APPROXIMATE LOCATION OF ANCHIALINE POND
BM
KEAHOLE 2
NATURAL ENERG
LABORATORY OF
HAWAII
2500'
(762.00)
BRL
FUTURE RUNWAY
PROTECTION ZONE
1750'
(533.40)
EL. 30'
(est.)
NELH BOUNDARY &
WIND CONE
(EXIST'G)
FUTURE
GLIDE SLOPE
FACILITY
1000'
(304.80)
ANEMOMETER &
WIND VANE
700'
(213.36)
FUTURE MALSR
LOC. ANT.
FUTURE
PAPI-6
FUTURE
MIDDLE
MARKER
RUNWAY
PROTECTION
ZONE
RSA
EL
37.76'
T/W 'A' SOUTH
FUEL
STORAGE
CARGO
BUILDINGS
T/W 'D'
HOLDING
BAY
25
2500'
(762.00)
(FORMER TAXIWAY)
HOST PARK BOUNDARY
RPORT BOUNDARY/FENCE
SERVICE
ROAD
50
MAMALAHOA TRAIL
RAMP L
FBO
LOTS
RAMP K
GENERAL
AVIATION
HANGARS
ITINERANT
AIRCRAFT
PARKING
ROAD 'N' SOUTH
8:1 HELICOPTER
APPROACH SURFACE
EQUIPMENT
STORAGE
HELIPORT
NELH ACCESS ROAD
75
TAKE-OFF
AREA & FATO
LEASE LOTS
LANDING
AREA & FATO
ROAD
125

BOTANICAL SURVEY

KEAHOLE AIRPORT MASTER PLAN

District of North Kona, Island of Hawai'i

by

George K. Linney

PREPARED FOR:

R. M. Towill Corporation

PREPARED BY:

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

SEPTEMBER 1987

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SECTION 1
INTRODUCTION

1.1 OVERVIEW

A survey of the terrestrial vertebrate fauna on the areas proposed for expansion of the Keahole Aiport, as well as the already existing developed areas, was conducted on 26 August 1987. Nine species of birds, all of them foreign or introduced, were recorded from the study site. Skeletal material of donkey and goat were found on the prehistoric pahoehoe lava flow south of the maintenance building. The presence of mongoose in the weedy scrub, fringe areas around the airport and car rental return lots was observed. One skink species was seen in a large lava tube on the study site. None of the fauna encountered during this survey is considered threatened or endangered by the Federal and/or State governments.

1.2 REVIEW OF THE LITERATURE

A number of recent fauna surveys have been conducted for the areas adjacent to or near the Keahole Airport. Walker (1975) made an intensive survey of the adjacent Natural Energy Laboratory of Hawaii (NELH) site and also a portion of the Hawaiian Ocean Science and Technology (HOST) Park. Both sites include coastal areas. Walker recorded eleven avian species. Three of these, the Golden Plover or Kolea (Pluvialis fulva), the Wandering Tattler or 'Ulili (Heteroscelus incanus), and the Ruddy Turnstone or 'Akeke (Arenaria interpres), are migratory shorebird species which winter over in the islands. The other birds recorded are all foreign species and included the following: Gray Francolin (Francolinus pondicerianus), Barred Dove (Geopelia striata), Common Myna (Acridotheres tristis), Japanese White-eye (Zosterops japonicus), House Finch (Carpodacus mexicanus), House Sparrow (Passer domesticus), Cardinal (Cardinalis cardinalis), and Red-crested Cardinal (Paroaria coronata). The Indian Mongoose (Herpestes auropunctatus) was the only mammal observed.

In a study of the nearby Keahole Agricultural Park site, Krauss (1977) also recorded most of the species observed by Walker including a pheasant species

(Phasianus sp.). In addition, Krauss also observed a Hawaiian-Owl or Pueo (Asio flammeus sandwichensis) over the agricultural park site.

Fifteen bird species were reported from the nearby Kohana-Iki and 'O'oma II by Kjargaard (1986a, 1986b). Four of these species, the 'Ulili, Kolea, Great Frigatebird or 'Iwa (Fregata minor palmerstoni), and the Black-crowned Night-heron or 'auku'u (Nycticorax nycticorax hoactli), were found along the coastal margin or around the anchialine ponds. The remaining eleven species recorded were: Gray Francolin, Rock Dove (Columba livia), Barred Dove, Common Barn-owl (Tyto alba), Melodious Laughing-thrush (Garrulax canorus), Japanese White-eye, Nutmeg Mannikin (Lonchura punctulata), House Sparrow, Yellow-billed Cardinal (Paroaria capitata), Cardinal, and House Finch. Only the mongoose was seen during this survey. However, mammalian skeletal material was abundant on the Kohana-Iki and 'O'oma II study sites, particularly on pahoehoe substrate and in the lava tubes and caves that dot the pahoehoe flows. The majority of the material was old and the following species were reported: Feral Cat (Felis catis), Feral Pig (Sus scrofa), Feral Goat (Capra hircus), and Donkey (Equus asinus).

1.3 SURVEY METHODS

The survey work was conducted on 26 August 1987 between the hours of 0645 and 1730. Birds and reptiles were detected both by sight and by their vocalizations. The landscaped areas around the airport were included in the survey as these areas provide water, food and nesting sites in an otherwise marginal habitat. In addition, presence of bird species was determined by indirect means such as by presence of tracks, droppings, and nests.

Mammalian presence and distribution were detected by sight and indirect means. Skeletal material was important in indicating historical occurence on the study site for species which had been extirpated from the area.

C. H. Lamoureux and W. H. Warren have very tentative treatments in manuscript. Where these two differ, Warren's has been followed, primarily because of greater familiarity.

SECTION 2
COMPOSITION OF THE VEGETATION

2.1 FIRST PARCEL

The first parcel of the site for proposed expansion is roughly 250 acres north of the present terminal and runway areas. Adjacent to the terminal area, it is much disturbed, largely graded with a well maintained gravel road leading to a quarry. Beyond this quarry, the road is extremely rough, used mostly by local people to gain access to a small beach. Public access is by gravel road directly from the highway, the two roads intersecting at the quarry. This portion of the parcel is very sparsely vegetated pahoehoe, part of the 1801 flow. On the western (makai) side of the parcel there is a well-maintained emergency-access gravel road, extending from the end of the present runway to near the northern end of the parcel. Elsewhere, the lava is largely undisturbed.

Both in numbers and biomass, the predominant plant on the lava is fountain grass, a noxious exotic characteristic of lava fields in this part of the island. It is a bunch-grass that tends to occupy most areas even minimally suited to vegetation. In less hostile environments it crowds out smaller native plants and threatens native trees and shrubs, its large, dry clumps presenting a serious fire-hazard. Other than this, it probably contributes to the production of soil on the bare lava. Another plant of almost equal numbers, but far less stature and biomass, is 'uhaloa. It is a common weed of dry, waste places throughout the islands. The third most common plant is maia-pilo, the native caper. It is represented by two growth forms. As an upright shrub it may reach heights of three or four feet on the lava here, though taller elsewhere. The crowns tend to be few-branched. As a prostrate ground-cover, it may not exceed a foot or two in height, often just a few inches, but may form a mat of 50 or more square-feet. Maia-pilo flowers are large, showy, and white with a powerful, sweet fragrance. Unfortunately, they

open only at night and wither in the early-morning sun the next day, or else they might be more useful for landscape plantings. Fruit is set, but ripe ones are rare, apparently eagerly sought out by birds.

Two more plants characteristic of the lava fields but too minor to be considered as significant components are noni (Morinda citrifolia), a shrub or small tree introduced by the Polynesians, and used medicinally by them; and also hairy sword-fern (Nephrolepis multiflora), a very agressive and persistent exotic weed able to survive in cracks in the rock and in lava tubes.

Along the edges of roads or other disturbed areas, fountain grass increases in density, and a number of low-statured exotic weeds, such as threadstem carpetweed (Mollugo cerviana) and hairy spurge (Chamaesyce hirta) are found. As these others tend to be no more than minor constituents of the vegetation, they are enumerated only in the species list. There was, however, one noteworthy find at the eastern (mauka) side of the parcel: a single 'ohi'a-lehua tree (Metrosideros polymorpha) about 9 to 10 feet in height. Much farther inland it becomes the characteristic forest tree, but had not been expected so close to the terminal buildings (within 1000 feet). Gravel has been quarried right up to the base of the tree, and it is in imminent danger of being bulldozed. It was noted that perhaps five others are present in the area between this parcel and the highway, all of greater stature. The only other woody plants in this parcel were two crownflower bushes (Calotropis procera). They have apparently spread here from a population of about a dozen and a half along the highway just south of the airport entrance. These in turn may have originated from a planting nearby. Seeds are wind-dispersed, and may be carried for miles. These are small trees with highly furrowed, quite decorative bark, and large purple-and-white flowers. The light green branches and foliage are covered with a dense white fuzz.

2.2 SECOND PARCEL

The second parcel, some 15 acres adjacent to the present car-rental facilities, appears to have been similarly, but more densely vegetated. However, it has now largely been graded, and the major vegetative components are ruderal (wayside) weeds growing adjacent to the tarmac of the car-rental sites. Increased water, supplied from the tarmac run-off, probably accounts for their great abundance in this area. Because they are associated with the edge of the tarmac, rather than the lava field, they are not considered to be significant components of the natural environment and will not be discussed in detail here. They are, however, included in the species list.

2.3 THIRD PARCEL

The third parcel is approximately 130 acres, roughly "L"-shaped, adjacent to and mauka of the present runway in the south of the airport property. It is mostly of prehistoric pahoehoe, though small patches of 'a'a are present. It is much more heavily vegetated than the other two parcels, though the same species predominate in all: fountain grass, 'uhaloa, and maia-pilo. The greater density, and perhaps the larger number of species, may be the result of a more favorable habitat provided by the older, weathered lava. Of the species found only on this parcel, almost all of them are single individuals or small colonies probably representing offspring of a single individual. This was true of lantana (Lantana camara), molasses grass (Melinus minutiflorus), klu (Acacia farnesiana), kiawe (Prosopis pallida), a'ali'i (Dodonaea viscosa), and to a lesser extent 'auhuhu (Tephrosia purpurea). The first three are exotic weeds: the first a shrub brought into Hawaii for its colorful flowers; the second a poor pasture-grass; the third, a shrub or small tree brought in for a defunct perfume industry. 'Auhuhu is considered a Polynesian introduction. An inconspicuous shrub, it was used in early Hawai'i and throughout the Pacific as a fish poison. Kiawe, also an exotic, is the dominant tree of lowland Hawai'i, and in areas adjacent to the study site forms savanna or forest. Within the study area the single specimen of kiawe was only a broad, low shrub.

Many of the more unusual species were found only in lava tubes, where the shelter from sun and wind, along with the higher humidity, provide protected habitat. Otherwise, many of these species would not usually be expected in the area. Because the plants of the lava tubes are such unusual finds for this area, a short discussion follows. The most characteristic element is the ferns. Many are limited to a single lava tube, and each tube has a different set of ferns and fern allies. These are sword-fern (Nephrolepis multiflora), iwa'iwa (Doryopteris decora), wood-fern (Thelypteris torresiana), holly fern (Cyrtomium falcatum), laua'e (Phymatodes scolopendria) and moa (Psilotum nudum). Only the second and last of these is native. In one particularly large lava tube, perhaps as much as 100 feet long by 30 feet wide by 15 feet high, ferns are abundant. The entrance of this lava tube is marked by a noni some 15 to 18 feet tall, a height it could never reach out on the open lava fields under the current climatic conditions. There were two other significant finds in this cave: Peperomia cookiana and Plectranthus parviflorus. They are unrelated, but similar in appearance and habitat requirements, and often found together on almost bare rocks. The Polynesians referred to them by the same name, 'ala'ala-wai-nui. They are characteristic of slightly moister areas a few hundred feet higher and farther inland.

SECTION 3
POTENTIAL PROBLEMS AND CONCERNS

3.1 FLORAL ELEMENTS NEEDING PROTECTION

There are no plant communities or individual species located in the study site requiring protection. This is not to say that some measure of care could not be exercised when the area is developed. Some elements of the present vegetation might be incorporated in the future landscaping. Onsite 'ohia is clearly adapted to the harsh environment, and might well be used in the landscaping, as might the maia-pilo. There does not seem to be any botanical impediment to the development of the study area, though the presence of the very large lava tube suggests there may be geological problems. That one feature poses a serious threat to operators of heavy equipment and suggests the presence of others not yet discovered.

For the most part, there is little of botanical interest within the three parcels that comprise the study site. In the north, the lava is of such recent age that it has not been heavily colonized by plants. To the east, it has already been disturbed by quarrying and grading. In the south, while vegetated and largely undisturbed, the harshness of the environment and prevalence of more agressive and better-adapted weeds has so degraded the vegetation, that little of merit is found there.

3.2 RECOMMENDATIONS FOR LANDSCAPING

It would seem advisable for the landscape architect to set a theme or particular goal, if problems with maintenance are to be avoided in the future. Potential themes could be "Tropical", making bold use of color or verdure, or "Desert", emphasizing the sunniness and aridity of the local climate, or "Hawaii", stressing local heritage through selective use of native and Polynesian-introduced species. Desirable goals would include reducing maintenance (irrigation, litter, pruning) and avoiding structural damage from tree branches and roots.

The advantages of using appropriate native plants are that they are already adapted to the harshness of the climate, requiring less soil and water than many widely-used landscape plants; they pose less threat to the near-by native vegetation should they escape from cultivation; they have not been so overused as to become prosaic; and they have not-inconsiderable cultural interest. Their disadvantages are that they have relatively few really showy representatives; landscapers have less experience with them and their cultural requirements; there are no large, pre-existing stocks, and so they must be propagated as needed; and appropriate choices are not always made, with resultant problems and disappointment. Some of these problems stem from selecting the correct species, but choosing stocks that are adapted to different conditions. Disappointment is also likely when seasonalities are not considered. Some species are seasonal in their growth and flowering, and if these are not balanced, they will produce a seasonally drab display. A more esoteric problem can arise if native plants are brought in from elsewhere and then escape or otherwise interact with the surrounding native plants. Cross-pollination with cultivated plants, for instance, can threaten the genetic integrity of the wild population of plants nearby.

Exotics have similar advantages and disadvantages. They are already commercially available and have been selected or bred for a showy effect. Many already in Hawaii, however, tend to be somewhat over-used, and there are real concerns about bringing in new species to Hawaii, because of the threat of new invasive species escaping cultivation and becoming serious pests. Few of them are well-adapted to the harsh conditions in the Keahole area, and their use could entail increased maintenance or result in a shabby appearance. It is

possible to use plants which require little or no irrigation once established, though that would eliminate many highly floriferous species. If the goal is to go for a bold splash of color against the starkness of the lava, with a few exceptions most choices would require at least a minimal amount of irrigation, perhaps a great deal.

The use of trees or other large, woody plants involves problems of crown and root spread. If installed too close to structures or pavement, periodic pruning of branches and roots may be required in order to prevent damage to structures or vehicles. Because of the nature of the lava, roots would tend to grow especially long and shallow, unless extensive site preparation is made. This involves the preparation of particularly deep beds of moisture-retentive soil. It is also necessary to consider the ultimate spread of the canopy, and to place no structures or pavement within that area.

Presence of soil and water is conducive to weed growth. Future weeding would be diminished by the use of drip-irrigation (or dribble-irrigation for larger plants) and mulching with black polyethylene. Two to four inches of crushed lava would conceal the plastic and keep the soil cool.

SECTION 4
SPECIES LIST

4.1 TERMS AND SYMBOLS

On the following pages is a list of all those species of vascular plants found during the Keahole Airport Expansion botanical survey. They are organized by family and scientific name. Each entry includes a common or Hawaiian name (if known), biogeographic status, and relative abundance on each parcel. The following symbols and abbreviations are used:

SCIENTIFIC NAME

- cf. - resembling species listed, but identity uncertain
- s.l. - in the broad sense
- sp. - an unidentified species

BIOGEOGRAPHIC STATUS

- E - endemic, native only to the Hawaiian Islands
- I - indigenous, native to the islands, but also to other geographic areas
- P - Polynesian introduction before arrival of western man
- X - exotic, introduced intentionally or accidentally since the arrival of western man

PARCEL

- 1 - area to north of present terminal
- 2 - area adjacent to car rental facility
- 3 - area to southeast of present terminal facilities

RELATIVE ABUNDANCE

- o - not seen (absent on parcel)
- s - single individual
- r - rare, less than 10 individuals
- u - uncommon, not a significant component
- c - common, a significant component
- a - abundant, a dominant component
- l - localized, found only in patches, number of patches may vary (used only in conjunction with another letter)

SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	BIOGEOGRAPHIC STATUS	PARCEL NO. 1	2	3
FERNS AND FERN ALLIES					
Adiantaceae					
Doryopteris decora Brack.	'iwa'iwa	I	o	o	s
Aspleniaceae					
Cyrtomium falcatum (Langsd. & Fisch.)	holly fern	X	o	o	s
Nephrolepis multiflora (Roxb.) Jarret ex Morton	sword fern	X	u	u	c
Thelypteris torresiana Gaud.	wood fern	X	o	o	r
Polypodiaceae					
Phymatodes scolopendria (Burm.) Ching	lau'ae	X	o	o	lu
Psilotaceae					
Psilotum nudum L.	moa	I	o	o	s
FLOWERING PLANTS					
MONOCOTS					
Cyperaceae					
Fimbrystylis pycnocephala Hbd.	fimbry	I	o	o	u
Gramineae					
Cynodon dactylon (L.) Pers.	Bermuda grass	X	s	o	o
Digitaria sp.	crab-grass	X	s	o	o

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3
Eragrostis tenella (L.) Beauv.	love-grass	X	lc	u	u
Heteropogon contortus (L.) Beauv. ex R. & S.	pili	I/P	o	o	u
Melinus minutiflorus Beauv.	molasses grass	X	o	o	s
Pennisetum setaceum (Forsk.) Chiov.	fountain grass	X	a	a	a
Rhynchelytrum repens (Willd.) C. E. Hubb.	Natal redtop	X	lc	c	lc
DICOTS					
Anacardiaceae					
Schinus terebinthifolius Raddi	Christmasberry	X	r	r	u
Asclepiadaceae					
Asclepias physocarpa (E. Meyer) Schlechter	gomphocarpus	X	o	o	s
Calotropis procera (Ait.) Ait. f.	crownflower	X	r	o	o
Capparaceae					
Capparis sandwichiana DC.	maia-pilo	E	c	c	c
Compositae					
Bidens pilosa L.	Spanish needle	X	o	u	o
Emilia coccinea (Sims) G. Don	orange-flowered emilia	X	u	u	u
Pluchea symphytifolia (Miller) Gillis	pluchea	X	r	r	r
Tridax procumbens L.	coat buttons	X	lc	lc	u
Euphorbiaceae					
Chamaesyce hirta (L.) Millsp.	hairy spurge	X	lc	u	u
Chamaesyce hypericifolia (L.) Millsp.	spurge	X	o	s	o

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3
Phyllanthus debilis Klein ex Willd.	phyllanthus	X	o	r	o
Labiatae					
Hyptis pectinata (L.) Poit.	comb hyptis	X	o	u	o
Plectranthus parviflorus Willd.	'ala'ala-wai-nui	I	o	o	lr
Leguminosae					
Acacia farnesiana (L.) Willd.	klu, huisache	X	o	o	s
Chamaecrista nictitans (L.) Moench.	partridge pea, lau-ki	X	lu	u	o
Desmodium tortuosum (Sw.) DC.	beggarstick	X	o	c	o
Indigofera suffruticosa Mill.	indigo	X	o	o	u
Leucaena leucocephala (Lam.) deWit	koa-haole, popinac	X	u	u	u
Macroptilium lathyroides (L.) Urb.	wild bush-bean	X	lu	u	o
Prosopis pallida (Humb. and Bonpl. ex Willd.) HBK	kiawe, mesquite	X	o	o	s
Tephrosia purpurea (L.) Pers.	'auhuhu, 'auhola	P	o	o	lu
Malvaceae					
Sida fallax Walp.	'ilima	I	r	r	u
Molluginaceae					
Mollugo cerviana (L.) Ser.	threadstem carpetweed	X	lc	o	o
Myrtaceae					
Metrosideros polymorpha Gaud.	'ohi'a-lehua	E	s	o	o

SCIENTIFIC NAME	COMMON NAME	STATUS	1	2	3
Passifloraceae					
Passiflora _foetida_ L.	love-in-a-mist	X	o	r	u
Piperaceae s.l.					
Peperomia _cookiana_ C. DC.	'ala'ala-wai-nui	E	o	o	lu
Portulacaceae					
Portulaca _oleracea_ L.	common purslane	X	r	u	u
Portulaca _pilosa_ L.	'ihi	X	o	u	u
Rubiaceae					
Morinda _citrifolia_ L.	noni	P	u	u	u
Sapindaceae					
Dodonaea _viscosa_ Jacq.	a'ali'i	I	o	o	s
Sterculiaceae					
Waltheria _indica_ L. var. _americana_ (L.) R. Br. ex Hosaka	'uhaloa, hi'aloa	I?	c	a	a
Verbenaceae					
Lantana _camara_ L.	lantana	X	o	o	s

APPENDIX B
Fauna Survey

REPORT:

Faunal Survey of Avian and Mammalian Species Kona International Airport, Keahole, North Kona, Hawai'i.

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February 2000

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Figures

Tables

Introduction:

This report summarizes the findings of a two day ornithological and mammalian survey of approximately 530 hectares within the existing Kona International Airport at Keahole facility (Figure 1). Fieldwork was conducted on December 7th and 8th 1999.

The primary purpose of the survey was to determine if there were any federally listed endangered, threatened, proposed, or candidate avian or mammalian species on, or in the immediate vicinity of the airport facility. In addition, we were asked to assess the probability of any usage of the site by listed species given the habitat available.

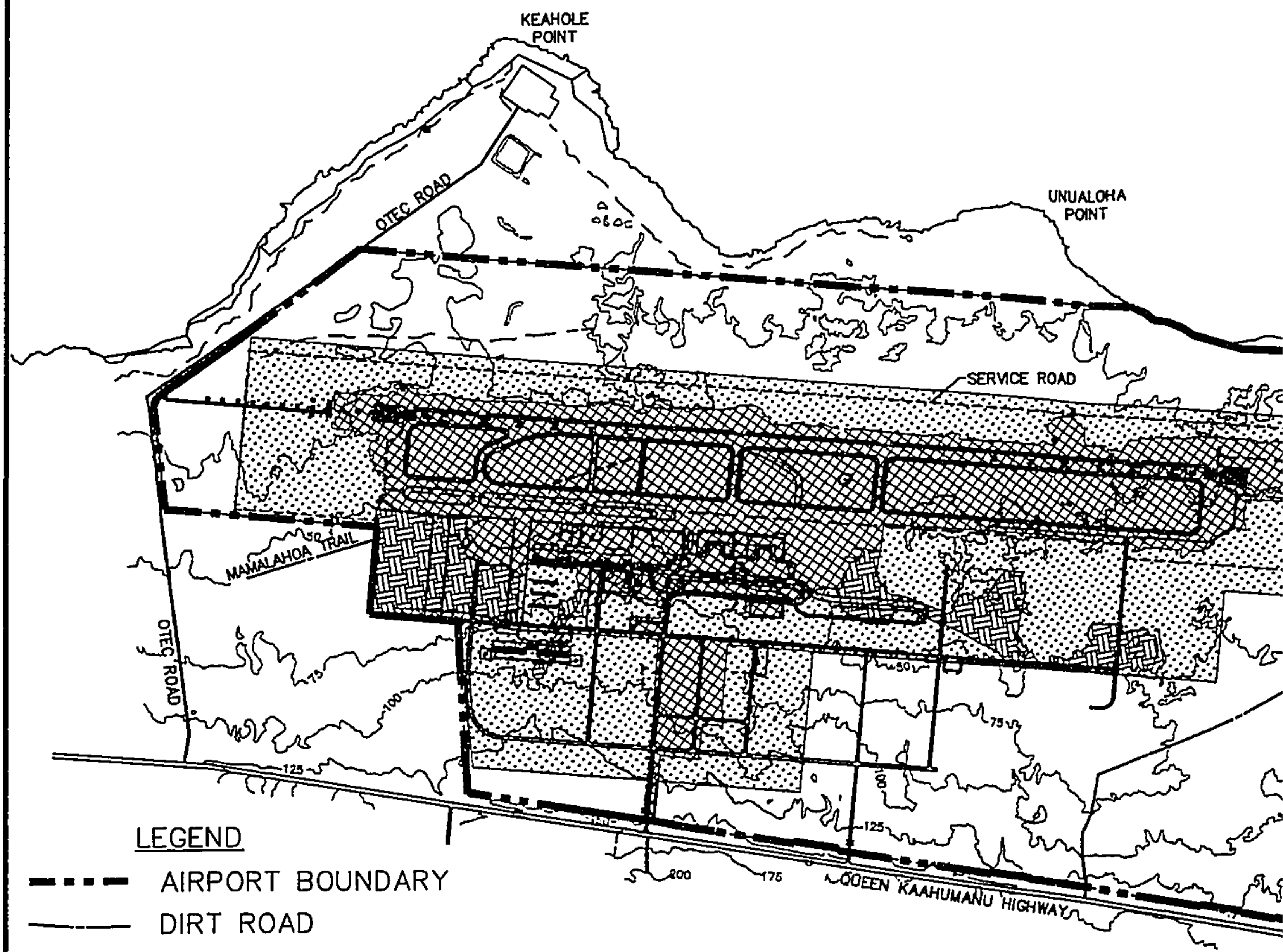
Avian phylogenetic order used in this report follows *Birds Of The World: A Checklist 4th Edition* (Clements 1991), and the *1st, 2nd and 3rd Supplements to Birds Of The World: A Checklist 4th Edition* (Clements 1997, 1998, Clements and Principe, Jr. 1992); scientific nomenclature follows *The AOU Checklist of North American Birds 7th Edition* (AOU 1998), Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner *et al.* 1990). Place names follow *Place Names of Hawaii* (Pukui *et al.* 1976).

General Site Description:

The study site encompasses approximately 526 hectares located within the existing Kona International Airport at Keahole, North Kona, Island of Hawai'i. The area surveyed extends from an elevation of approximately 6 meters to a maximum of 43 meters above mean sea level (Figure 1).

The terrain gently slopes from east to west and is composed of a mix of pahoehoe and a'a lava flows dating from the Holocene and Pleistocene ages (1500-3000 years ago) overlain to the north of the facility by a younger flow dating from 1801 (Wolfe and Morris 1996, USGS 1996).

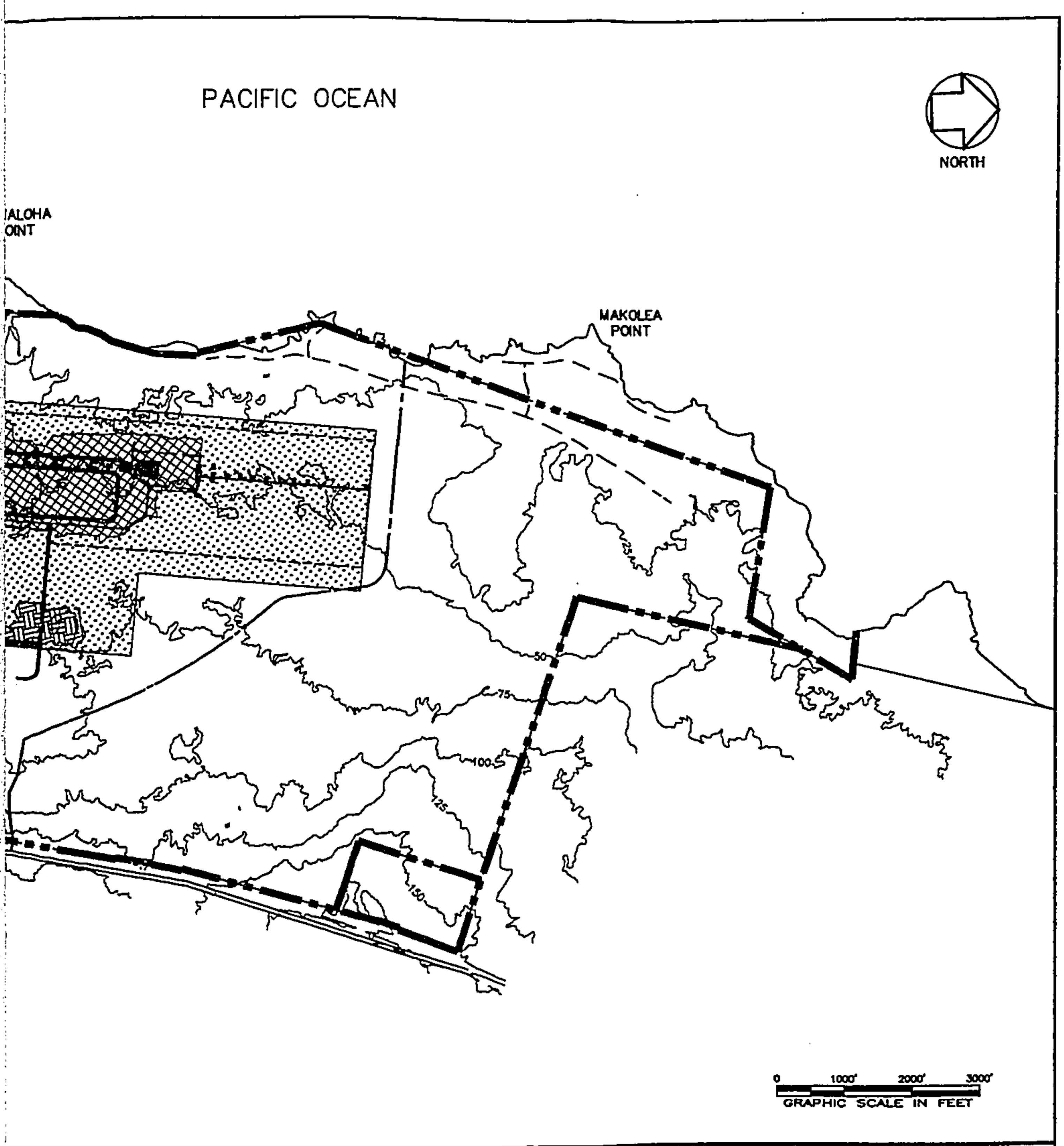
The vegetation within the study site can be best characterized as a Lowland Vegetation Community. The vegetation on the upper or eastern part of the site falls within the Fountain Grass Grassland subtype of the Lowland Dry Grassland Community. This habitat is dominated by fountain grass (*Pennisetum setaceum*) an alien (introduced to Hawai'i by man) African grass (Gagne and Cuddihy 1990 in: Wagner *et al.* 1990).. Additionally several native plants including *Capparis sandwichiana*, A'ali'i (*Dodonaea viscosa*) are present in small numbers. There is little vegetation on most of the 1801 lava flow within the airport facility, especially along the western, northern and portions of the northeast side of the runway complex. Within the terminal area the vegetation is made up primarily of alien ornamental species planted as landscaping around the various buildings, parking lots etc. Much of the area surrounding the south ramp area has been bulldozed, and compacted, and currently has very little vegetation on it.



LEGEND

AIRPORT BOUNDARY
DIRT ROAD
TRAIL
CONTOURS
DEVELOPED AREA
FOUNTAIN GRASS/SCRUB VEGETATION
RUDERAL VEGETATION

KONA INTERNATIONAL AI
AT KEAHOLE
NORTH KONA, HAWA



RNATIONAL AIRPORT
T KEAHOLE
KONA, HAWAI'I

DISTRIBUTION OF
VEGETATION TYPES
ON URBAN DESIGNATED
LANDS

FIGURE

1

There is a small anchialine wetland system (26 x 19 meters) located approximately 48 meters east of the southwest fence corner at the southern end of the runway (Figure 1). Brackish water is located in an extensive crack system around the edge of a pahoehoe depression, which shows signs that it holds water following either very high tides or extensive rains. The vegetation at the edges of this wetland was made up mainly of a wetland facultative (F+) indigenous (native to, but also found elsewhere) sedge species *Fimbristylis dichotoma.*

Mammalian Survey Methods:

With the exception of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), all other terrestrial mammals found on the Island of Hawai'i are alien species. Most are ubiquitous in distribution, no trapping program was proposed or undertaken to quantify the usage by alien mammalian species of the study site. Observations of mammalian species were of an incidental nature. A running tally was kept of all vertebrate species observed and heard while within the boundaries of the site. The survey of mammals was limited to visual and auditory detection, coupled with observation of scat, tracks and other animal sign.

Avian Survey Methods:

An initial reconnaissance visit was made to the airport on December the 6th to identify habitat types present within the study area and to ascertain the general nature of the avian species present. Two different avian censusing protocols were implemented during this survey. Within the terminal area and the undeveloped areas located to the east of the current terminal facility and west of Queen Ka'ahumanu Highway we sited 20 count stations (Figure 1). Six-minute unlimited distance counts were made at each station (Reynolds *et al.* 1980). For the portions of the study area located on the sparsely vegetated 1801 lava flow we performed a walking survey, which entailed walking the perimeter of the fenced runway complex recording every bird detected. Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated during the early morning hours between 0600 hrs. and 1100 hrs., the peak of daily bird activity. An additional 2 hours were spent on the evenings of the 7th and 8th of December, 1999, in an attempt to detect nocturnally flying seabirds and owls overflying the airport facility. Time not spent counting was used to search the site and the surrounding area for species and habitats not detected during count sessions.

Results:

The lone mammalian species seen during the course of this survey were several small Indian mongooses (*Herpestes a. auropunctatus*). In addition we encountered skeletal remains of two feral goat (*Capra h. hircus*) and one domestic cow (*Bos taurus*). Scat of domestic dog (*Canis f. familiaris*), cat (*Felis catus*), donkey (*Equus a. asinus*) as well as that of goat was encountered in numerous places within the site. No live rodents were detected during the course of this survey; however, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus doemsticus*) and possibly Polynesian rats (*Rattus exulans hawaaiiensis*) utilize various habitats within the site. Without conducting a trapping program, it is difficult to assess the population densities of these often hard-to-see mammals. All of these introduced mammalian species are deleterious to avian populations. Hawai'i's sole endemic terrestrial mammalian species, the endangered Hawaiian hoary bat, or 'Ope'ape'a, was not detected.

A total of 14 avian species representing 10 families were detected during station counts (Table 1). The only native species recorded was Pacific Golden-Plover (*Pluvialis fulva*), a common indigenous migratory species. Plover were seen close to the south ramp and within area A35. All of the other 13 species recorded are considered to be alien to the Hawaiian Islands. The most common species recorded during station counts was the House Sparrow (*Passer domesticus*). This comensal alien species nests and feeds within the airport structures.

During the course of the perimeter walking survey we only detected a total of 5 individual birds, representing 3 avian species; House Sparrow, House Finch (*Carpodacus m. mexicanus*) and Common Myna (*Acridotheres tristis*). We detected 2 each of House Finch and Common Myna and a lone House Finch. The extremely low number of species and numbers of birds detected on the 1801 lava flow is not surprising given the lack of vegetation and water present.

All of the birds detected are common species found throughout the leeward lowland areas on the Island of Hawai'i. No endangered or threatened avian species were detected within the Kona International Airport at Keahole site (DLNR 1986, Federal Register 1998). The findings of both the avian and mammalian surveys were consistent with the present habitat available within the facility boundaries.

Previous Surveys:

There have only been four comprehensive bat surveys conducted on the Island of Hawai'i (Jacobs 1994, Cooper et al. 1995, Cooper and David 1995, David 1996). Only one of these surveys addressed lands close to the study area addressed in this survey. David Jacobs conducted an Island wide survey between 1990-1993 which attempted to ascertain the distribution and abundance of Hawaiian hoary bats by sampling along paved principal roadways around the Island of Hawai'i (Jacobs 1994). The bulk of the remaining published literature relies heavily on anecdotal and incidental information on bat distribution and abundance on the Island (Baldwin 1950, Bryan 1955, Tomich 1986).

The first systematic surveys of the avifauna of Hawai'i were undertaken in 1976. Starting in that year and continuing until 1983 the U.S. Fish & Wildlife Service (USFWS) conducted a state wide survey of the avifauna of Hawai'i (Scott *et al.* 1986). During the

Table 1

Key To Table 1		
ST / Status		RA / Relative Abundance
A - Alien	IM – Indigenous Migrant	= #birds/ stations

AVIAN SPECIES DETECTED DURING STATION COUNTS WITHIN THE KONA INTERNATIONAL AIRPORT AT KEAHOLE

COMMON NAME	*SCIENTIFIC NAME*	*ST*	*RA*
PLOVERS	Charadriidae		
Pacific Golden-Plover	*Pluvialis fulva*	IM	0.50
PHEASANTS & ALLIES	*Phasianidae*		
Grey Francolin.	*Francolinus pondicerianus*	A	1.00
PIGEONS & DOVES	Columbidae		
Spotted Dove.	*Streptopeia chinensis.*	A	2.00
Zebra Dove.	*Geopelia striata.*	A	4.00
STARLINGS	Sturnidae		
Common Myna.	*Acridotheres tristis.*	A	2.50
SILVEREYES	Zosterops		
Japanese White-eye	*Zosterops japonica*	A	2.00
LARKS	Alaudidae		
Sky Lark	*Alauda a. arvensis*	A	0.50
OLD WORLD SPARROWS	Passeridae		
House Sparrow	*Passer domesticus*	A	13.00
WAXBILLS & ALLIES	Estrilididae		
Warbling Silverbill	*Lonchura malabarica.*	A	1.50
Java Sparrow	*Padda oryzivora.*		2.00
FRINGILLIDS	Fringillidae		
Yellow-fronted Canary	*Serinus mozambicus*	A	2.00
House Finch.	*Carpodacus m. mexicanus.*	A	3.00
WARBLERS & SPARROWS	Emberizadae		
Yellow-billed Cardinal	*Paroaria capitata*	A	1.00
Saffron Finch	*Sicalsis flaveola*	A	2.00
Northern Cardinal	*Cardinalis cardinalis*	A	1.00

course of the Hawaii Forest Bird Surveys program (HFBS), the subject property was not surveyed due to it's lack of native forest it was not thought that any native forest birds would be found in the habitat present. In recent years there have been several Environmental Impact Statement (EIS) level faunal surveys conducted on lands within the general vicinity of the study site (PBR 1991, CH2M Hill 1992, 1993, David 1995a, 1995b, 1999, 2000).

Discussion:

A one time survey can not provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact over a number of years. The airport site and most of North Kona has been experiencing drought conditions for the past 3 years.

The findings of the mammalian survey are consistent with other surveys conducted within the lowland areas of North Kona within the recent past (David 1995a, 1995b, 1999, 2000). It is likely that Hawaiian hoary bats overfly the airport facilities upon occasion, as they have been seen in numerous lowland areas in North Kona on a seasonal basis (David 1993, Jacobs 1994, R. David unpublished field notes 1975-1999).

The low diversity and density of avian species detected during this survey is lower than one would ordinarily expect from this location. The ongoing drought has greatly impacted many of the lowland alien avian species normally present in this area. Results of recent faunal surveys conducted by the author in the lowland grassland areas of the North Kona District have shown greatly reduced avian diversity and density over the last year or so (David 1999, 2000) as compared to earlier surveys and publications covering the same general area (David 1989, 1990, 1991a, 1992, 1993, 1994, 1995a, 1995b). The habitat currently found on the site and within the fountain grass dominated lowland areas in North Kona do not provide the resources necessary for the sustenance or nesting of native avian species. In a wetter year it is to be expected that additional resident avian alien species utilize the existing habitat within the project site. It is likely that following the further development of the site, and the installation of irrigated landscaping that many of the commonly occurring alien species currently found in North Kona will be recorded on the site. If lawns, parking lots and other open areas are created it is likely that these features will also attract a number of migratory shorebirds between the months of September and May each year. Many of the more than 80 species of migratory and extralimital avian species which have been recorded from Hawai'i have been recorded from coastal areas in North Kona (Pyle *et al.* 1988, David 1991b, Pyle 1992, 1997).

Although not detected during this survey, the endangered Hawaiian Stilt *(Himantopus mexicanus knudseni)* have been recorded within the existing airport boundaries. In fact stilt were recorded nesting along the main runway for the first time in 1998 (Ohashi

1999). At least three birds were killed soon thereafter, probably as a result of aircraft strikes. Additional stilt eggs were removed from the runway by US Fish and Wildlife (USFWS) personnel. The increase in the number of stilts in the area and the nesting range expansion is due in part to the mitigation plan that the USFWS has required of the Cyanotech Corporation, in response to their unintentional taking of stilts attracted to their extensive aquaculture ponds located less than 700 meters due west of the main runway. Given that the aquaculture operations are continuing to expand within the Natural Energy Laboratory of Hawaii Authority (NELHA) facility and the Cyanotech Corporation is being required to continue managing habitat to increase the production of stilts it is an inescapable conclusion that there will continue to be bird air strike hazard (BASH) incidents involving endangered Hawaiian Stilts and probably also endangered Hawaiian Coots (*Fulica alai*) and any number of migratory waterfowl and shorebird species which are also being attracted to the mitigation ponds. The small wetland located just outside the existing perimeter fence supports at least one species of Hawaiian anchialine shrimp, the red pond shrimp (*Halocardina rubra*), or ʻopaeʻula. This is one of the prey items that Hawaiian Stilt travel distances to exploit. It is probable that as the population of stilt increase within the aquaculture farms that they will "discover" this food resource, putting more birds in the direct path of aircraft approaching or climbing away from the southern end of the main runway.

It is possible that small numbers of the endangered endemic Hawaiian subspecies of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), or Uaʻu over-fly the airport facilities between the months of May and October (Banko 1980, Harrison 1990). This species was formerly common on the Island of Hawaiʻi (Wilson & Evans 1890-1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as the mid to high elevations of Mount Hualalai. It has within recent historic times been reduced to relictual breeding colonies located at high elevations on Mauna Loa and possibly Mount Hualalai (Banko 1980, Harrison 1990, Cooper & David 1995, Cooper *et al.* 1995, R. David Unpbl Field Notes 1986-1995, 1999).

The primary cause of mortality in Dark-rumped Petrels is thought to be predation by alien mammalian species at the nesting colonies (Day and Cooper 1998, Cooper and Day 1994). Collision with utility structures is considered to be the second most significant cause of mortality of this seabird species in Hawaiʻi. Nocturnally flying seabirds, especially fledging birds, can become disoriented by exterior lighting on their way to sea in the Summer and Fall. When disoriented, seabirds often collide with manmade structures and, if not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Ainley and Podosky 1993, Ainley *et al.* 1994, Cooper and Day 1994, Day and Cooper 1997, Cooper and Day 1998, Podolsky et al. 1998). There is no suitable nesting habitat within the project site for this species.

The principal potential impact that further development of airport facilities poses to Dark-rumped Petrels is the increased threat of the downing of birds disoriented by exterior lighting which may be required in conjunction with further expansion of the facilities.

Recommendations:

The USFWS /Ducks Unlimited mitigation project within the Cyanotech facility has been unsuccessful in meeting its stated objective of reducing incidental take within that facility (Ohashi 1999). Furthermore, these mandated actions have precipitated repeated incidental takes within the existing airport facility by airport clients. This is primarily due to the "attractive nuisance" of the mitigation ponds. It is imperative that this issue be revisited by the airports division with the USFWS and an objective non-agency biologist to explore other alternatives for mitigating both Cyanotech 's and the state Department of Transportation's responsibilities under the Endangered species Act of 1973, as amended (ESA). Logical options to the existing plan include improving habitat at the Kona sewage treatment plant (KSTP), which has a partially completed pond that is not used in their current operation. Improving habitat at the Kaloko-Honokohau National Historical Park which contains Aimakapa Pond, which prior to the opening of the KSTP supported the core populations of both Hawaiian Stilt and Hawaiian Coot on the Island (David 1989, 1990, 1991a, 1992, 1993, 1994). Develop hazing protocols to make the aquaculture ponds less attractive to wetland species. In the real world it will probably take a combination of all of these options to satisfy the requirements of the ESA, as well as reducing the threat of BASH incidents at the airport from wetland avian species.

In the interest of reducing the potential for unwanted interactions between nocturnally flying Dark-rumped Petrel's with external lights and man made structures, it is recommended that any lights planned within the expanded facility be shielded (Reed *et al.* 1985).

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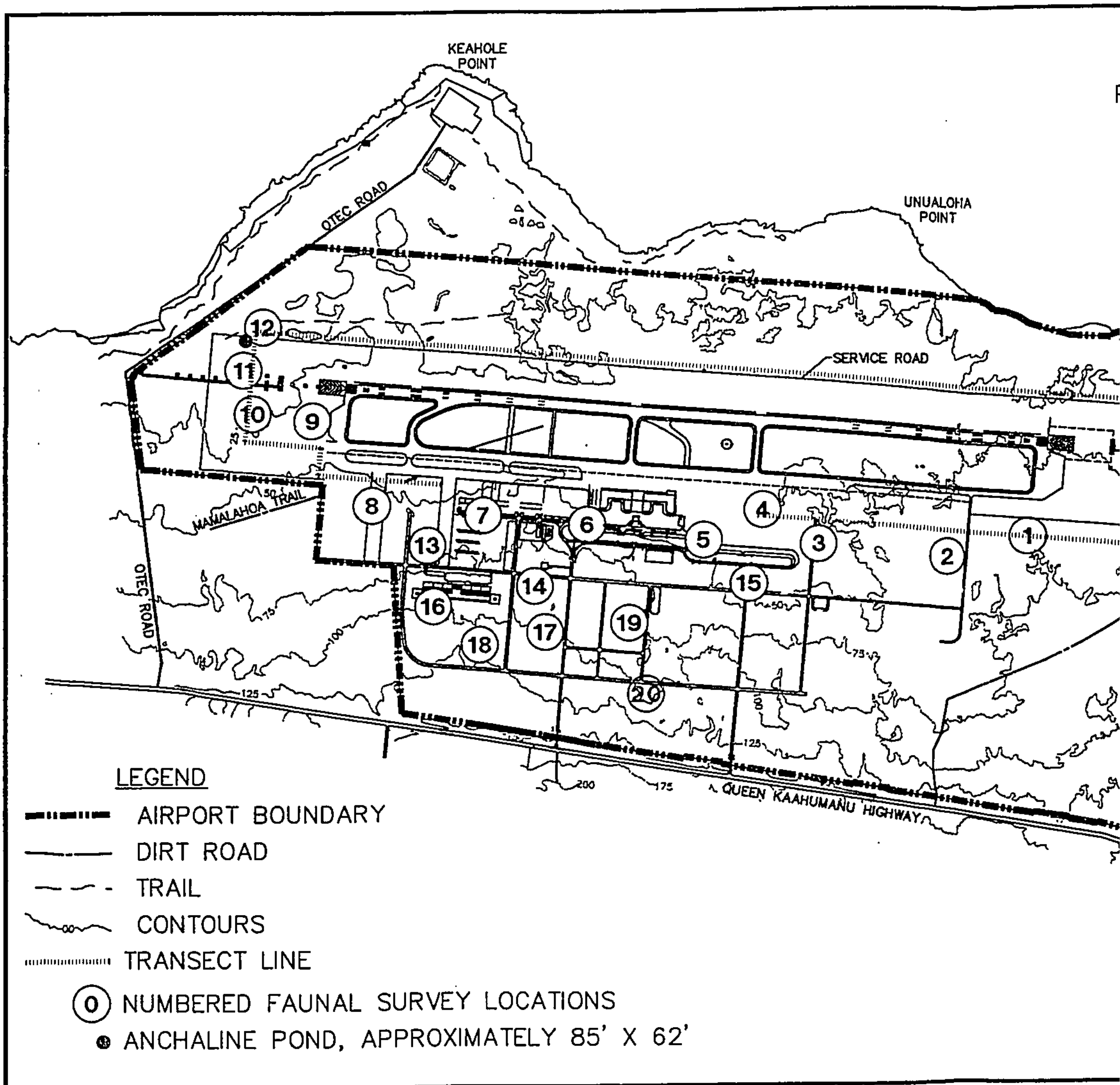
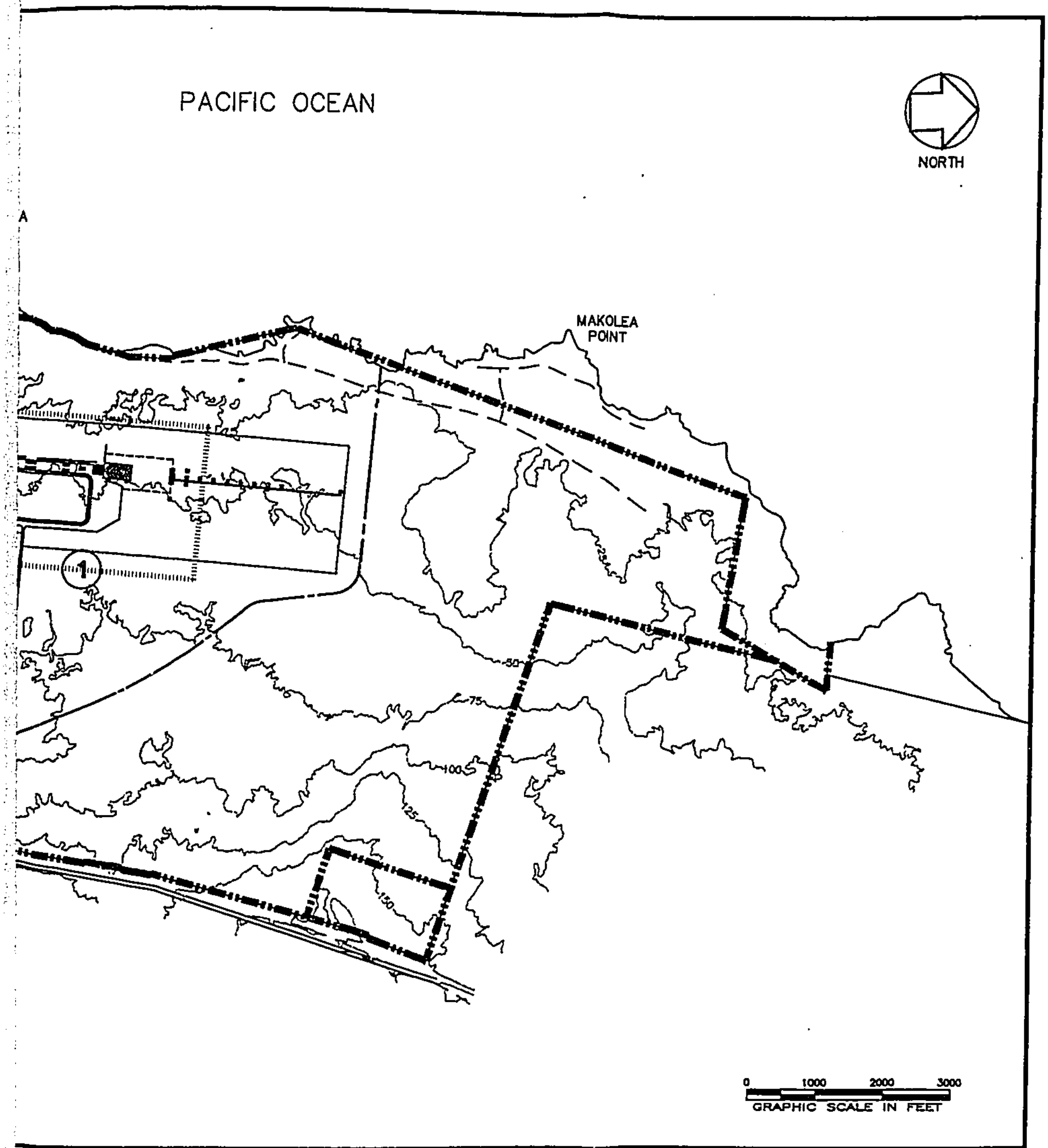


KONA INTERNATIONAL AIRF
AT KEAHOLE
NORTH KONA, HAWAI'I



TIONAL AIRPORT EAHOLE NA, HAWAI'I	TRANSECT LINE AND FAUNAL SURVEY LOCATIONS	FIGURE 2

FAUNA SURVEY

KEAHOLE AIRPORT MASTER PLAN

District of North Kona, Island of Hawai'i

by

Winona P. Char

PREPARED FOR:

R. M. Towill Corporation

PREPARED BY:

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

SEPTEMBER 1987

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SECTION 1
INTRODUCTION

1.1 OVERVIEW

A survey of the terrestrial vertebrate fauna on the areas proposed for expansion of the Keahole Aiport, as well as the already existing developed areas, was conducted on 26 August 1987. Nine species of birds, all of them foreign or introduced, were recorded from the study site. Skeletal material of donkey and goat were found on the prehistoric pahoehoe lava flow south of the maintenance building. The presence of mongoose in the weedy scrub, fringe areas around the airport and car rental return lots was observed. One skink species was seen in a large lava tube on the study site. None of the fauna encountered during this survey is considered threatened or endangered by the Federal and/or State governments.

1.2 REVIEW OF THE LITERATURE

A number of recent fauna surveys have been conducted for the areas adjacent to or near the Keahole Airport. Walker (1975) made an intensive survey of the adjacent Natural Energy Laboratory of Hawaii (NELH) site and also a portion of the Hawaiian Ocean Science and Technology (HOST) Park. Both sites include coastal areas. Walker recorded eleven avian species. Three of these, the Golden Plover or Kolea (Pluvialis fulva), the Wandering Tattler or 'Ulili (Heteroscelus incanus), and the Ruddy Turnstone or 'Akeke (Arenaria interpres), are migratory shorebird species which winter over in the islands. The other birds recorded are all foreign species and included the following: Gray Francolin (Francolinus pondicerianus), Barred Dove (Geopelia striata), Common Myna (Acridotheres tristis), Japanese White-eye (Zosterops japonicus), House Finch (Carpodacus mexicanus), House Sparrow (Passer domesticus), Cardinal (Cardinalis cardinalis), and Red-crested Cardinal (Paroaria coronata). The Indian Mongoose (Herpestes auropunctatus) was the only mammal observed.

In a study of the nearby Keahole Agricultural Park site, Krauss (1977) also recorded most of the species observed by Walker including a pheasant species

(Phasianus sp.). In addition, Krauss also observed a Hawaiian Owl or Pueo (Asio flammeus sandwichensis) over the agricultural park site.

Fifteen bird species were reported from the nearby Kohana-Iki and 'O'oma II by Kjargaard (1986a, 1986b). Four of these species, the 'Ulili, Kolea, Great Frigatebird or 'Iwa (Fregata minor palmerstoni), and the Black-crowned Night-heron or 'auku'u (Nycticorax nycticorax hoactli), were found along the coastal margin or around the anchialine ponds. The remaining eleven species recorded were: Gray Francolin, Rock Dove (Columba livia), Barred Dove, Common Barn-owl (Tyto alba), Melodious Laughing-thrush (Garrulax canorus), Japanese White-eye, Nutmeg Mannikin (Lonchura punctulata), House Sparrow, Yellow-billed Cardinal (Paroaria capitata), Cardinal, and House Finch. Only the mongoose was seen during this survey. However, mammalian skeletal material was abundant on the Kohana-Iki and 'O'oma II study sites, particularly on pahoehoe substrate and in the lava tubes and caves that dot the pahoehoe flows. The majority of the material was old and the following species were reported: Feral Cat (Felis catis), Feral Pig (Sus scrofa), Feral Goat (Capra hircus), and Donkey (Equus asinus).

1.3 SURVEY METHODS

The survey work was conducted on 26 August 1987 between the hours of 0645 and 1730. Birds and reptiles were detected both by sight and by their vocalizations. The landscaped areas around the airport were included in the survey as these areas provide water, food and nesting sites in an otherwise marginal habitat. In addition, presence of bird species was determined by indirect means such as by presence of tracks, droppings, and nests.

Mammalian presence and distribution were detected by sight and indirect means. Skeletal material was important in indicating historical occurence on the study site for species which had been extirpated from the area.

SECTION 2
SURVEY RESULTS

2.1 FAUNAL HABITATS

The areas proposed for expansion of the Keahole Airport provide only marginal wildlife habitat. Very sparse vegetation, primarily fountain grass (*Pennisetum setaceum*), is found on the parcels north of the runway and adjacent to the present car rental facilities. Scrub vegetation composed of fountain grass, 'uhaloa (*Waltheria indica* var. *americana*), maia-pilo (*Capparis sandwichiana*), and other shrubby species covers the prehistoric pahoehoe flow south of the present maintenance building. A more detailed discussion of the vegetation, as well as a plant species checklist, can be found in the botanical survey report.

The landscaped areas around the terminal and car rental lots were also included in the survey as most of the bird and mammal species occur here. These landscaped areas provide trees for nesting sites as well as food and water. Expansion of the airport property will result in more available habitat for the species already present. An out-migration into these newly landscaped areas is expected.

Very few species utilized the areas away from the terminal. A few birds such as the Lace-necked Dove (*Streptopelia chinensis*) and the House Finch were observed in the areas of the pahoehoe flow where the scrub vegetation was thickest.

2.2 ANNOTATED SPECIES LIST

Common and scientific names of the bird species are in accordance with those listed in *Hawaii's Birds* (Hawaii Audubon Society 1984).

Birds

1. Zebra Dove or Barred Dove (*Geopelia striata*): Foreign
Individuals and small flocks of this species were observed around the terminal and car rental areas. Very tame; commonly observed around areas where people have dropped food scrapes, i.e., snack bars, trash cans, waiting area, etc.

2. Lace-necked Dove or Spotted Dove (*Streptopelia chinensis*): Foreign
This species was observed occasionally around the terminal area and infrequently

in the scrub vegetation near the maintenance building.

3. Japanese White-eye or Mejiro (*Zosterops japonicus*);Foreign
Japanese White-eye were commonly seen in trees and shrubs around the terminal.

4. Common Indian Myna or Myna (*Acridotheres tristis*): Foreign
The Myna is one of the more abundant species around the airport. In the evening, the birds are especially numerous in the large trees around the terminal. Both the Myna and the House Sparrow have built nests under the eaves of buildings in the area.

5. House Sparrow or English Sparrow (*Passer domesticus*): Foreign
One of the more abundant species in the airport area. Often building nests in and around buildings.

6. Cardinal or Northern Cardinal (*Cardinalis cardinalis*): Foreign
One Cardinal was heard in the monkeypod (*Samanea saman*) trees bordering the airport.

7. Yellow-billed Cardinal (*Paroaria capitata*): Foreign
One individual was observed feeding on the fruit of the golden-fruited palm (*Chrysolidocarpus lutescens*). This species was introduced to the Kona area in the 1930's, but was not documented in the region until the early 1970's (Kjargaard 1986a). It is reported to be common on the nearby Kohana-Iki area.

8. Yellow-fronted Canary (*Serinus mozambicus*): Foreign
A pair of birds was observed foraging in a grassy area within the terminal. Airport personnel report that this species is quite common around the airport especially during the early morning hours.

9. House Finch or Linnet (*Carpodacus mexicanus*): Foreign
Also known locally as Papayabird. Four birds were seen in the scrub vegetation south of the maintenance building. The birds were observed feeding on pluchea seeds (*Pluchea symphytifolia*).

Mammals

1. Mongoose or Indian Mongoose (Herpestes auropunctatus): Foreign

Although no animals were actually observed, fresh mongoose scat (or droppings) were found in koa-haole (Leucaena leucocephala) shrubs along the fence of the car rental return lots.

2. Other mammal species

Very old skeletal material of donkey (Equus asinus) was found on the prehistoric pahoehoe flow south of the maintenance building. Old droppings from goats (Capra hircus) were found in a number of lava tubes and caves in the same area. One almost complete, adult, goat skeleton was found in a very large lava tube (see botanical survey report for detailed description of site). Goat and donkey no longer are found in this area.

Reptiles

One skink species, tentatively identified here as a Snake-eyed Skink (Cryptoblepharus boutoni poecilopleurus), was observed among rocks at the opening of the large lava tube.

2.3 THREATENED OR ENDANGERED SPECIES

No threatened or endangered vertebrate animal species were observed from the study site during the course of this survey.

The Hawaiian Hoary Bat (Lasiurus cinereus semotus), the only native land mammal, may fly over the study site on its way to nearby ponds and coastal areas where it is known to feed (Kramer 1971, van Riper and van Riper 1982, Kjargaard 1986a).

SECTION 3
DISCUSSION AND RECOMMENDATIONS

3.1 SUMMARY OF FINDINGS

The areas proposed for expansion of the airport consist mostly of sparsely vegetated lava flows which provide poor habitat for wildlife. The majority of the wildlife observed during the study occurred in areas which were landscaped

or periodically maintained.

All of the species encountered were foreign species which have been introduced into the islands either accidentally or intentionally by man. Nine species of birds were recorded: the most numerous being those species commensal with man — House Sparrow, Myna, and Barred Dove.

Although only one skink species was observed, there may be other gecko and skink species present on the study site. None of these terrestrial reptiles is native to the islands.

The mongoose was the only extant mammal recorded, however, a few other introduced species such as the House Mouse (Mus musculus), Roof Rat (Rattus rattus), Polynesian Rat (Rattus exulans), and Feral Cat (Felis catus) are likely to occur in and around the airport facilities.

3.2 RECOMMENDATIONS

No recommendations are offered at this time. The areas proposed for the airport expansion do not provide suitable habitat for native terrestrial species and the project is not expected to have a significant impact on the native wildlife. At present the areas proposed for expansion provide only marginal habitat even for the foreign species. When the expansion project is completed, the foreign bird species as well a number of mammal and skink and gecko species already present in the area are expected to increase in numbers as there will be more available habitat.

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APPENDIX C
Wildlife Hazard Management Plan

6.6 WILDLIFE HAZARD MANAGEMENT

There is no wildlife hazard at Keahole Airport. Should one develop the Keahole Airport shall take immediate measures to alleviate the hazards. The FAA shall be contacted to arrange for an ecological study to be conducted whenever:

1. Any aircraft experiences a multiple bird strike or engine ingestion on the airport or on final approach or departure.

2. Any aircraft experiences a damaging collision with wildlife other than birds.

3. Wildlife of a size and in number capable of causing an event such as 1. and 2. above is observed to have access to any airport flight pattern or movement area.

Should an independent ecological study be conducted, it shall contain at least those items listed in FAR Part 139.337.

6.7 AIRPORT CONDITION REPORTING

The following personnel are authorized to issue NOTAMS:

ADM and Assistant ADM

General Construction and Maintenance Supervisor

Airport Maintenance Repairer, III

Airport Fire Commander

ARFF Shift Supervisor

NOTAMS will be issued covering at least the following:

1. Construction or maintenance work on pavement or safety areas.

2. Rough or wavy portions of pavement or safety areas.

3. The presence of parked aircraft or other objects on, or next to, runways or taxiways.

4. The failure or irregular operations of all or part of the airport lighting operated by the operator of the airport.

APPENDIX D
Environmental Compliance Audit
(Kona International Airport at Keahole)

Selected Excerpts

HAWAII COUNTY AIRPORTS

Hilo International Airport
Kona International Airport
at Keahole
Kamuela Airport
Upolu Airport

Prepared by:

Kimura International, Inc.
1600 Kapiolani Boulevard, Suite 1610
Honolulu, Hawaii 96814

June1999

State of Hawaii
Department of Transportation
Airports Division
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Honolulu, Hawaii 96819-1880

Environmental Compliance Audit

Recommendations

- Properly collect, treat, characterize, and dispose of washwater.

Kona International Airport Summary and Site-Specific Recommendations

Underground Storage Tanks

Summary of Findings

- Eleven USTs were identified at Kona International Airport.
- The DOTA's 6,000-gallon Jet-A UST was not registered with the HDOH.
- Five of the USTs operated by the DOTA (Permit No. 9-601310) were not in compliance with construction requirements and were scheduled for removal.
- The HDOH database lists a UST registered to Dollar; however, personnel have no knowledge or record of its location.
- Alamo personnel state that a UST is located at the site of its maintenance activities at the former Thrifty facility, and that the DOTA is responsible for its removal; no records were found for Thrifty in the HDOH database.

- The HDOH database indicates a 10,000-gallon UST is registered to Tropical Rental Car; however, Tropical was not identified during the audit.

Recommendations

- Register the 6,000-gallon Jet A DOTA UST with the HDOH.
- Ensure proper removal and close out of the DOTA USTs.
- Identify and confirm the three questionable USTs at Dollar, Alamo, and Tropical Rental Car.

Used Oil

Summary of Findings

- A total of 20 facilities generated used oil at Kona International Airport.
- Improper labeling of used oil AST at Federal Express.
- No used oil disposal documentation and/or record keeping on site at Aloha Airlines, Big Island Air, Circle Rainbow Air, Classic Aviation, the DOTA (for one UST scheduled for removal), Federal Express, Hawaii Helicopters, and Skycraft; unknown for Kenai Helicopters and KOA Air.
- Dark staining of soil directly beneath used oil storage containers at Big Island Air, Circle Rainbow Air, and Skycraft.
- Used oil storage drums at Century Aviation and Hawaii Helicopters were in deteriorating condition.

Recommendations

- Ensure proper labeling of used oil AST at Federal Express.
- Ensure on-site record keeping of all waste management activities at Aloha Airlines, Big Island Air, Circle Rainbow Air, Classic Aviation, the DOTA, Federal Express, Hawaii Helicopters, Skycraft, Kenai Helicopters, and KOA Air.
- Ensure proper spill containment at Big Island Air, Circle Rainbow Air, and Skycraft, and characterize the affected ground surface.
- Ensure that used oil is properly stored, and that all storage containers are in good condition and of sound integrity at Century Aviation and Hawaii Helicopters.

Waste Management

Summary of Findings

- Five facilities generated waste material at Kona International Airport--Air Service, Century Aviation, Circle Rainbow Air, Hawaii Helicopters and Kenai Helicopters.
- All five generated quantities of hazardous waste that classify them as CESQGs; however, none of them were listed in the EPA RCRA database.
- The EPA RCRA database lists Federal Express and the State of Hawaii Kona International Airport as CESQGs; however, hazardous waste was not observed at Federal Express or DOTA Maintenance.

- Drums of unknown contents with strong odors, no labels; no personnel available for interview at Kenai Helicopters.
- Drums of unknown contents; no evidence of proper waste management and disposal at Hawaii Helicopters.
- No disposal records on site at Circle Rainbow Air; record keeping unknown for Hawaii Helicopters and Kenai Helicopters.
- Rusty containers at Century Aviation and Hawaii Helicopters.

Recommendations

- Ensure accurate, updated EPA RCRA database classification for all generators of hazardous waste at Kona International Airport.
- Ensure proper labeling of all containers used to store waste materials at Kenai Helicopters and Hawaii Helicopters.
- Ensure proper waste management, disposal and on-site record keeping of all waste management activities at Circle Rainbow Air, Hawaii Helicopters, and Kenai Helicopters.
- Ensure that all storage containers are in good condition and of sound integrity at Century Aviation and Hawaii Helicopters.

Hazardous Materials

Summary of Findings

- A total of 17 facilities stored hazardous materials at Kona International.

- Of these, only Skycraft did not maintain MSD Sheets on site as required; whether Hawaii Helicopters does is unknown.
- Only Budget and Skycraft did not have personnel trained in spill response; whether Hawaii Helicopters does is unknown.
- Of the 13 facilities required to submit an HCIF to the HDOH, eight did not--Air Service, Aloha Airlines, Budget, Century Aviation, Circle Rainbow Air, the DOTA, Hawaii Helicopters, and Skycraft.

Recommendations

- Ensure that Skycraft and Hawaii Helicopters have MSD Sheets on site as required.
- Ensure that Budget and Skycraft have employees trained in chemical use and emergencies.
- Ensure that Air Service, Aloha Airlines, Budget, Century Aviation, Circle Rainbow Air, the DOTA, Hawaii Helicopters, and Skycraft provide the HDOH and other local emergency planning organizations with required HCIFs and proper notification of hazardous materials storage.

Spill Equipment

Summary of Findings

- A total of 17 facilities maintained spill equipment; no compliance concerns or issues were observed.

Aboveground Storage Tanks

Summary of Findings

- A total of 23 ASTs were identified at Kona International Airport.
- Of these, four had ASTs with capacities in excess of 660 gallons and, based on recommendations by EPA Region IX representatives, should have SPCC Plans; however, Circle Rainbow Air, Dollar, and United Airlines did not.
- The DOTA did not have spill response equipment on site.
- Federal Express did not meet testing, inspection and record keeping requirements. (Its lack of disposal documentation, and improper AST labeling, are addressed in the Used Oil section above.)

Recommendations

- Ensure that Circle Rainbow Air, Dollar, and United Airlines have SPCC Plans.
- Fulfill requirements for spill response equipment on site for DOTA facility.

Mobile Solvent Recovery Units

Summary of Findings

- Thirteen facilities operate mobile solvent recovery units at Kona International Airport.

- No disposal documentation on site for spent solvent at Aloha Airlines.

Recommendations

- Ensure proper spent solvent management and record keeping by Aloha Airlines.

Mobile Storage Tankers

Summary of Findings

- Mobile storage tankers are not specifically regulated, but should be properly managed and equipped to avoid potential hazards--11 tankers were identified at Kona International Airport.

- Of these, only Hawaii Helicopters was not equipped with spill equipment and did not have personnel trained for spill response.

- All tankers were regularly tested and inspected.

Recommendations

- Ensure that Hawaii Helicopters has spill equipment and personnel trained in spill response.

ARFF Facility

Summary of Findings

- The DOTA maintains a crash/fire training pit, for which no compliance concerns or issues were observed.

- A second fire training pit, out of service at the time of the site visit, appeared to have gross petroleum contamination; however, no other information about the facility was available.

Recommendations

- Perform a site characterization of the second fire training pit to determine the extent and nature of the contamination at the site. Once a site characterization is completed, options for remedial action, if necessary, can be determined.

Air Emissions

Summary of Findings

- No facilities with air emission issues were noted at Kona International Airport.

Oil/Water Separators and Sumps

Summary of Findings

- Seven oil/water separators and sumps were identified at the airport.

- Budget did not have a permit as required; whether Thrifty does is unknown.

- Budget and National did not have laboratory data or documentation for disposal of waste; whether Thrifty does is unknown.

Recommendations

- Ensure that Budget and Thrifty have permits as required.
- Ensure that Budget, National, and Thrifty maintain consistent inspection and testing procedures, including proper sampling and laboratory analysis at least annually to accurately characterize the waste.
- In addition, ensure that Alamo, Avis, Budget, Hertz and National properly manage and dispose of their waste materials, and maintain disposal documentation as required.

Other Notable Areas

Summary of Findings

- The DOTA has a total of 50 injection wells at Kona International Airport; it has an expired permit for 14 of them; there is no permit for the remaining 36.
- Avis had an expired permit for an injection well at its facility.

Recommendations

- Obtain permits for all DOTA injection wells.
- Ensure that Avis renews its permit.

Findings of Environmental Audit Activities at Kona International Airport

Tenant Screening

After the primary screening process to eliminate those tenant facilities that were not likely to use or store hazardous materials/waste or discharge pollutants into the air, water, or soil on Kona International Airport property, the secondary screening process was undertaken during July 24-31, 1998.

Using the DOTA's Tenant Listing Base, telephone calls were placed to the Kona International Airport tenants that had been identified for further screening. These calls revealed that some of the tenants were no longer present and some of the listed contacts and phone numbers were no longer valid. In addition, some of the contacts did not have telephone listings.

Following the secondary screening process and notification of tenants subject to the audit, the project team began its on-site activities at Kona International Airport on August 3, 1998. The audit process started with an interview of each available tenant to obtain information on the environmental activities relevant to the facility. Other tenants not identified during the screening process were determined to be subject to the audit under the scope of this project. Twenty-eight tenants were interviewed. One tenant was unavailable for internview. The 29 tenants involved in the site inspections are listed in Table 4.13 on the following page.

Table 4.13 Tenants Interviewed at Kona International Airport

Name of Tenant	Contact Name	Contact Phone No.	Description of Services
Above It All	Phil Auldridge	(808)	aircraft rental
Air Service Hawaii	Chris Sauer	(808) 334-0699	fuel handler
Alamo Rent A Car	Don Sing	(808) 329-8896	car rental
Aloha Airlines	Chauncey Wong-Yuen	(808) 329-5705	air transportation
Avis Rent A Car	Mike Johnson	(808) 327-3007	car rental
Big Island Air	Tom Beard	(808) 329-0991	aircraft rental
Blue Hawaiian Helicopters	Lorden Young		aircraft rental
Budget Rent A Car	Joe Gallegos	(808) 329-8511	car rental
Century Aviation	David Gregoire	(808) 329-8707	fuel handler
Circle Rainbow Air	Larry Kane	(808) 329-6966	fuel handler
Classic Aviation	Keith Varner	(808) 324-1656	aircraft rental
Dollar Rent A Car	Steve Betts	(808) 926-4242	car rental
DOTA	Joe Maria	(808)	miscellaneous maintenance
DOTA Fire Rescue Facility/ Crash Fire Training Pit	Captain Henry Cho, Jr.		fire rescue
Federal Express	Kehau Palama	(808) 326-2820	courier service
Hawaii Helicopters	John Sheridan	(808) 329-0453	aircraft rental
Hawaiian Airlines	Roy Alkai	(808) 331-3312	air transportation
Harper Truck Rental	Faleala Mika	(808) 329-6688	car rental
Hertz Rent A Car	Larry Pond	(808) 329-3566	car rental
Japan Airlines	Al Miyatake	(808) 329-3573	air transportation
Kaiwi Helicopters	Bolton Rory	(809) 987-9082	aircraft rental
Kenai Helicopters	David Luke	(808) 329-7412	aircraft rental
KOA Air	Tim	(808) 326-2288	aircraft rental
National Car Rental	Phillip Mootmeg	(808) 329-1674	car rental
Rainbow Pacific Helicopters	Florian	(808) 834-1111	aircraft rental
Skycraft Air Maintenance	Wes Brown		aircraft maintenance
Thrifty Car Rental	Rodney Ako	(808) 329-1339	car rental
United Airlines	Frank Gipson	(808) 329-5435	air transportation
United Parcel Service	Dennis Higa	(808) 836-9342	courier service

Air and ground transportation and support services comprise most of the business activities at Kona International Airport. The following table provides a complete list.

Table 4.14 Tenants Identified by Activity at Kona International Airport

Business Activity	Airport Tenants
Air Transportation	Aloha Airlines Hawaiian Airlines United Airlines Japan Airlines
Aircraft Rental	Above It All Big Island Air Blue Hawaiian Helicopters Classic Aviation Hawaii Helicopters Kaiwi Helicopters Kenai Helicopters KOA Air Rainbow Pacific Helicopters
Aircraft Maintenance	Skycraft Air Maintenance
Car Rental	Alamo Rent A Car Avis Rent A Car Budget Rent A Car Dollar Rent A Car Harper Truck Rental Hertz Rent A Car National Car Rental Thrifty Car Rental
Fuel Handling	Air Service Hawaii Century Aviation Circle Rainbow Air
DOTA	DOTA Maintenance DOTA Fire Rescue/Crash Fire Training Pit
Courier Service	Federal Express United Parcel Service

Findings of Tenant Activities at Kona International Airport

An inventory of the environmental assets of each tenant was compiled during the site visits. The following is an itemization.

Above It All
According to Above It All personnel, all aircraft maintenance work is contracted to Skycraft Air Maintenance.

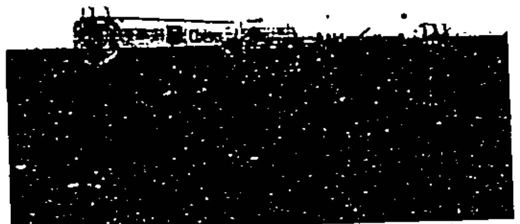


Photo: Air Service Hawaii mobile tanker.

Air Service Hawaii
- Two 5,000-gallon mobile tankers storing Jet A
- 55-gallon drums containing waste fuel

Alamo Rent A Car
- 10,000-gallon UST used to store gasoline (Permit No. 9-601715)
- 550-gallon AST for storing used oil
- 550-gallon AST used to store new motor oil
- Parts washing unit
- Car wash with sump
- Sump unit by maintenance area
- Spill equipment
- Injection well

Alamo also operates a maintenance area that was formerly occupied by Thrifty Rental Car. The site has gasoline pumps and a UST.


Photo: Waste oil AST at Aloha Airlines.

Aloha Airlines
- 200-gallon AST used to store used oil
- 55-gallon drums containing new lube oil
- Spill equipment

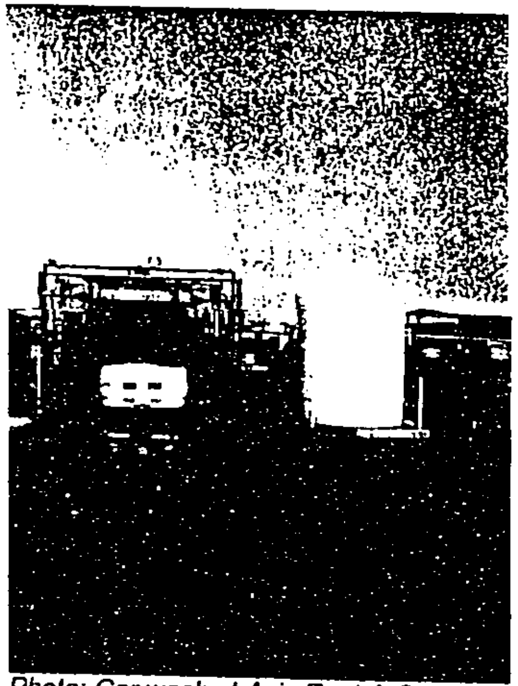


Photo: Car wash at Avis Rent A Car.

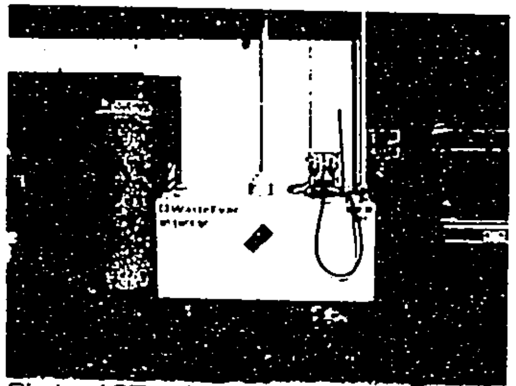


Photo: AST at Budget Rent A Car.

- 5,000-gallon tanker truck used to store Jet A fuel
- Parts washing unit
- Hazardous materials storage

Avis Rent A Car
- 10,000-gallon UST used to store gasoline (Permit No. 9-601644)
- 200-gallon AST for storing used oil
- 180-gallon AST used to store new motor oil
- Spill equipment
- Parts washing unit
- Car wash
- Injection well (Permit No. UH-1540)

Big Island Air
- 55-gallon drums storing used oil
- Parts washing unit
- Hazardous materials storage

Blue Hawaiian Helicopters
- 55-gallon drums of used oil
- Parts washing unit
- Spill equipment

Budget Rent A Car
- 10,000-gallon UST used to store gasoline (Permit No. 9-601649)
- 500-gallon AST for storing used oil
- 250-gallon AST used to store new motor oil
- Spill equipment
- Parts washing unit
- Limited quantities of hazardous materials
- MSD Sheets

- Car wash with sump
- Injection well


Photo: Century Aviation ASTs.

Century Aviation
- 10,000-gallon AST used to store Avgas
- 17,000-gallon AST used to store Jet A fuel
- 11,000-gallon AST used to store Jet A fuel
- SPCC Plan
- Two 5,000-gallon Jet A mobile tanker trucks
- 10,000-gallon Jet A mobile tanker truck
- Spill equipment
- Four 55-gallon drums containing waste fuel mixture

Circle Rainbow Air
- 10,000-gallon Jet A mobile tanker truck
- 8,000-gallon Jet A mobile tanker truck
- 3,000-gallon Jet A mobile tanker truck
- 2,500-gallon Jet A mobile tanker truck
- Spill equipment
- Two 19,000-gallon ASTs used to store Jet A fuel
- 55-gallon drums storing used oil
- 55-gallon drum of waste fuel
- MSD sheets

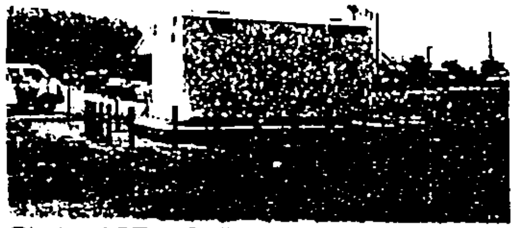


Photo: AST at Dollar Rent A Car.

Classic Aviation
Classic Aviation contracts aircraft maintenance to Keith Varner.

Dollar Rent A Car
- 6,000-gallon AST used to store gasoline
- 50-gallon AST used to store new motor oil
- Two 240-gallon ASTs used to store new and used oil

- Parts washing unit
- Spill equipment
- Injection well
- Possible UST


Photo: Fuel station and USTs at DOTA Maintenance facility.

DOTA Maintenance
- Two 1,000-gallon gasoline USTs (Permit No. 9-601310)
- 1,000-gallon diesel UST (Permit No. 9-601310)
- 550-gallon used oil UST (Permit No. 9-601310)
- 1,000-gallon diesel UST (Backup generator, Permit No. 9-601310)
- 6,000-gallon UST (ARFF training pit)
- 350-gallon diesel AST (Backup generator near Administration Building)
- 55-gallon drum containing used oil
- 55-gallon drum containing new solvent
- Limited quantities of hazardous materials storage
- MSD Sheets
- Parts washing unit

DOTA Fire Rescue Facility/Crash Fire Training Pit
- Spill equipment
- Oil/water separator


Photo: Drum storage of new and used oil at DOTA Maintenance facility.

Federal Express
- 120-gallon AST used to store used oil
- Limited quantities of hazardous materials
- MSD Sheets
- Spill equipment

Hawaii Helicopters
Although an appointment was made to perform the site visit, Hawaii Helicopter personnel and its facility were unavailable. The following were observed.

- 55-gallon drum of used oil
- 2,000-gallon Jet A mobile tanker truck
- Unlabeled 55-gallon drums

Photo: Hawaii Helicopters mobile tanker truck.

Hawaiian Airlines

- 55-gallon drums of used oil
- Parts washing unit
- Limited quantities of hazardous materials
- MSD Sheets
- Spill equipment
- Surface staining on asphalt near used oil drums

Harper Truck Rental

- Car wash
- Injection well

Hertz Rent A Car

- 10,000-gallon UST used to store gasoline (Permit No. 9-601612)
- Two 250-gallon ASTs for storing used oil
- Two 250-gallon ASTs used to store new oil
- Spill equipment
- Car wash
- Two injection wells
- Parts washing unit
- Limited quantities of hazardous materials
- MSD Sheets

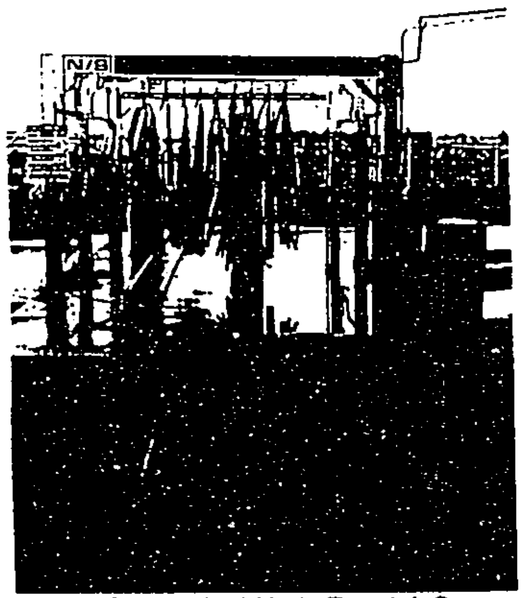


Photo: Car wash at Hertz Renat A Car.

Japan Airlines

No maintenance is performed at the airport. Emergency maintenance is contracted to outside mechanics.


Photo: UST at National Car Rental.

Kaiwi Helicopters
According to Kaiwi Helicopters personnel, no maintenance is performed at the airport facility.

Kenai Helicopters
Although an appointment was made to perform the site visit, Kenai Helicopters personnel and its facility were unavailable. The following were observed.

- Four 55-gallon drums of used oil
- 55-gallon drum of unknown content, unlabeled, emitting strong, noxious odor
- 30-gallon drum of unknown content, unlabeled, emitting strong, noxious odor

KOA Air
No interview was performed. Information gathered is based on observations made during a site visit.

- One 55-gallon drum containing used oil

National Car Rental

- 6,000 gallon UST used to store gasoline (Permit No. 9-601620)
- Four 55-gallon drums containing used oil
- Two 55-gallon drums containing new oil
- Car wash with sump
- Injection well
- Spill equipment
- Parts washing unit
- Hazardous materials storage

Rainbow Pacific Helicopters
According to Rainbow Pacific Helicopters personnel, no maintenance is performed at the airport facility.

Skycraft Air Maintenance
- Four 55-gallon drums of used oil
- Hazardous materials storage
- Spill equipment


Photo. United Airlines AST.

Thrifty Car Rental
Thrifty personnel use their area to wash their car rental vehicles. The cars are hand-washed. The wash water was observed to enter a floor drain with a sump.

United Airlines
- 55-gallon drum containing used oil
- Parts washing unit
- 1,000-gallon AST used to store gasoline
- Spill equipment
- Petroleum staining and puddles on asphalt ground cover

United Parcel Service
- Parts washing unit
- Spill equipment

Regulatory Compliance

Underground Storage Tanks

A total of 11 USTs were found to be present at Kona International Airport. Of these, ten were confirmed to be registered with the HDOH's UST Section. One of them, the 6,000-gallon Jet A UST operated by the DOTA at its Fire Training facility, was not found in the HDOH UST database.

Five of the USTs, operated by the DOTA, were not in compliance with construction requirements. The five USTs, identified with Permit Number 9-601310, were scheduled for removal in December 1998.

One UST, National's 6,000-gallon tank, used a combination of tightness testing with inventory control. While this combined method of leak detection is acceptable, it can only be used for a limited time period. National can use this method for ten years from the date of its UST system upgrade to meet spill, overfill, and corrosion protection standards.

Dollar personnel indicated that a UST may be located at their facility; however, they did not have any records or knowledge of its actual location. The HDOH UST database indicated that a 7,500-gallon-gasoline UST is registered to Dollar.

Alamo personnel indicated that the facility's maintenance activities were performed at the former Thrifty facility. Alamo personnel stated that a gasoline UST is located at the site, and that the DOTA is responsible for its removal. No records were found in the HDOH UST database for Thrifty.

A 10,000-gallon gasoline UST is registered to Tropical Rental Car at Kona International Airport (Permit No. 9-601308). Tropical Rental Car was not a tenant at the time of this inspection.

Table 4.15 Underground Storage Tanks at Kona International Airport

Bldg	Space	Subdiv	Volume	Units	Contents	Known Releases From Site	Owner	Registered	Construction Standards Met	Leak Detection Working	Record Keeping	Notes	Permit
002	106		10000	gal	gasoline	no	Alamo	yes	yes	yes	yes		9-601715
002	110		10000	gal	gasoline	no	Avis	yes	yes	yes	yes		9-601644
002	124		10000	gal	gasoline	no	Budget	yes	yes	yes	yes		9-601649
672	112		6000	gal	Jet A	no	DOTA	no	yes	yes	yes		
310	000		1000	gal	diesel	no	DOTA	yes	no	no	yes	scheduled for removal this year	9-601310
004	105		1000	gal	diesel	no	DOTA	yes	no	no	no	scheduled for removal by 12/98	9-601310
004	105		1000	gal	gasoline	no	DOTA	yes	no	no	no	scheduled for removal by 12/98	9-601310
004	105		1000	gal	gasoline	no	DOTA	yes	no	no	no	scheduled for removal by 12/98	9-601310
004	105		550	gal	used oil	no	DOTA	yes	no	no	no	scheduled for removal by 12/98	9-601310
002	109	A	10000	gal	gasoline	no	Hertz	yes	yes	yes	yes		9-601612
002	112		6000	gal	gasoline	no	National	yes		no	yes		9-601620
			10,000	gal	gasoline	unknown	Tropical	yes	unknown	unknown	unknown	removed 10/1/98, per DOTA	9-601308

Used Oil

A total of 28 facilities generated used oil as part of their operational activities. Eight of them--Big Island Air, Circle Rainbow Air, Classic Aviation, Hawaii Helicopters, KOA Air, Skycraft, Hawaiian Airlines, and Federal Express--did not provide evidence or records of proper disposal of their used oil.

Three facilities--Big Island Air, Circle Rainbow Air, and Skycraft--stored their used oil in 55-gallon drum containers. Petroleum staining was noted on the ground beneath and around the drums at each facility. Additionally, the 55-gallon drums used to store used oil at Century Aviation and Hawaii

Helicopters were found to be in deteriorating condition. Drums used to store oil at Big Island Air, Circle Rainbow Air, Classic Aviation, Koa Air, and Skycraft were considered to be in fair condition.

Table 4.16 Used Oil at Kona International Airport

Bldg	Space	Subdiv	Volume	Units	Type of Containers	Owner	Proper Waste Management	Record Keeping	Notes
002	106		550	gal	AST	Alamo		yes	Unitek removes every 2 months
004	106		200	gal	AST	Alcha Airlines		yes	Mr. Wong-Yuen could not find disposal records
002	110		200	gal	AST	Avis		yes	
510	103		385	gal	55 DM	Big Island Air	unknown	no records	heavy staining beneath drums, on asphalt
403	102		110	gal	55 DM	Blue Hawaiian Helicopters	yes	yes	Unitek
002	124		500	gal	AST	Budget		yes	Unitek removes oil monthly
510	102	B	220	gal	55 DM	Century Aviation	yes	yes	Unitek removes waste
510	103		55	gal	55 DM	Circle Rainbow Air	unknown	no records	heavy staining beneath drums, on asphalt
510	103		55	gal	55 DM	Classic Aviation	unknown	no records	
002	109	B	240	gal	AST	Dollar		yes	Unitek removes used oil
004	105		550	gal	UST	DOTA		no	scheduled for removal by 12/98
004	105		55	gal	55 DM	DOTA	yes	yes	
516	101		120	gal	AST	Fed Ex		no	no disposal records, improper AST labeling
510	103		55	gal	55 DM	Hawaii Helicopters	no	no	Manager Mr. Sheridan uncooperative, no documentation
630	102		500	gal	55 DM	Hawaiian Airlines	yes	yes	Unitek removes used oil
002	107		250	gal	AST	Hertz		yes	Unitek removes every month
002	107		250	gal	AST	Hertz		yes	Unitek removes every month
516	101		220	gal	55 DM	Kenai Helicopters	unknown	unknown	
510	103		55	gal	55 DM	KOA Air	unknown	unknown	Tim (326-2288) not available for interview
002	112		200	gal	55 DM	National	yes	yes	
510	103		220	gal	55 DM	Skycraft	unknown	no records	heavy staining beneath drums, on asphalt
004	104		55	gal	55 DM	United Airlines	yes	yes	
004	104		55	gal	55 DM	United Airlines	yes	yes	Unitek

Waste Management

Five facilities--Air Service, Century Aviation, Circle Rainbow Air, Hawaii Helicopters, and Kenai Helicopters--were found to generate waste material as part of their operations.

Based on information provided by the generators, and on visual observations made at the time of the site visit, all of the facilities generate quantities of hazardous waste that classify them as conditionally exempt small quantity generators (CESQGs).

The following information was obtained from the EPA RCRA database listing:

LQG = large quantity generator
SQG = small quantity generator
CESQG = conditionally exempt small quantity generator

Facility	EPA Identification number	Status
Federal Express	HID984467787	CESQG
Kona International Airport	HID984468066	CESQG

Hazardous waste was not observed to be present at Federal Express or the DOTA Maintenance facility at the time of the site visit.

Air Service, Century Aviation, and Circle Rainbow Air each generated a waste Jet A fuel and water mixture that is drained from their mobile tanker trucks during their maintenance. The waste is stored in 55-gallon drums on site. Air Service personnel indicated that they have not yet disposed of the waste material. Circle Rainbow Air did not have disposal records on site.

No information was available on the waste material generated by Hawaii Helicopters and Kenai Helicopters, other than observations made at the time of the site visit. Visual observations indicated that the storage containers at each facility were in fair to poor condition, and none of the containers were labeled or marked. The contents of the drums at Kenai Helicopters exhibited strong, noxious odors.

Table 4.17 Waste Management at Kona International Airport

Bldg	Space	Subdiv	Contents	Type of Containers	Owner	Condition of Containers	Proper Waste Management	Record Keeping	Notes
006	102		watery Jet A fuel	55 DM	Air Service	good	no labels	never emptied	
510	102	B	waste Jet A and used oil	55 DM	Century Aviation	rusty	yes	yes	Unitek removes waste
510	103		waste fuel	55 DM	Circle Rainbow Air	good	unknown	no records	
516	102		unknown	55 DM	Hawaii Helicopters	rusty	unknown	unknown	no evidence provided of proper management and disposal
516	101		unknown	55 and 30 gallon drums	Kenai Helicopters	fair	no (no labels)	unknown	no one available to interview; drums had strong odors

Hazardous Materials

A total of 17 facilities were found to store hazardous materials. Of these, 15 maintained updated catalogs of MSD Sheets, and had employees who were trained in chemical use and emergencies. Thirteen facilities were required to submit HCIFs to the HDOH; however, seven facilities--Air Service, Aloha Airlines, Budget, Century Aviation, Circle Rainbow Air, the DOTA and Hawaii Helicopters and Skycraft--did not.

Table 4.18 hazardous Material Storage at Kona International Airport

Bldg	Space	Subdiv	MSDS On Site	Owner	Reporting	Personnel Trained	Notes
516	102		yes	Air Service	no	yes	
002	106		yes	Alamo	yes	yes	
004	106		yes	Aloha Airlines	no	yes	
002	110		yes	Avis	yes	yes	
404	106		yes	Big Island Air	NA	yes	
002	124		yes	Budget	no	no	
510	102		yes	Century Aviation	no	yes	
510	102		yes	Circle Rainbow Air	no	yes	
002	113		yes	Dollar	yes	yes	
004	105		yes	DOTA	no	yes	
103	106		yes	Federal Express	NA	yes	
516	102		unknow n	Hawaii Helicopters	no	unknown	
630	102		yes	Hawaiian Airlines	NA	yes	
002	107		yes	Hertz	yes	yes	
510	103		yes	Kona Airport Fire Station	NA	yes	used for fueling small trucks
002	112		yes	National	yes	yes	
404	104		no	Skycraft	no	no	

Spill Equipment

A total of 17 facilities were observed to maintain spill equipment at Kona International Airport. They are identified in the table on the following page.

Table 4.19 Spill Response Kits at Kona International Airport

Bldg	Space	Subdiv	Owner
002	106		Alamo
343	101		Aloha Airlines
002	110		Avis
403	102		Blue Hawaiian Helicopters
002	124		Budget
510	102		Century Aviation
510	103		Circle Rainbow Air
002	113	B	Dollar
002	109	B	Dollar
102	000		DOTA
103	106		Fed Ex
630	102		Hawaiian Airlines
002	107		Hertz
347	000		Kona Airport Fire Station
002	112		National Rental Car
404	104		Skycraft
004	104		United Airlines
104	105		UPS

ASTs

A total of 23 ASTs were identified at Kona International Airport. Only one of the facilities, Century Aviation, had an SPCC Plan. Circle Rainbow Air, Dollar, and United Airlines each operated ASTs in excess of 660 gallons, and based on recommendations by EPA Region IX representatives, should have an SPCC plan.

Table 4.20 Above Ground Storage Tanks at Kona International Airport

Bldg	Space	Subdiv	Volume	Units	Contents	Owner	SPCC Plan	Spill Response Equipment On Site	Personnel Trained for Spill	Testing, Inspection & Record Keeping	Notes
002	106		550	gal	new oil	Alamo	NA	yes	yes	yes	
002	106		550	gal	used oil	Alamo	NA	yes	yes	yes	Unitek removes every 2 months
004	106		200	gal	used oil	Aloha Airlines	NA	yes	yes	yes	Mr. Wong-Yuen could not locate disposal records
002	110		180	gal	new oil	Avis	NA	yes	yes	yes	
002	110		200	gal	used oil	Avis	NA	yes	yes	yes	
002	124		500	gal	used oil	Budget	NA	yes	yes	yes	Unitek removes used oil monthly
002	124		250	gal	new oil	Budget	NA	yes	yes	yes	
510	102	A	10000	gal	Avgas	Century Aviation	yes	yes	yes	yes	
510	102	A	17000	gal	Jet A	Century Aviation	yes	yes	yes	yes	
510	102	A	11000	gal	Jet A	Century Aviation	yes	yes	yes	yes	
510	102	A	19000	gal	Jet A	Circle Rainbow Air	no	yes	yes	yes	
510	102	A	19000	gal	Jet A	Circle Rainbow Air	no	yes	yes	yes	
002	113	B	50	gal	new oil	Dollar	NA	yes	yes	yes	
002	113	B	6000	gal	gasoline	Dollar	no	yes	yes	yes	
002	109	B	240	gal	new oil	Dollar	NA	yes	yes	yes	
002	109	B	240	gal	used oil	Dollar	NA	yes	yes	yes	Unitek removes used oil
005	108		350	gal	diesel	DOTA	NA	no	yes	yes	emergency generator for admin building
516	101		120	gal	used oil	Fed Ex	NA	yes	yes	no	no disposal records, improper labeling of AST
002	107		250	gal	new oil	Hertz	NA	yes	yes	yes	
002	107		250	gal	new oil	Hertz	NA	yes	yes	yes	
002	107		250	gal	used oil	Hertz	NA	yes	yes	yes	Unitek removes every month
002	107		250	gal	used oil	Hertz	NA	yes	yes	yes	Unitek removes every month
004	104		1000	gal	gasoline	United Airlines	no	yes	yes	yes	

Mobile Solvent Recovery Units

Mobile solvent recovery units use solvent to degrease parts and equipment. Generally, the solvent used is petroleum-based, and may be flammable. Proper management of the spent solvent involves compliance with applicable hazardous waste regulations, if the solvent is characterized as hazardous. For solvent that is not regulated as a hazardous waste, proper record keeping and good housekeeping should be maintained.

A total of 13 facilities operate mobile solvent recovery units. Of these, 11 had appropriate disposal documentation on site. Aloha Airlines did not have any disposal documentation on site. Murray Air indicated that they have not disposed of any solvent to date.

Table 4.21 Mobile Solvent Recovery at Kona International Airport

Bldg	Space	Subdiv	Owner	Frequency of Replacement	Solvent Contractor	Notes
002	106		Alamo	quarterly	Unitek	
004	106		Aloha Airlines	unknown	unknown	Mr. Wong-Yuen did not know how often the solvent is removed, or by whom
002	110		Avis	every 2 months	Unitek	
404	106		Big Island Air	rarely	Unitek	
403	102		Blue Hawaiian Helicopters		Unitek	
002	124		Budget	monthly	Unitek	
002	109	B	Dollar	every 2 months	Unitek	
101	000		DOTA		Unitek	
630	102		Hawaiian Airlines	every other month	Unitek	
002	109	A	Hertz	quarterly	Unitek	
002	112		National		Unitek	
004	104		United Airlines	semi-annually	Unitek	
104	105		United Parcel Service	none to date	Unitek	facility is new and will be used in the future

Mobile Storage Tankers

Mobile storage tankers are not specifically regulated under any current environmental regulations. However, these units pose potential health and environmental risks, if they are not properly managed and equipped. Mobile tankers should maintain spill response equipment that is readily available and sufficient in quantity to address releases from the vehicles. Additionally, these vehicles should be regularly inspected and tested.

A total of 11 mobile storage tankers were found to be present at Kona International Airport. Ten of the tankers were equipped with spill equipment and had personnel who were trained for spill response. The tankers were also regularly tested and inspected. No spill equipment was observed on the tanker operated by Hawaii Helicopters.

Table 4.22 Mobile Storage Tanks/ Tankers at Kona International Airport

Bldg	Space	Subdiv	Volume	Units	Contents	Owner	Spill Response Equipment On Site	Personnel Trained for Spill?	Testing, Inspection & Record Keeping	Notes
516	102		5000	gal	Jet A	Air Service	yes	yes	yes	
516	102		5000	gal	Jet A	Air Service	yes	yes	yes	
510	102	B	5000	gal	Jet A	Aloha Airlines	yes	yes	yes	fuel from Century Aviation
510	102	B	10000	gal	Jet A	Century Aviation	yes	yes	yes	
510	102	B	5000	gal	Jet A	Century Aviation	yes	yes	yes	
510	102	B	5000	gal	Jet A	Century Aviation	yes	yes	yes	
510	102	B	2500	gal	Jet A	Circle Rainbow Air	yes	yes	yes	
510	102	B	3000	gal	Jet A	Circle Rainbow Air	yes	yes	yes	
510	102	B	8000	gal	Jet A	Circle Rainbow Air	yes	yes	yes	
510	102	B	10000	gal	Jet A	Circle Rainbow Air	yes	yes	yes	
516	102		2000	gal	Jet A	Hawaii Helicopters	no	no	yes	

ARFF Facility

The DOTA maintains a crash/fire pit for use in training fire rescue personnel in managing airport fires. The pit is lined and filled with a mixture of Jet A fuel and water. The water is contained in a bermed 500-gallon aboveground holding pond.

Table 4.23 Fire Training Pit at Kona International Airport

Bldg	Space	Subdiv	Type of Fuel	Owner	Notes
605	105		Jet A	DOTA	

In addition, a second fire training pit, out of service at the time of the site visit, was observed at the airport. The pit consisted of an area approximately 30 yards in diameter, with a metal mock airplane located in the center. The pit, constructed of soil and rock, appeared to have gross petroleum contamination. No other information was available about the facility.

Air Emissions

No facilities generating air emissions were identified.

Oil/Water Separators and Sumps

Seven oil/water separators and sumps were identified at Kona International Airport. Three facilities--Alamo, Budget, and National and Thrifty Car Rental --used separators/sumps to collect sludge, debris, and petroleum residue from their car washing units. Alamo and Budget also operated oil/water separators that processed water generated from the wash down of their respective maintenance areas. The DOTA operated an oil/water separator that processed water and fuel from the fire training pit.

The DOTA and Alamo had laboratory analyses and/or disposal records of the waste generated during the cleaning of their units. Budget, and National and Thrifty, did not.

Table 4.24 Oil/Water Separators and Sumps at Kona International Airport

Bldg	Space	Subdiv	Volume	Units	Source of Waste	Frequency of Cleaning	Owner	Permit	Discharge	Lab Testing and Disposal Certificates	Notes
002	106		100	gal	carwash	semi-annually	Alamo	NA	water recycled	yes	Unitek tests and pumps
002	106		100	gal	floor drains	semi-annually	Alamo	NA	unknown	yes	Unitek tests and pumps
002	110		200	gal	carwash	semi-annually	Avis	NA	injection well	yes	
002	124		100	gal	floor drains in shop	none	Budget	no	unknown	no	
002	124		100	gal	carwash	semi-annually	Budget	NA	injection well	no	J&L cleans sump
672	112		100	gal	Jet A		DOTA	NA		yes	
002	112		100	gal	carwash	semi-annually	National	NA	injection well	no	J&L cleans sump
			unknown	unknown	carwash	unknown	Thrifty	unknown	unknown	unknown	

Other Notable Areas

Based on DOTA records, Kona International Airport has a total of 50 injection wells. Records indicate that 14 of them were covered by a permit (UIC Permit No. UH-1673) from the HDOH Safe Drinking Water Branch. However, the permit expired on November 12, 1996. Accordingly, the permit for the 14 injection wells should be renewed, and a permit application for the remaining 36 injection wells should be submitted.

Avis Rental Car has a permit for an injection well at their facility. The permit (UH-1540) was issued on December 3, 1991 and expired on December 2, 1996. No records were found indicating that the permit was renewed.

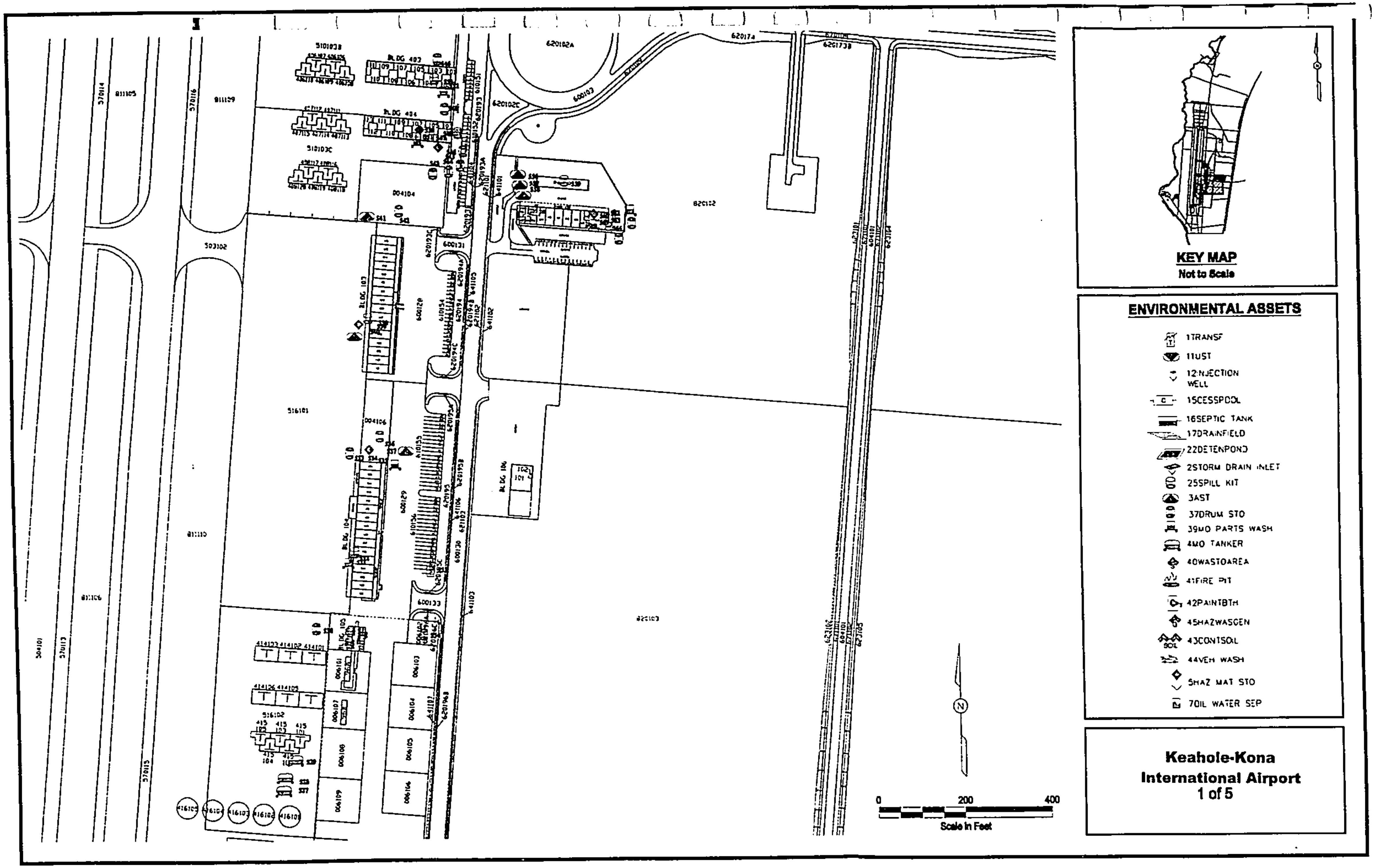
Findings of Environmental Audit Activities at Waimea Airport

Tenant Screening

After the primary screening process to eliminate those tenant facilities that were not likely to use or store hazardous materials/waste or discharge pollutants into the air, water, or soil on Waimea Airport property, the secondary screening process was undertaken during July 30-31, 1998.

Using the DOTA's Tenant Listing Base, telephone calls were placed to the Waimea Airport tenants that had been identified for further screening. These calls revealed that some of the tenants were no longer present and some of the listed contacts and phone numbers were no longer valid. In addition, some of the contacts did not have telephone listings.

Following the secondary screening process and notification of tenants subject to the audit, the project team began its on-site activities at Waimea Airport on August 5, 1998. The audit process started with an interview of each available tenant to obtain information on the environmental activities relevant to the facility. Other tenants not identified during the screening process were determined to be subject to the audit under the scope of this project.



KEY MAP
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ENVIRONMENTAL ASSETS
1TRANSF
11UST
12INJECTION WELL
15CESSPOOL
16SEPTIC TANK
17DRAINFIELD
22DETENPOND
2STORM DRAIN INLET
25SPILL KIT
3AST
37DRUM STO
39MO PARTS WASH
4MO TANKER
40WASTOAREA
41FIRE PIT
42PAINTBTH
45HAZWASGEN
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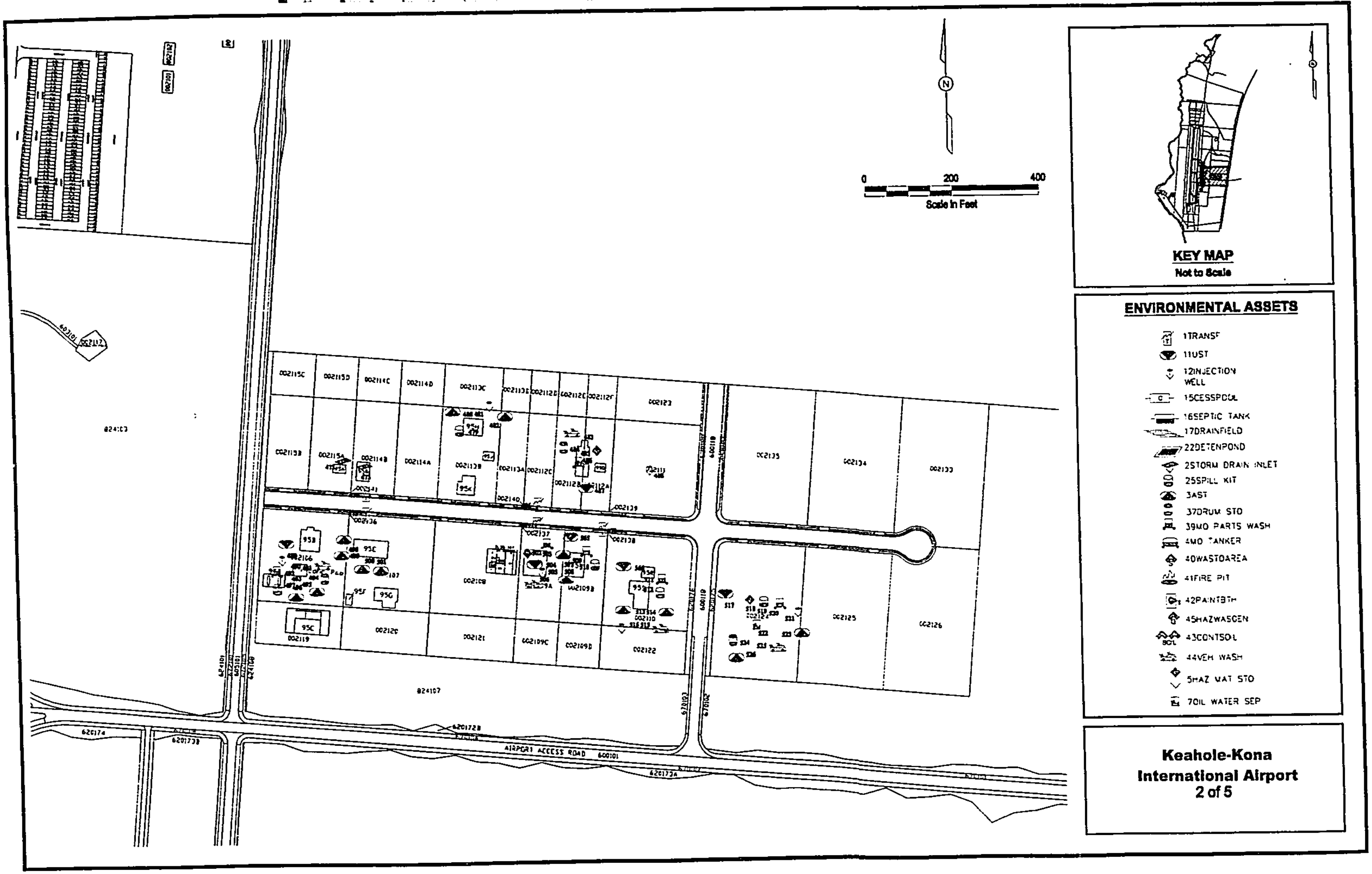

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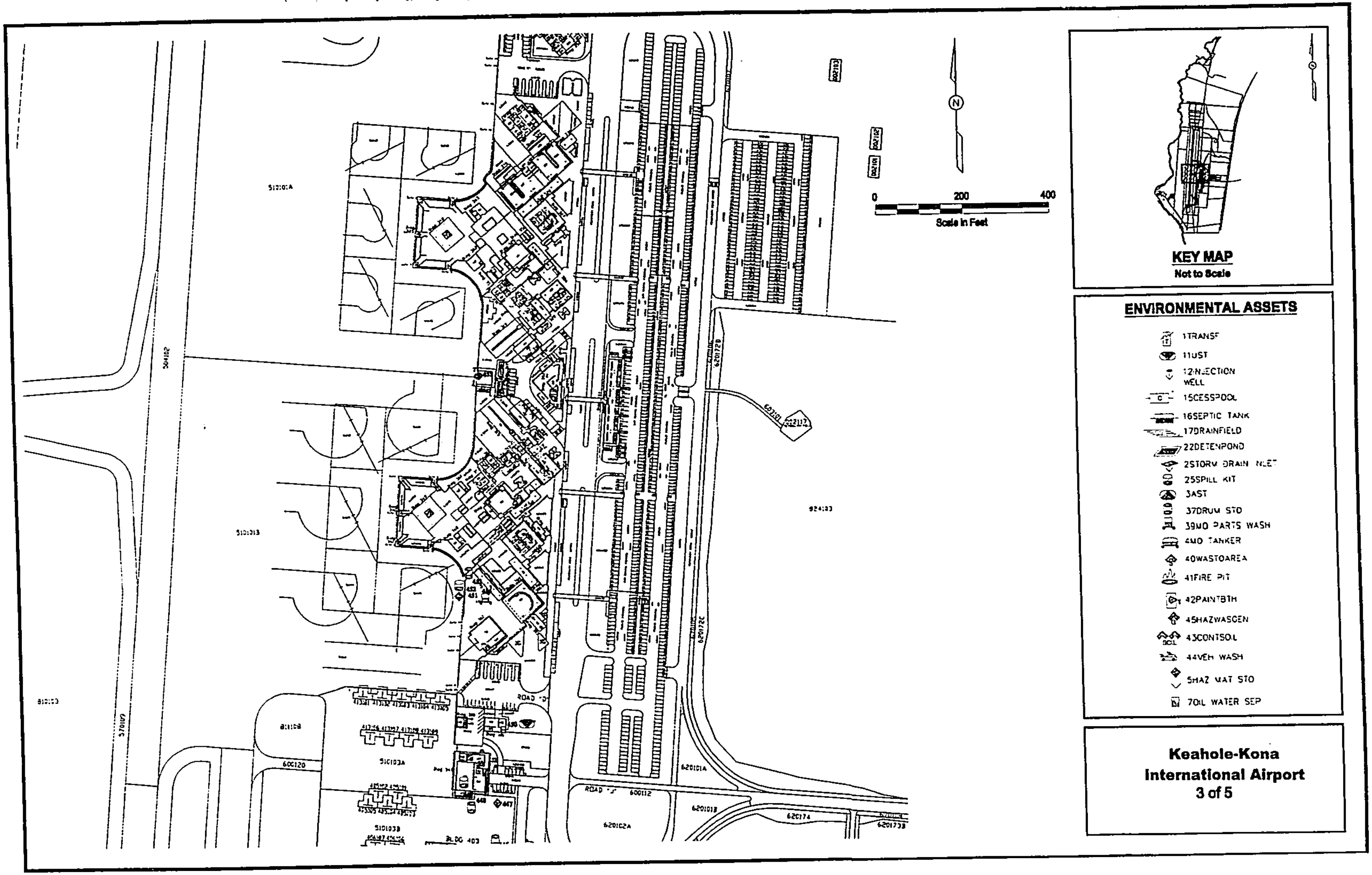

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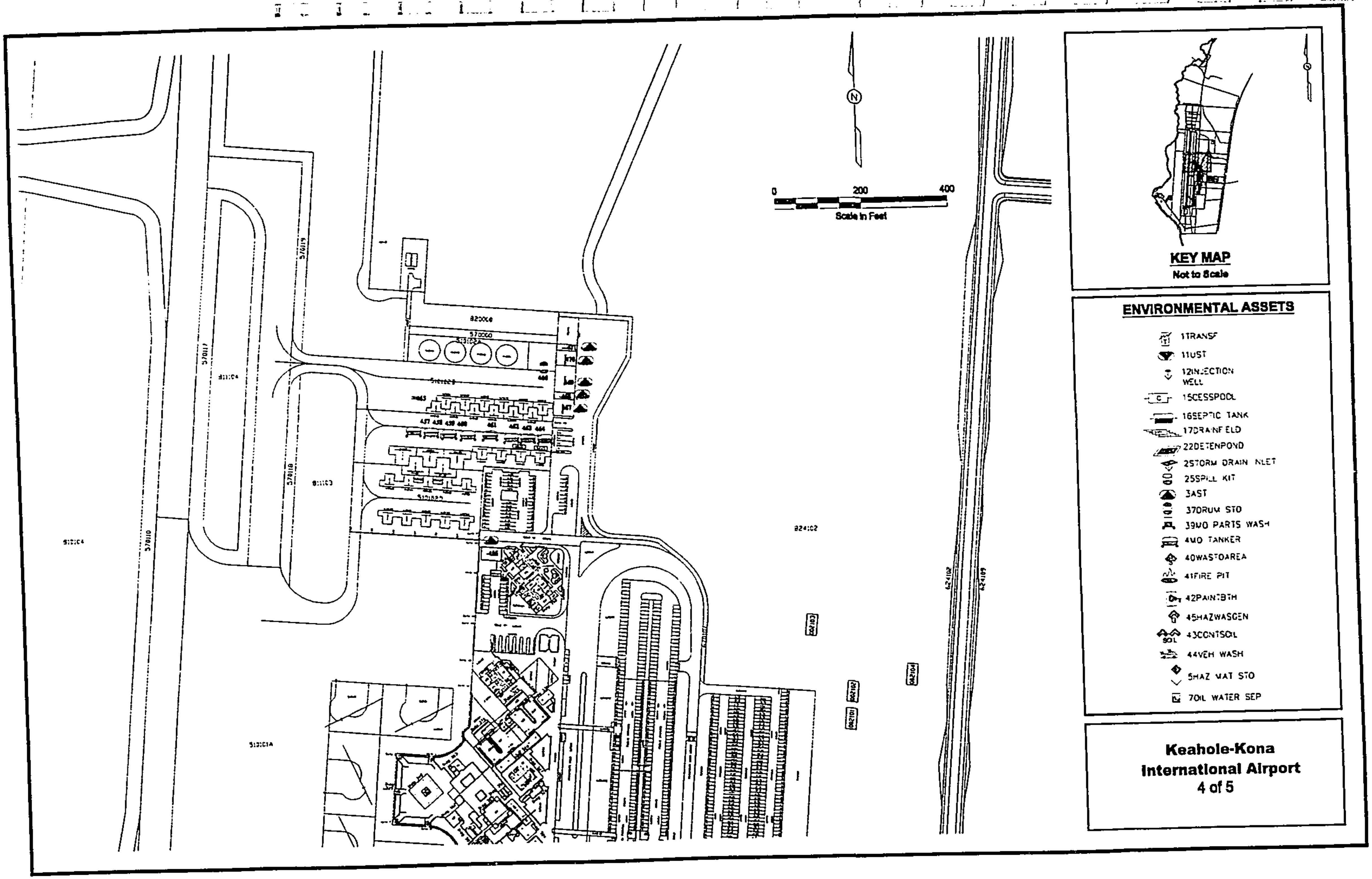
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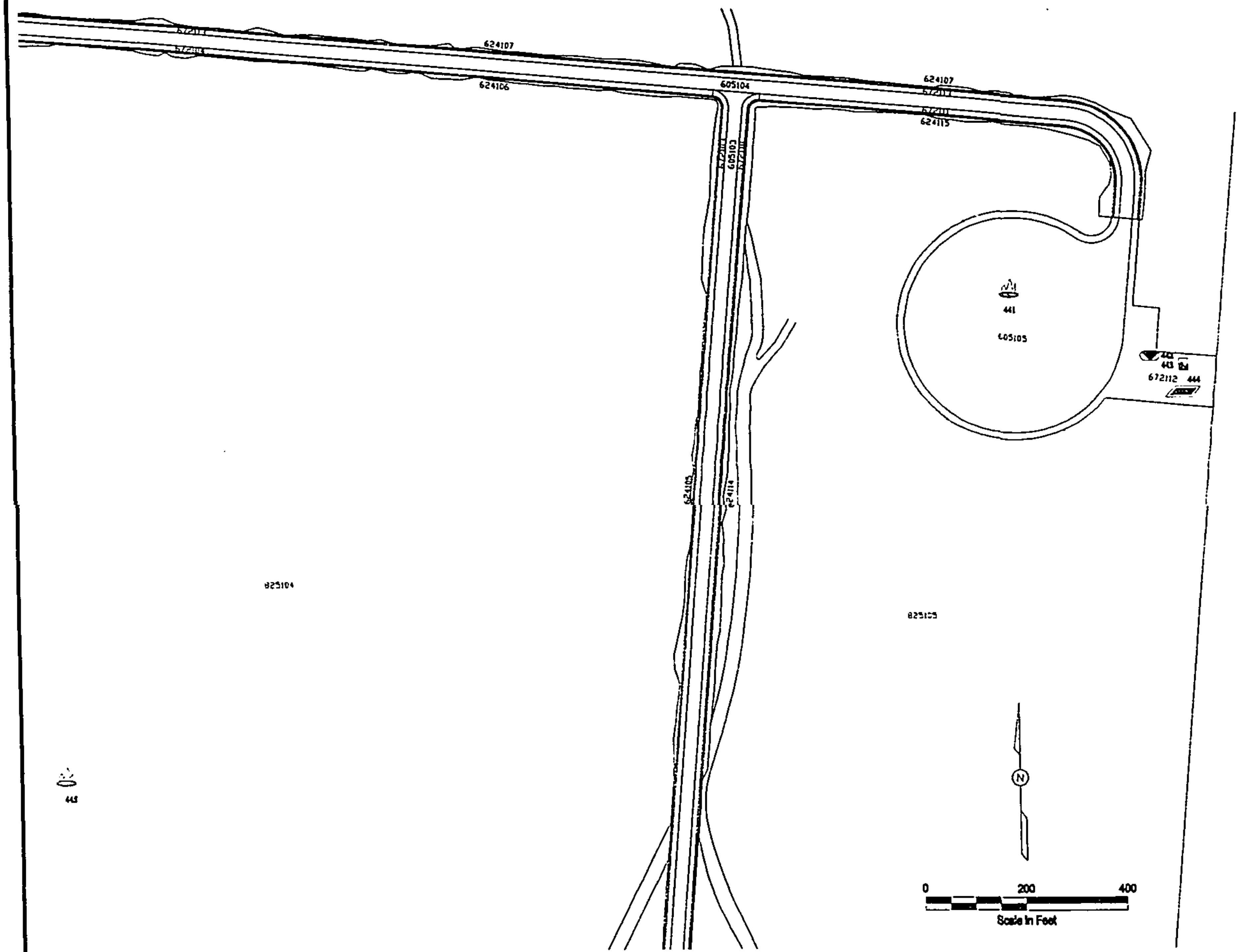

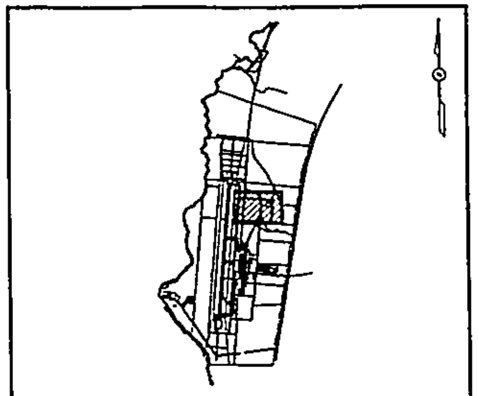

KEY MAP
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ENVIRONMENTAL ASSETS

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APPENDIX E
Water Quality Monitoring Program

Final Report: Year One

July 15, 1997 - June 15, 1998
for the

Water Quality Monitoring Program

for the

Keahole Airport Expansion

Contract No. DOT-97-032

Prepared by

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December 1998

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INTRODUCTION

CONTRACTUAL INFORMATION

After several years of discussions, in March 1997 the Natural Energy Laboratory of Hawaii Authority (NELHA) submitted a proposal to the Department of Transportation Airports Division (DOT-A) to initiate an environmental monitoring program mandated by the County of Hawaii and the State Land Use Commission for the expansion of the Kona International Airport at Keahole. The special conditions attached to the Airport's Special Management Area Use Permit from the County state that the monitoring program must be coordinated with the ongoing Comprehensive Environmental Monitoring Program (CEMP) at NELHA.

NELHA had assisted DOT-A by recommending consultants to design the airport monitoring program so that it would be comparable to the NELHA program. The consultants recommended a two-year baseline data collection period of monthly sampling from groundwater monitoring wells located strategically throughout the airport complex. The Program was designed around the phasing of the airport improvements, so that some of the monitoring wells were installed in 1997 with the rest to follow prior to Phase II of the Expansion.

Since the LUC/SMA conditions specified that the new monitoring program was to be coordinated with NELHA's CEMP and since that existing program requires monitoring of similar wells on the adjacent NELHA property, the NELHA Analytical Laboratory was asked to conduct the monitoring and analyses for DOT-A. It was also recognized that this sharing of resources between two Departments should result in cost efficiencies for the State.

The monitoring of the airport wells does, however, require additional analyses beyond those required for monitoring NELHA activities. The potential for spill of aviation fuels and/or lubricants leads to the need to monitor for release of certain heavy metals and hydrocarbons that are not considered potential problems at NELHA. These additional analyses require specialized instrumentation, specifically an atomic absorption spectrophotometer for the heavy metals and a gas chromatograph/mass spectrometer for the hydrocarbons. Discussions of the requirements for airport expansion over the years since 1990 had led NELHA to recognize the potential need for these analyses, and appropriate instrumentation was purchased in preparation for the work. Because of its availability, the GC/MS was used by NELHA for development of fatty acid analysis for bacterial identification in groundwater and shellfish culture tissues. The AAS was used for some metals analyses in geothermal fluids, but methods for use in seawater proved difficult to develop. When the NELHA Analytical Laboratory staff was reduced by 50% in late 1995, these activities were dramatically curtailed so that all efforts could be directed toward performing NELHA's CEMP.

Though staff and budget reductions have reduced the ability of the NELHA Analytical Laboratory to perform additional contract work, the similarity of the required work to that already being performed made it appropriate for NELHA to propose to do the work for the airport. Analysis of the tasks involved indicated that the remaining staff would not be adequate for the additional work, so NELHA planned to hire an additional laboratory assistant through its Special Fund. This additional person would allow a re-distribution of laboratory tasks so that the chemists and microbiologists could handle the additional sampling and analyses. NELHA prepared a proposal to perform the monthly sampling and analyses based upon this plan to hire an additional laboratory assistant.

At the request of DOT-A, NELHA provided the proposal to perform the sampling and analysis work. The subject contract was negotiated based upon NELHA's proposal, and the work began upon notice to proceed on 15 July, 1997.

SCOPE OF WORK

The contract specified monthly sampling from the six monitoring wells that had been installed by DOT-A. These samples were to be analyzed for a specified number of constituents and the results were to be reported quarterly to DOT-A. In addition, the NELHA was to contract for semi-annual offshore biota monitoring to establish a baseline for future potential pollution event measurements. The costs for the contract were based upon costs of sampling and standardized rates for each of the required analyses, plus additional costs for the biota monitoring contract and for preparation of data reports.

SAMPLING SITES AND PROCEDURES

Samples were taken from the six monitoring wells already installed by DOT-A. They are in three sets, forming an approximate line from the highway entrance to the airport through the airport terminal area to the ocean shoreline (Figure 1). Well 11, near the airport highway intersection, is a single well, 172 ft. deep. Well Set 13 consists of two wells, 83 ft and 63.5 ft deep, located in the parking area near the freight terminal. Well set 14 includes three wells with depths of 50, 40 and 30 ft, located near the coastline on NELHA property. The well locations and characteristics are summarized in Table I.

Monitoring of both mid-water and benthic biota is performed semi-annually along transects offshore of NELHA and the airport by consultants Dr. Richard Brock and Dr. Stephen Dollar from the University of Hawaii. Their northernmost transect, just north of Ho`ona Bay, is directly offshore of groundwater monitoring Well Set 14, and thus serves as the most logical site for the airport monitoring baseline. This transect is particularly useful because of the 10 year accumulation of monitoring data at the site. Since there was little justification for establishment of a separate nearby transect for this stage of airport monitoring, the data from the Ho`ona transect serve as the control survey for the biota baseline.

FIGURE 1. Sampling Site Location Map

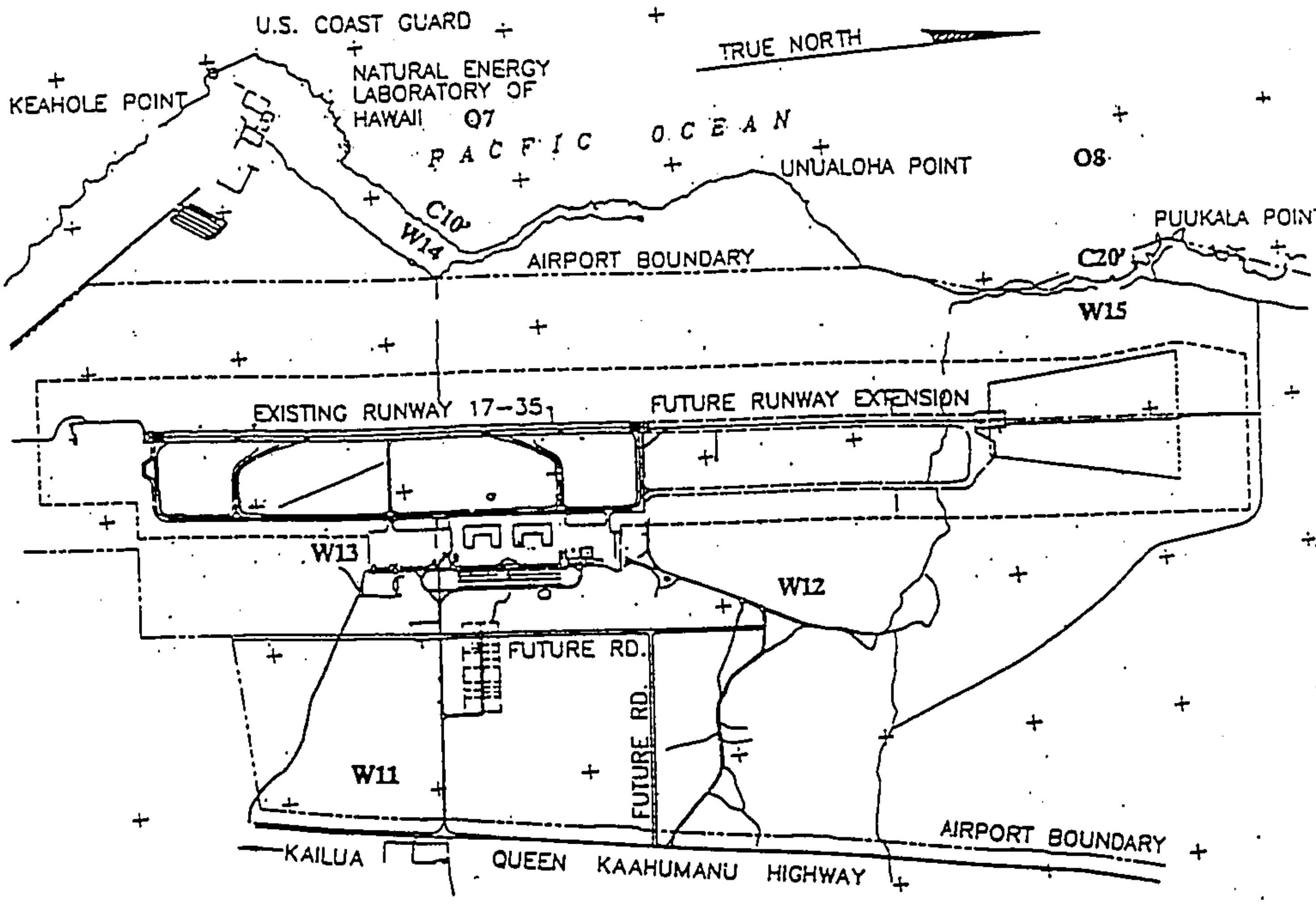


TABLE I. Monitoring Wells

Well No.	N-S Location	E-W Location	Pad Elevation (~4" above grade)	Elevation of top of Casing	Depth Below Grade
W-11	N 327883.12	E 316383.14	140.83 ft	143.26 ft	171.8 ft
W-13A	N 327381.55	E 312933.01	55.05 ft	57.63 ft	83.0 ft
W-13B	N 327381.60	E 312936.02	55.05 ft	57.63 ft	63.5 ft
W-14A	N 328865.78	E 308932.01	22.79 ft	25.21 ft	50.0 ft
W-14B	N 328665.78	E 308935.01	22.79 ft	25.21 ft	40.0 ft
W-14C	N 328665.78	E 308938.01	22.79 ft	25.21 ft	30.0 ft

Note: Positions are NAD27 State Plane coordinates. Individual well locations estimated from drawing, not surveyed.

CONTRACT PERFORMANCE

Samples were taken from the airport wells on the following dates:

11 August 1997
29 September 1997
13 October 1997
05 November 1997
17 December 1997
06 January 1998
04 February 1998
11 March 1998
15 April 1998
13 May 1998
03 June 1998
15 July 1998

Analyses for nutrients and other variables requiring prompt analysis were performed within 24 hours, as required. Remaining sample aloquots for other variables were stored and frozen as required to assure accurate analyses later.

During the initial preparations for the contract, NELHA personnel recognized that additional staff training would be required to allow proper utilization of the AAS and GC/MS for the new analyses. Training classes were arranged and were attended by lab personnel in August and September, 1997. Some difficulties with the refurbishment of the instruments after several years of minimal use were remedied through maintenance contracts with the manufacturers, but these led to delays in beginning the analyses for metals and hydrocarbons. Though not all of the analyses were completed by the end of the first quarter in October, the quarterly report was submitted as required. The analyses were completed and reported by the end of the second quarter. The third quarter report was also submitted as required. The fourth quarter sampling and analyses were completed on time, but the report has been delayed because of difficulties caused by DOT-A's failure to renew the contract as expected. This final report includes the analysis results from the fourth quarter.

Quarterly data reports on the analyses were forwarded to the County Planning Department, as requested by the Airports Division.

Detailed offshore biota monitoring surveys were conducted for benthic biota in November 1997 and May 1998 by Dr. Steven Dollar of Marine Research Consultants and for midwater biota in December 1997 and June 1998 by Dr. Richard Brock of Environmental Assessment Company. Their reports present observations for six transects along the extent of the NELHA property. The Ho'ona Bay transect data from these surveys provide the baseline for the Airport Expansion monitoring program.

ANALYTICAL PROCEDURES AND QUALITY ASSURANCE

NELHA follows standardized procedures for quality assurance of all analyses. All procedures and reports are maintained in NELHA files to ensure chain of custody and proper analytical procedures.

Metals analyses are performed using the Perkin Elmer AA-5100 Atomic Absorption Spectrophotometer (AAS) and following EPA Standard Method 200.9, Rev. 2.2. Procedures for analyzing samples on the AAS and sample operations logs are attached as Appendix A.

Nutrient analyses are performed using the Technicon Auto-Analyzer II. Total dissolved phosphorus is measured using photo-oxidation followed by colorimetric analysis in the Technicon AA. Total dissolved nitrogen and total organic carbon are measured by high temperature catalytic oxidation with the Antek Model 7000B nitrogen analyzer and the Shimadzu TOC-5000A analyzer. NELHA has developed a unique and effective method for utilizing the TOC 5000 furnace for both TOC and TDN analyses.

Salinities are measured with an AGE Mod. 2100 salinometer and pH with a Corning pH/ion meter. Dissolved oxygen is measured by Winkler titration, per the standard methods of Strickland & Parsons (1972).

As part of its Quality Assurance program, NELHA participates in U.S. Environmental Protection Agency Water Pollution Laboratory Performance Evaluation Studies. The Performance Evaluation Report for Study WP039 is attached as Appendix B. This report shows that the NELHA analytical laboratory achieved acceptable performance on all variables in the tests conducted in May 1998.

shows that the NELHA analytical laboratory achieved acceptable performance on all variables in the tests conducted in May 1998.

DATA REPORTS

Tables II-V contain the complete data summaries for each quarter of the year. Figures 2 and 3 present plots of the measured data vs time. Appropriate portions of Dr. Brock's and Dr. Dollar's biota monitoring reports describing their findings for the control surveys along the Ho'ona baseline transect are presented in Appendixes C and D.

There are no significant unexpected features in the data. All values fall within expected norms. The following observations are of interest:

- The nutrient values from each well are generally consistent throughout the year.
- The relationships between the nutrient levels in separate wells remain remarkably consistent.
- As expected, the nutrient concentrations increase with distance from the shoreline and decrease with depth.
- Nitrate, total dissolved nitrogen, total organic carbon and dissolved oxygen concentrations are greater at the deep W13A than at the inshore W11, apparently because W13A extends deeper into the aquifer. The two wells have the same salinity, indicating similar levels of mixing between groundwater and seawater.
- Ammonia values fluctuate more than other variables, possibly due to the imprecision of analyses at these extremely low concentrations. Similar variability is common to all groundwater ammonia measurements.
- Though not environmentally significant, the slight increase in nitrate and TDN concentrations in Nov 97 showed up in all wells, indicating how small inputs of nurrients can be easily tracked with these measurements.
- pH in W13B was abnormally high (basic) throughout most of the year, but returned to normal values of about 8 by the end of the year. The was most probably caused by some contamination during the drilling.
- As expected in the absence of fuel spills, heavy metals and hydrocarbons were largely below the detectable limits. Three instances of chromium detection slightly above the minimum detectable limit of 2 ppb do not indicate an environmental problem but do demonstrate that the analyses are effective at these low levels.
- One instance of significant coliform detection at 83 ft depth in W13A is unexplained and possibly due to sample contamination.
- Enterococci were only found once, just at the detectability limit of 1 colony per 100 ml.

TABLE II.
KEAHOLE AIRPORT ENVIRONMENTAL MONITORING PROGRAM
QUARTERLY REPORT
AUG - OCT 1997

GROUNDWATER MONITORING WELLS

SITE/Depth (feet)	DATE (D-M-Y)	JULIAN DATE	TIME (2400)	PO4 (µM/L)	NO3 (µM/L)	NH4 (µM/L)	Si (µM/L)	TDP (µM/L)	TDN (µM/L)	TOC (mg/L)	SALINITY (o/oo)	TEMP (Deg C)	pH	DO (ppm)	Coliform Bact/100ml	Enterococci Bact/100ml	Pb (ppb)	Cr (ppb)	Cd (ppb)	Hydrocarbons (ppb)
W11/172'	11-Aug-97	1997.61	1100	4.24	83.1	0.08	660	4.36	85.5	0.56	5.029	21.7	8.005	8.10	<1	<1				
W11/172'	29-Sep-97	1997.75	908	4.26	82.8	0.18	789	4.38	89.5	0.50	5.010	22.0	8.047	8.09	<1	<1				
W11/172'	13-Oct-97	1997.78	945	4.27	86.9	0.09	784	4.43	91.7	0.50	5.002	22.0	8.048	8.06	<1	<1				
W13A\83'	11-Aug-97	1997.61	1126	3.83	131	0.08	638	3.85	136	0.61	4.780	21.1	8.046	8.20	<1	<1				
W13A\83'	29-Sep-97	1997.75	935	3.84	125	0.10	748	3.89	153	0.61	4.797	22.2	8.109	8.23	<1	<1				
W13A\83'	13-Oct-97	1997.78	1020	3.85	128	0.02	751	3.87	144	0.62	4.717	22.2	8.097	8.28	<1	<1				
W13B\63'5"	11-Aug-97	1997.61	1134	2.72	53.8	0.19	505	2.85	56.1	0.49	15.041	20.5	8.645	4.99	<1	1	<2.00	2.35	<0.20	None Detecte
W13B\63'5"	29-Sep-97	1997.75	940	2.85	54.5	0.23	495	3.08	58.7	0.47	14.319	21.5	8.617	3.82	<1	<1	<2.00	<2.00	<0.20	None Detecte
W13B\63'5"	13-Oct-97	1997.78	1009	2.87	59.9	0.04	481	3.00	62.5	0.46	13.820	21.6	8.675	3.91	<1	<1	<2.00	<2.00	<0.20	None Detecte
W14A\50'	11-Aug-97	1997.61	1015	1.54	21.5	0.09	358	1.64	29.1	0.33	24.672	20.5	7.996	3.74	<1	<1				
W14A\50'	29-Sep-97	1997.75	1016	1.67	27.7	0.28	373	1.80	30.4	0.37	24.343	21.5	8.019	3.76	<1	<1				
W14A\50'	13-Oct-97	1997.78	1109	1.64	29.2	0.09	381	1.74	30.1	0.40	24.070	21.7	8.027	3.82	<1	<1				
W14B\40'	11-Aug-97	1997.61	1005	1.88	35.1	0.11	409	1.98	36.3	0.33	21.802	21.0	7.992	4.48	<1	<1				
W14B\40'	29-Sep-97	1997.75	1026	1.98	36.0	0.25	440	2.10	38.3	0.46	21.457	21.6	8.043	4.43	<1	<1				
W14B\40'	13-Oct-97	1997.78	1057	1.89	36.4	0.08	410	2.01	38.1	0.32	21.680	21.8	8.026	4.31	<1	<1				
W14C\30'	11-Aug-97	1997.61	958	3.17	81.1	0.06	583	3.30	83.0	0.51	10.010	21.4	8.086	7.18	<1	<1	<2.00	<2.00	<0.20	None Detecte
W14C\30'	29-Sep-97	1997.75	1032	3.22	79.6	0.14	628	3.33	85.6	0.54	10.647	21.7	8.131	6.99	<1	<1	<2.00	<2.00	<0.20	None Detecte
W14C\30'	13-Oct-97	1997.78	1019	3.14	84.6	0.03	632	3.20	89.6	0.48	10.104	22.3	8.116	7.06	<1	<1	<2.00	<2.00	<0.20	None Detecte

TABLE III.
KEAHOLE AIRPORT ENVIRONMENTAL MONITORING PROGRAM
QUARTERLY REPORT
. NOV 97 - JAN '98

GROUNDWATER MONITORING WELLS

SITE/Depth (feet)	DATE (D-M-Y)	JULIAN DATE	TIME (2400)	PO4 (µM/L)	NO3 (µM/L)	NH4 (µM/L)	Si (µM/L)	TDP (µM/L)	TDN (µM/L)	TOC (mg/L)	SALINITY (o/oo)	TEMP (Deg C)	pH	DO (ppm)	Coliform Bact/100ml	Enterococci Bact/100ml	Pb (ppb)	Cr (ppb)	Cd (ppb)	Hydrocarbons (ppb)
W11/172'	05-Nov-97	1997.85	1010	4.05	90.7	0.03	782	4.18	111	0.46	5.012	21.7	8.040	8.06	<1	1				
W11/172'	17-Dec-97	1997.96	946	4.28	86.6	0.03	792	4.31	90.5	0.58	5.043	21.7	8.035	8.13	<1	<1				
W11/172'	06-Jan-98	1998.02	1207	4.27	85.9	0.03	787	4.44	89.6	0.56	5.042	20.6	8.043	8.20	<1	<1				
W13A\83'	05-Nov-97	1997.85	1102	3.74	135	0.15	744	3.81	173	0.61	4.787	21.5	8.107	8.32	<1	<1				
W13A\83'	17-Dec-97	1997.96	1016	3.86	126	0.05	756	3.87	134	0.57	4.803	22.4	8.120	8.45	<1	<1				
W13A\83'	06-Jan-98	1998.02	1235	3.83	121	0.02	749	3.96	126	0.54	4.870	21.5	8.128	8.38	<1	<1				
W13B\63'5"	05-Nov-97	1997.85	1056	2.74	56.7	0.36	564	2.83	66.0	0.37	15.171	21.2	8.239	5.23	<1	<1	<2.00	2.01	<0.20	None Detected
W13B\63'5"	17-Dec-97	1997.96	1010	2.78	54.9	0.09	571	2.83	57.5	0.47	14.971	21.0	8.466	5.08	<1	1	<2.00	<2.00	<0.20	None Detected
W13B\63'5"	06-Jan-98	1998.02	1229	2.88	55.5	0.02	553	3.04	58.0	0.48	14.862	21.0	8.287	5.00	<1	<1	<2.00	2.69	<0.20	None Detected
W14A\50'	05-Nov-97	1997.85	935	1.60	29.5	0.33	370	1.70	33.2	0.33	24.220	20.8	8.028	4.49	<1	<1				
W14A\50'	17-Dec-97	1997.96	907	1.57	26.5	0.13	359	1.64	28.2	0.37	25.036	20.9	8.018	3.72	<1	<1				
W14A\50'	06-Jan-98	1998.02	1058	1.60	27.6	0.04	370	1.76	29.5	0.35	24.666	20.8	8.036	3.83	<1	<1				
W14B\40'	05-Nov-97	1997.85	930	1.90	38.8	0.33	433	2.01	43.2	0.32	21.374	21.1	8.010	3.92	<1	<1				
W14B\40'	17-Dec-97	1997.96	859	1.90	36.0	0.12	429	1.98	37.7	0.40	21.853	21.2	8.022	4.41	<1	<1				
W14B\40'	06-Jan-98	1998.02	1052	1.97	38.1	0.01	443	2.14	40.1	0.40	21.344	21.2	8.042	4.50	<1	<1				
W14C\30'	05-Nov-97	1997.85	925	3.09	85.7	0.19	620	3.13	102	0.46	10.748	21.8	8.128	7.10	<1	<1	<2.00	<2.00	<0.20	None Detected
W14C\30'	17-Dec-97	1997.96	852	3.05	77.7	0.02	614	3.16	80.6	0.51	11.258	21.8	8.110	7.05	<1	<1	<2.00	<2.00	<0.20	None Detected
W14C\30'	06-Jan-98	1998.02	1017	3.12	80.5	0.04	627	3.32	85.0	0.53	10.702	21.7	8.136	7.14	<1	<1	<2.00	<2.00	<0.20	None Detected

TABLE IV.
KEAHOLE AIRPORT ENVIRONMENTAL MONITORING PROGRAM
QUARTERLY REPORT
FEB - APR 1998

GROUNDWATER MONITORING WELLS

SITE/Depth (feet)	DATE (D-M-Y)	JULIAN DATE	TIME (2400)	PO4 (µM/L)	NO3 (µM/L)	NH4 (µM/L)	Si (µM/L)	TDP (µM/L)	TDN (µM/L)	TOC (mg/L)	SALINITY (o/oo)	TEMP (Deg C)	pH	DO (ppm)	Coliform Bact/100ml	Enterococci Bact/100ml	Pb (ppb)	Cr (ppb)	Cd (ppb)	Hydrocarbons (ppb)
W11/172'	04-Feb-98	1998.10	1011	4.12	88.5	0.03	784	4.25	91.0	0.52	5.060	21.4	8.060	8.17	<1	<1				
W11/172'	11-Mar-98	1998.19	1131	4.39	86.4	0.08	797	4.65	88.2	0.63	5.071	21.7	7.908	8.18	<1	<1				
W11/172'	15-Apr-98	1998.29	1013	4.31	84.6	0.18	788	4.41	86.5	0.64	5.085	21.9	7.939	8.19	<1	<1				
W13A\83'	04-Feb-98	1998.10	1040	3.68	123	0.01	742	3.78	132	0.60	4.934	21.2	8.135	8.30	<1	<1				
W13A\83'	11-Mar-98	1998.19	1201	3.96	119	0.09	748	4.15	121	0.59	5.013	21.5	8.012	8.23	<1	<1				
W13A\83'	15-Apr-98	1998.29	1044	3.95	120	0.11	748	3.97	124	0.60	4.930	21.6	8.022	8.45	<1	<1				
W13B\63'5"	04-Feb-98	1998.10	1034	2.61	54.0	0.04	556	2.75	57.5	0.44	14.908	20.9	8.482	4.89	<1	<1	<2.00	<2.00	<0.20	None Detected
W13B\63'5"	11-Mar-98	1998.19	1156	2.93	56.0	0.15	556	3.14	57.3	0.46	14.669	21.0	8.455	4.66	<1	<1		<2.00	<0.20	None Detected
W13B\63'5"	15-Apr-98	1998.29	1038	2.95	55.5	0.25	549	2.98	57.4	0.52	14.395	20.9	8.422	4.51	<1	<1			<0.20	None Detected
W14A\50'	04-Feb-98	1998.10	918	1.59	28.5	0.02	379	1.69	29.8	0.37	24.275	20.8	8.045	3.88	<1	<1				
W14A\50'	11-Mar-98	1998.19	1044	1.72	28.9	0.13	380	2.22	30.4	0.38	24.327	20.9	7.848	3.86	<1	<1				
W14A\50'	15-Apr-98	1998.29	926	1.73	26.7	0.10	372	1.82	28.3	0.45	25.020	20.9	7.859	3.74	<1	<1				
W14B\40'	04-Feb-98	1998.10	913	1.94	38.6	0.03	450	2.63	40.1	0.38	21.244	21.2	8.053	7.09	<1	<1				
W14B\40'	11-Mar-98	1998.19	1039	2.07	39.5	0.18	450	2.20	41.0	0.42	21.134	21.3	7.859	4.58	<1	<1				
W14B\40'	15-Apr-98	1998.29	918	2.02	36.2	0.11	443	2.12	38.3	0.40	21.777	21.1	7.866	4.39	<1	<1				
W14C\30'	04-Feb-98	1998.10	908	3.07	79.9	0.03	622	3.24	83.4	0.53	10.956	21.6	8.145	4.53	<1	<1	<2.00	<2.00	<0.20	None Detected
W14C\30'	11-Mar-98	1998.19	1034	3.23	79.4	0.07	624	3.37	80.5	0.56	11.439	21.7	7.965	6.96	<1	<1		<2.00	<0.20	None Detected
W14C\30'	15-Apr-98	1998.29	912	3.24	76.1	0.13	625	3.33	76.6	0.55	11.364	21.5	7.974	6.97	<1	<1			<0.20	None Detected

TABLE V.
KEAHOLE AIRPORT ENVIRONMENTAL MONITORING PROGRAM
QUARTERLY REPORT
MAY - JUL 1998

GROUNDWATER MONITORING WELLS

SITE/Depth (feet)	DATE (D-M-Y)	JULIAN DATE	TIME (2400)	PO4 (µM/L)	NO3 (µM/L)	NH4 (µM/L)	Si (µM/L)	TDP (µM/L)	TDN (µM/L)	TOC (mg/L)	SALINITY (o/oo)	TEMP (Deg C)	pH	DO (ppm)	Coliform Bact/100ml	Enterococci Bact/100ml	Pb (ppb)	Cr (ppb)	Cd (ppb)	Hydrocarbons (ppb)
W11/172'	13-May-98	1998.36	1049	4.45	82.7	0.04	793	4.53	85.7	0.61	5.070	21.7	7.922	8.20	<1	<1				
W11/172'	03-Jun-98	1998.42	1005	4.38	83.4	0.05	779	4.48	86.6	0.45	5.042	21.6	7.924	8.17	<1	<1				
W11/172'	15-Jul-98	1998.54	1041	4.35	85.9	0.08	795	4.46	87.2	0.45	5.128	19.9	7.933	8.35	<1	<1				
W13A\83'	13-May-98	1998.36	1120	4.04	116.8	0.08	747	4.07	117.9	0.61	4.985	21.6	8.029	8.72	<1	<1				
W13A\83'	03-Jun-98	1998.42	1040	3.96	116.4	0.09	746	4.03	116.5	0.54	5.098	21.5	8.012	8.37	15	<1				
W13A\83'	15-Jul-98	1998.54	1108	3.95	118.1	0.08	752	3.98	119.7	0.51	5.056	19.6	8.012	8.37	<1	<1				
W13B\63'5"	13-May-98	1998.36	1114	2.93	52.6	0.09	544	3.02	56.1	0.57	14.642	21.1	8.313	4.65	<1	1				None Detected
W13B\63'5"	03-Jun-98	1998.42	1033	2.90	52.1	0.07	558	2.95	54.2	0.37	15.329	21.1	8.042	4.97	<1	<1				None Detected
W13B\63'5"	15-Jul-98	1998.54	1103	2.77	51.8	0.21	571	2.85	54.2	0.40	15.405	19.8	8.028	4.98	<1	<1				None Detected
W14A\50'	13-May-98	1998.36	958	1.68	27.0	0.15	368	1.81	29.1	0.38	24.802	20.8	7.864	3.86	<1	<1				
W14A\50'	03-Jun-98	1998.42	920	1.67	27.1	0.11	365	1.71	28.3	0.25	24.848	21.0	7.868	3.83	<1	<1				
W14A\50'	15-Jul-98	1998.54	908	1.63	26.0	0.16	364	1.71	27.9	0.31	25.351	21.0	7.840	3.74	<1	<1				
W14B\40'	13-May-98	1998.36	951	2.04	36.5	0.17	440	2.16	39.1	0.38	21.642	21.1	7.866	4.48	<1	<1				
W14B\40'	03-Jun-98	1998.42	914	1.95	36.4	0.11	428	2.01	36.6	0.32	22.098	21.1	7.860	4.41	<1	<1				
W14B\40'	15-Jul-98	1998.54	903	1.89	33.2	0.19	427	2.02	35.6	0.28	22.724	21.2	7.851	4.28	<1	<1				
W14C\30'	13-May-98	1998.36	942	3.22	72.9	0.13	611	3.30	75.4	0.50	12.334	21.4	7.962	6.84	<1	<1				None Detected
W14C\30'	03-Jun-98	1998.42	908	3.09	72.2	0.09	601	3.19	76.6	0.40	12.646	21.6	7.950	6.77	<1	<1				None Detected
W14C\30'	15-Jul-98	1998.54	838	3.10	71.3	0.10	612	3.21	74.8	0.39	15.577	21.6	7.940	6.86	<1	<1				None Detected

FIGURE 2. Nutrient Concentrations

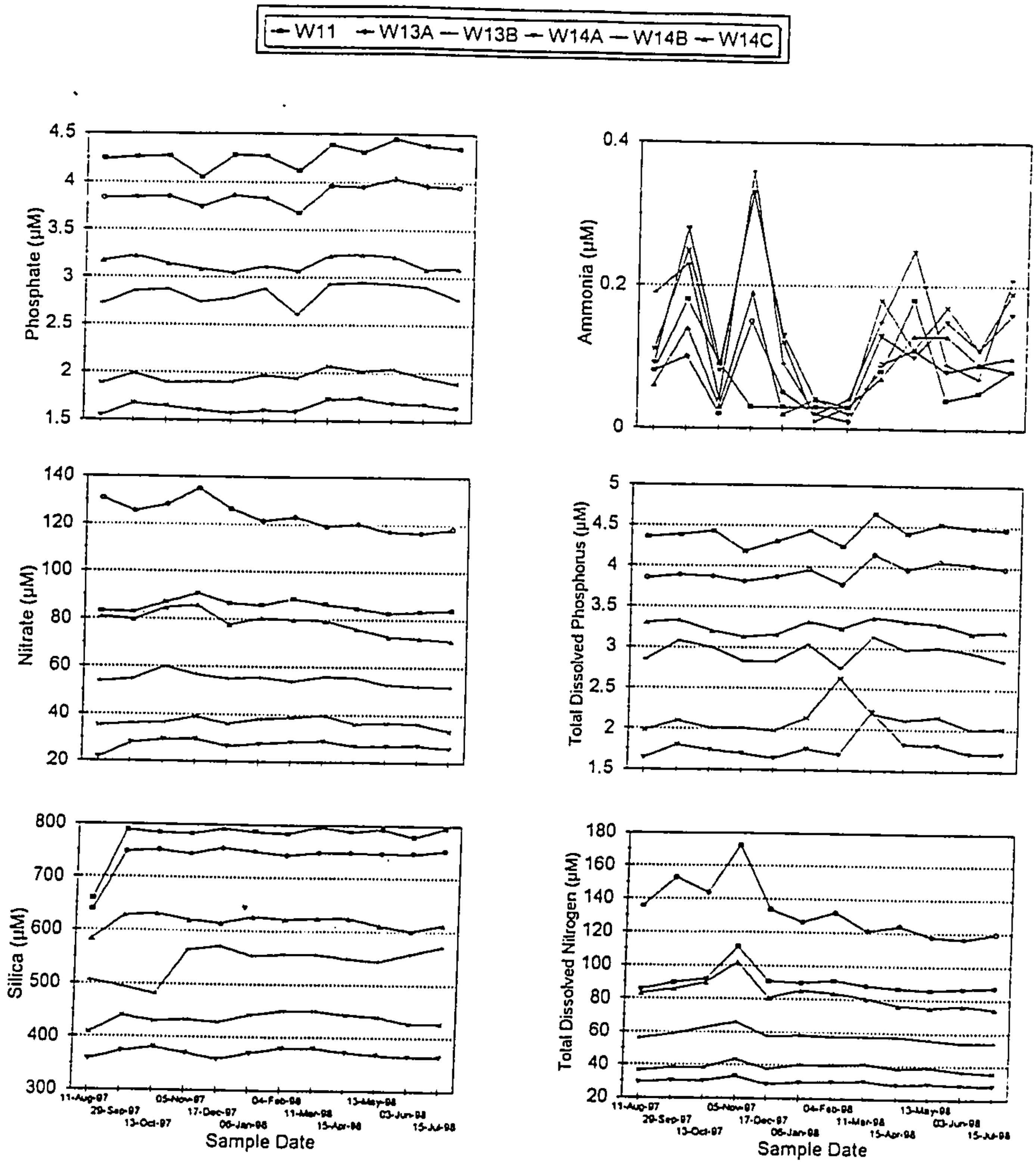
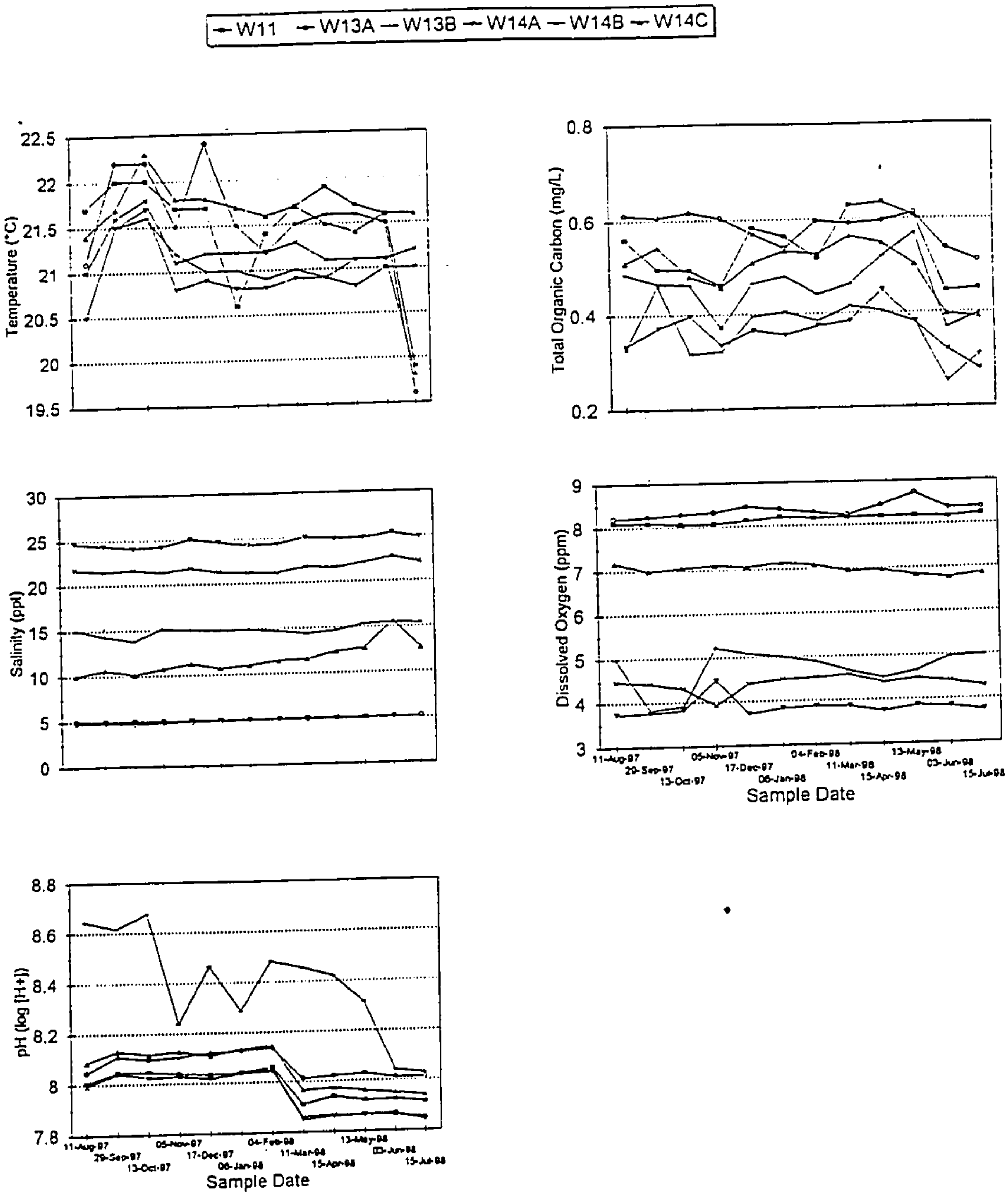


FIGURE 3. Additional Variables



SUMMARY

Under Contract No. DOT-97-032, the NELHA Analytical Laboratory has performed the first year of monitoring mandated by the County of Hawaii Planning Department for the expansion of the Kona International Airport at Keahole. This report represents the completion of that monitoring contract.

Though it is not clear that this single year of ground water monitoring has established an adequate baseline, the County Planning Director has determined that monthly monitoring is no longer required. This determination has led the airport management to decide to perform the monitoring semi-annually. NELHA's proposal for that work was deemed too expensive by Airport management, so they have contracted with a private firm for that work. NELHA was forced to propose relatively high per-sample costs for the semi-annual monitoring, since much of the program cost was for maintaining the specialized instrumentation required for the specific analyses required by the airport monitoring program and for paying part of the salary of an additional lab assistant hired to perform the extra work required for the monthly sampling. The NELHA Analytical Laboratory is not allowed to compete for private sector contracts and is therefore unable to generate the additional revenues needed to cover these substantial costs.

NELHA hopes that these data will serve as an adequate baseline for future monitoring of the environmental impacts of Airport activities. NELHA staff will work with the airport in whatever way possible to ensure the continuation of a monitoring effort adequate to protect the environment we share.

APPENDIX A: SAMPLE PROCEDURES AND OPERATING LOGS FOR AAS

ATOMIC ABSORPTION SPECTROSCOPY

SUBJECT: ANALYZING OF SAMPLES

PRIOR TO RUNNING OF SAMPLES:
Running of 10 LRB replicates to determine SD
Running of 7 replicates of LFM for MDL (fortified LRB like LFE
Running of Std to determine the LDR

TURN ON INSTRUMENT

CLEAN FURNACE AND WINDOWS
NEW TUBE: RUN CONDITIONING PROGRAM (CD TUBE)

RUN AIR BLANK
RUN 2 CAL BLANKS

RUN 5 REPS OF LFB: RSD of areas must be under 5 %
made same as STD with lab reagent water
lab fortified reagent blank (fortified with 3xsd of the area of 10 blanks)

RUN BLANK
RUN CALIBRATION CURVE : check correlation factor, should be at least 0.995

RUN CAL BLANK
RUN QCS: +/- 10 % , should be at the middle point of cal curve

RUN IPC schould be +/- 5 % directly after curve, later on during run +/- 10 %
same concentration as QCS
spiked lab reagent water made just like standards

RUN SAMPLES,
every 10 samples checks as written in Element Parameters / QC
cal blank, IPC
every 10 samples spike one sample with level of LFB, must be +/- 30%
LFB with each batch, made with treated blank (in bottle),
must be between 85 and 115 % recovery
1 LRB (treated, in bottle) every 20 samples

Definitons: LRB Laboratory reagent blank (2 % HNO3)
Cal blank Blank of the Cal curve = first standard (2 % HNO3)
LFB Laboratory fortified blank: fortified so that the absorbance is about 0.1
treated as sample
LFM fortified LRB for Method detection limit
Rinse blank: fo flush analyzer (2 % HNO3)

LFB: Laboratory fortified blank (9.3.2), 1 LFB with each batch of samples,

Accuracy: R = x 100 R = % recovery
s = concentration of analyte added

Concentration : prep: must be 85 - 115 %
Date: conc. measured: %:

IPC: Instrument performance check: (9.3.4.), midpoint of cal curve,
1 IPC sample and 1 Cal blank must be run
a) immediately after calibration (limits +/- 5 %)
Date: Conc. prep: Conc. meas.: %:

b) after every tenth sample (limits +/- 10 %)
Date: Conc. prep: Conc. meas.: %:

c) at the end of run (limits +/- 10 %)
Date: Conc. prep: Conc. meas.: %:

SPIKES: (9.4.), adding of a known amount of each analyte to a minimum of 10% of samples, concentration must be the same as that of the LFB, recovery must be 70 - 130 % (no calculation required if the concentration added is < 25 % of the unfortified sample.)

R = x 100 R = % recovery
Cs = fortified sample concentration
C = sample background concentration
s = concentration equivalent of analyte added to fortigy sample

Date:	Sample:	Conc:	Spike:	R:
Date:	Sample:	Conc:	Spike:	R:
Date:	Sample:	Conc:	Spike:	R:
Date:	Sample:	Conc:	Spike:	R:
Date:	Sample:	Conc:	Spike:	R:

LABORATORY PERFORMANCE: (9.3.3) LFB must be within 85 - 115 %

Date: Value:

Other Checks:

AAS STANDARD PREPARATION LOG

Pb

DATE ANALYST	WORKING STANDARD ID (STOCK, CAL, IPC, QCS) [Pb]	STOCK Maker	Lot #	Exp Date	Prep Date	[Pb]	Volume	DILUENT ID	Prep Date	Total Volume
1/13/98 TD	Stock 1.0 ppm	Fisher	967921-24	12/98	—	1000 ppm	500 µl	2% HNO_3	1/13/98	500 ml
1/15/98 TD	Std 5.0 ppb	TD			1/13/98	1.0 ppm	250 µl	2% HNO_3	1/13/98	50 ml
	Std 10 ppb						500 µl			50 ml
	Std 20 ppb						1000 µl			50 ml
	Std 40 ppb						2000 µl			50 ml
1/16/98 TD	QCS 10 ppb A	Spex QC-21	12-126AS	10/15/98	—	100 ppm	10 µl	2% HNO_3	1/15/98	100 ml
	QCS 1.0 ppm	Spex QC-21	12-126AS		—	100 ppm	1.0 ml			100 ml
	QCS 10 ppb B	TD	12-126AS		1/16/98	1 ppm	1.0 ml			100 ml
1/20/98 TD+AH	IPC 10 ppb	TD	967921-24	12/98	1/13/98	1.0 ppm	500 µl	2% HNO_3	1/16/98	50 ml
	Std 80 ppb						800 µl			10 ml
	Std 160 ppb						1600 µl			10 ml
	Std 100 ppb						3000 µl			30 ml
	Std 120 ppb						1200 µl			10 ml
1/21/98 TD	LFB 0.25 ppb	TD	967921-24	12/98	1/15/98	20 ppb	250 µl	2% HNO_3	1/20/98	20 ml
1/23/98 TD	LFB 0.25 ppb	TD				40 ppb	250 µl			40 ml

AAS STANDARD PREPARATION LOG

Pb

DATE ANALYST	WORKING STANDARD ID (STOCK, CAL, IPC, QCS) [Pb]	STOCK Maker	Lot #	Exp Date	Prep Date	[Pb]	Volume	DILUENT ID	Prep Date	Total Volume
1/27/98 [illegible]	LFB 0.60ppb	[illegible]	976921-24	12/98	1/15/98	40ppb	1.5ml	2% HNO3	1/20/98	100ml
↓	LFB 2.0ppb	[illegible]	↓	↓	1/13/98	1ppm	200µl	↓	↓	100ml
1/28/98 [illegible]	Std 50ppb	[illegible]	976921-24	12/98	1/13/98	1ppm	800µl	2% HNO3	1/20/98	10ml
↓	Std 120ppb	↓	↓	↓	↓	↓	1200µl	↓	↓	10ml
↓	Std 60ppb	↓	↓	↓	↓	↓	600µl	↓	↓	10ml
↓	Std 5ppb	↓	↓	↓	↓	↓	500µl	↓	↓	100ml
↓	Std 10ppb	↓	↓	↓	↓	↓	500µl	↓	↓	50ml
↓	Std 20ppb	↓	↓	↓	↓	↓	1000µl	↓	↓	50ml
2/26/98 [illegible]	STD 2ppb	[illegible]	976921-24	12/98	1/13/98	1ppm	200µl	2% HNO3	2/26/98	100ml
↓	STD 5ppb	↓	↓	↓	↓	↓	200µl	↓	↓	40ml
↓	Std 10ppb	↓	↓	↓	↓	↓	500µl	↓	↓	50ml
↓	Std 20ppb	↓	↓	↓	↓	↓	500µl	↓	↓	25ml
↓	IPC 10ppb	↓	↓	↓	↓	↓	500µl	↓	↓	50ml

AAS REAGENT PREPARATION LOG

Pb

DATE ANALYST	REAGENT ID CONCENTRATION	MOLECULAR FORMULA	REAGENT STOCK Concentration	Volume	Maker	Lot #	Exp Date	DILUENT ID	Prep Date	Total Volume
1/13/98 D	2%	HNO_3	69.71%	10ml	Fisher Optima	127040	—	ddi	—	500ml
↓	matrix modifier (mm) Pd + Mg	$Pd(NO_3)_2$ $Mg(NO_3)_2$	10,000ppm 10,000ppm	3.0ml 300ul	Perkin Elmer	B783989 P/T #70191	—	ddi	—	30ml
1/15/98 D	2%	HNO_3	69.71%	10ml	Fisher Optima	127040	—	ddi	-	500ml
1/16/98 D	2%	HNO_3	69.71%	10ml	Fisher Optima	127040	-	ddi	-	500ml
1/20/98 D	2%	HNO_3	69.71%	10ml	Fisher Optima	127040	-	ddi	-	500ml
1/27/98 D	mm Pd+ Mg	$Pd(NO_3)_2$ $Mg(NO_3)_2$	10,000ppm 10,000ppm	3.0ml 300ul	Perkin Elmer	B783989 P/T70191	-	ddi	-	30ml
1/28/98 D	2%	HNO_3	69.71%	10ml	Fisher Optima	127040	-	ddi	-	500ml
↓	Rinse Container Refill 2%	HNO_3	↓	40ml	↓	↓	-	ddi	-	2L
1/30/98 D	mm. $NH_4H_2PO_4$/Mg	$NH_4H_2PO_4$ $Mg(NO_3)_2$	10% 10,000ppm	2.0ml 1.0ml	Perkin Elmer	732918 P/T #70191	—	2% HNO_3	1/28/98	100ml
2/25/98 D	m.m. Pd + Mg	$Pd(NO_3)_2$ $Mg(NO_3)_2$	10,000ppm 10,000ppm	6.0ml 600ul	Perkin Elmer	B783989 P/T #70191	—	ddi	-	60ml
2/26/98 D	2%	HNO_3	69.71%	10ml	Fisher Optima	127040	—	ddi	-	500ml
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

AAS SPIKE AND RECOVERY LOG

Pb

DATE ANALYST	SPIKE ID	SPIKE Prep Date	SPIKE [Pb]	SPIKE Volume	SAMPLE ID	SAMPLE Date	SAMPLE [Pb]	SAMPLE Volume	EXPECTED [Pb]	MEASURED [Pb]	RECOVERY (%)
2/21/98 [illegible]	STOCK	1/13/98	10 ppm	500 µl	W13B	8/11/97	0.17 ppb	5 ml	10.17 ppb	10.48 ppb	103%
↓	↓	↓	↓	↓	W13B	2/4/98	-0.24 ppb	↓	10.0 ppb	10.10 ppb	101%
↓	↓	↓	↓	↓	W11C	8/11/97	0.00 ppb	↓	10.0 ppb	10.50 ppb	105%
↓	↓	↓	↓	↓	W14C	2/11/98	-0.17 ppb	↓	10.0 ppb	10.17 ppb	102%
↓	↓	↓	↓	↓	LRB	8/14/97	-0.04	↓	10.0 ppb	10.34 ppb	103%

APPENDIX B: USEPA WP039 PERFORMANCE EVALUATION REPORT

Performance Evaluation Report
USEPA Water Pollution Study WP039

Report: PS00
Page: 1
Date: 12MAY92

Participant ID: HI00012 Type: STATE Requesting Office: HI

	Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
NUTRIENTS IN MILLIGRAMS/LITER						
031-AMMONIA-NITROGEN						
	01	0.868	0.840	0.594- 1.13	0.658- 1.07	Accept.
032-NITRATE-NITROGEN						
	01	1.118	1.10	0.868- 1.31	0.921- 1.26	Accept.
033-ORTHOPHOSPHATE						
	01	0.240	0.250	0.203-0.296	0.214-0.285	Accept.
034-KJELDAHL-NITROGEN						
	02	0.346	0.360	D.L. -0.907	0.0785-0.794	Accept.
035-TOTAL PHOSPHORUS						
	02	0.201	0.170	0.15-0.252	0.162- 0.24	Accept.
DEMANDS IN MILLIGRAMS/LITER						
037-TOC						
	01	73.7	76.0	63.6- 86.4	66.6- 83.4	Accept.
MISCELLANEOUS ANALYTES						
019-PH-UNITS						
	01	5.028	5.03	4.93- 5.14	4.95- 5.12	Accept.

********** END OF DATA FOR HI00012 **********
NOTE: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR HI00012 **********

* Based on gravimetric calculations, or a reference value when necessary.

APPENDIX C: MIDWATER BIOTA MONITORING REPORTS

Note: This appendix contains portions dealing with the Ho`ona Bay transect excerpted from Dr. Richard Brock's monitoring reports for December 1997 and June 1998. The complete reports containing data from five other transects are on file and available for review at NELHA.

COOPERATIVE ENVIRONMENTAL MONITORING

PROGRAM FOR THE

NATURAL ENERGY LABORATORY OF HAWAII AUTHORITY

SURVEY FOR ANCHIALINE AND MARINE FISH RESOURCES

7 JUNE 1998 SURVEY

and

6 DECEMBER 1997 SURVEY

Prepared For:

The Natural Energy Laboratory of Hawaii Authority
P.O. Box 1749
Kailua-Kona, Hawaii 96740

By:

Richard E. Brock, Ph.D.
Environmental Assessment Co.
1820 Kihi Street
Honolulu, Hawaii 96821

August 1998
EAC Report No. 98-04

EXECUTIVE SUMMARY

The Cooperative Environmental Monitoring program for the NELHA facility has monitored anchialine and marine fish resources since October 1991. This program has been carried out by Environmental Assessment Co. up through late 1995. At that time, the monitoring program was assigned to OI Consultants, Inc. with whom it remained until late 1997 at which time we again undertook the program. This report summarizes the second of our monitoring efforts since the program was reassigned. Under our program surveys have been carried out on thirteen occasions: in October 1991, March, May and October 1992, May and December 1993, May, June and October 1994, March and June 1995 and again in December 1997 and June 1998. This report summarizes the June 1998 findings. In total there are fourteen identified anchialine pools on the project site: five of these are located north of the NELHA compound and nine in the southern part of the project site. One of these nine pools was first recorded in the October 1992 survey and is the result of the extreme high tide at that time. The southern complex of anchialine pools are inhabited by native species. These pools have shown no statistically significant changes in the abundance of the native biota over the period of this study. The northern complex of five pools was colonized by exotic fishes (topminnows) which spread since October 1991 and had colonized all pools by May 1992. The exotic fishes effectively preclude many of the important native aquatic species. On 4 May 1992 the exotic fishes were removed from these pools using an ichthyocide. Native species (shrimp) returned to four of the five pools; one pool remained with exotic fishes through the October 1992 survey. By May 1993, these exotic fishes had once again recolonized all of the pools in the northern complex, thus effectively driving the native shrimp from the lighted portion of the system. This situation remains unchanged in the most recent survey.

The Cooperative Environmental Monitoring program has routinely surveyed the status of the marine fish resources at three locations offshore of NELHA project area since October 1991. These sites are offshore of Wawaloli Beach, the 18-inch pipeline and Ho'ona Bay. In the May 1992 survey we added transects to three additional permanently marked sites for routine sampling to bring the total number of sites up to six. The sites now routinely sampled are (from south to north): Wawaloli Beach, the 18-inch pipeline, the 12-inch warmwater pipe, the 12-inch coldwater pipe, the Net Power Production Experiment site (or NPPE) and Ho'ona Bay. Three zones or biotopes are sampled at each of the six sites resulting in the routine sampling of 18 transects. The sampled zones are depth related with the biotope of boulders and *Pocillopora meandrina* being the shallowest and located adjacent to shore, the mid-depth zone or biotope of *Porites lobata* and the deeper more offshore biotope of *Porites compressa*. A statistical comparison of all data spanning the entire period has shown that the December 1997 survey had a statistically greater mean number of individual fish censused on a transect over many previous surveys and similarly, the mean estimated standing crop was significantly higher in the December 1997 survey over all others. Further analysis showed that these significant changes only occurred in the zone located adjacent to shore, the boulder/ *Pocillopora* biotope and were due to encounters with schools of adult ringtail surgeonfish or pualo (*Acanthurus blochii*) which were very common at shallow and mid-depth stations. It is surmised that these fishes were naturally aggregated for the purpose of reproduction. Other than these changes due to natural causes, the analysis of the fish communities in the waters fronting Keahole Point over this 79-month period of study show that the development at NELHA has had no significant impact to these communities.

COOPERATIVE ENVIRONMENTAL MONITORING PROGRAM

FOR

HAWAII OCEAN SCIENCE AND TECHNOLOGY PARK

AND THE

NATURAL ENERGY LABORATORY OF HAWAII AUTHORITY

6 DECEMBER 1997 and 7 JUNE 1998 SURVEYS

INTRODUCTION

Both the Hawaii Ocean Science and Technology Park (HOST Park) and the Natural Energy Laboratory of Hawaii Authority (NELHA) are situated at Keahole Point, North Kona, Hawaii. These two State of Hawaii facilities are linked in a number of ways: they will share critical infrastructure for the delivery and disposal of seawater; the impact of their operations on the environment will be similar and affect the same ecosystems and they share certain environmental permits. These common elements have allowed the development of a combined program to monitor the environmental effects of operations at the two facilities.

The Cooperative Environmental Monitoring Program has two broad objectives: (1) to protect the unique environmental resources of the Keahole Point area and their diverse uses, and (2) to provide the information necessary to comply with the permit requirements of the various County, State and Federal agencies.

Both HOST Park and NELHA will in the future be using and disposing of large quantities of warm and cold seawater brought on-site and distributed through a network of pipes. At the present time, disposal of water from these facilities has been into trenches dug into the lava at some distance inland from the shore. The potential impacts of this and other disposal options (i.e., injection wells, deep ocean outfall, direct discharge) were described and compared in the Environmental Impact Statements for the respective facility (HTDC 1985; NELH 1987). The latter document suggested a monitoring program and GK and Associates (1989) presented the details for such a program. The first phase of the biological monitoring program establishing a preliminary baseline was carried out by Brock (1989).

In the Cooperative Environmental Monitoring Program are four steps to meeting the objective of protecting the environmental resources of Keahole Point. These steps are:

1. To collect field data in the monitoring program utilizing methods identical and complementary to those used in the baseline and subsequent surveys to allow comparative analysis;

2. To undertake comparative analysis of data from the monitoring program with those of the baseline and previous surveys to detect change;

3. To work with NELHA personnel and the water quality monitoring program to trace the cause of any unacceptable change to its source;

4. To provide facilities management with suggested options for corrective measures.

Since the completion of the preliminary baseline in December 1989 (Brock 1989), several changes were instituted in the monitoring program. The first change was to divide the sampling effort between two parties and to redefine some of the stations. Secondly, in late 1995, the monitoring program was assigned to OI Consultants, Inc. with wnom it remained until late 1997. Under the OI Consultants, Inc. program, some of the sampling methodologies were different making much of the data collected in this period difficult to analyze with respect to earlier and our subsequent recent surveys. This document comparatively analyses data collected from the surveys conducted prior to the OI Consultants 1995-97 work to that collected in the most recent survey efforts carried out in December 1997 and June 1998. Specifically it covers the status of (1) the marine fish communities at a series of eighteen permanently marked stations and (2) the aquatic fauna of the anchialine pools present on the NELHA project site. Marine benthic communities are covered by Dollar (in prep.). Data on the status of the anchialine resources is presented first followed by information on the nearshore fish communities resident to the waters fronting the NELHA project site.

MARINE BIOTA

A. Introduction

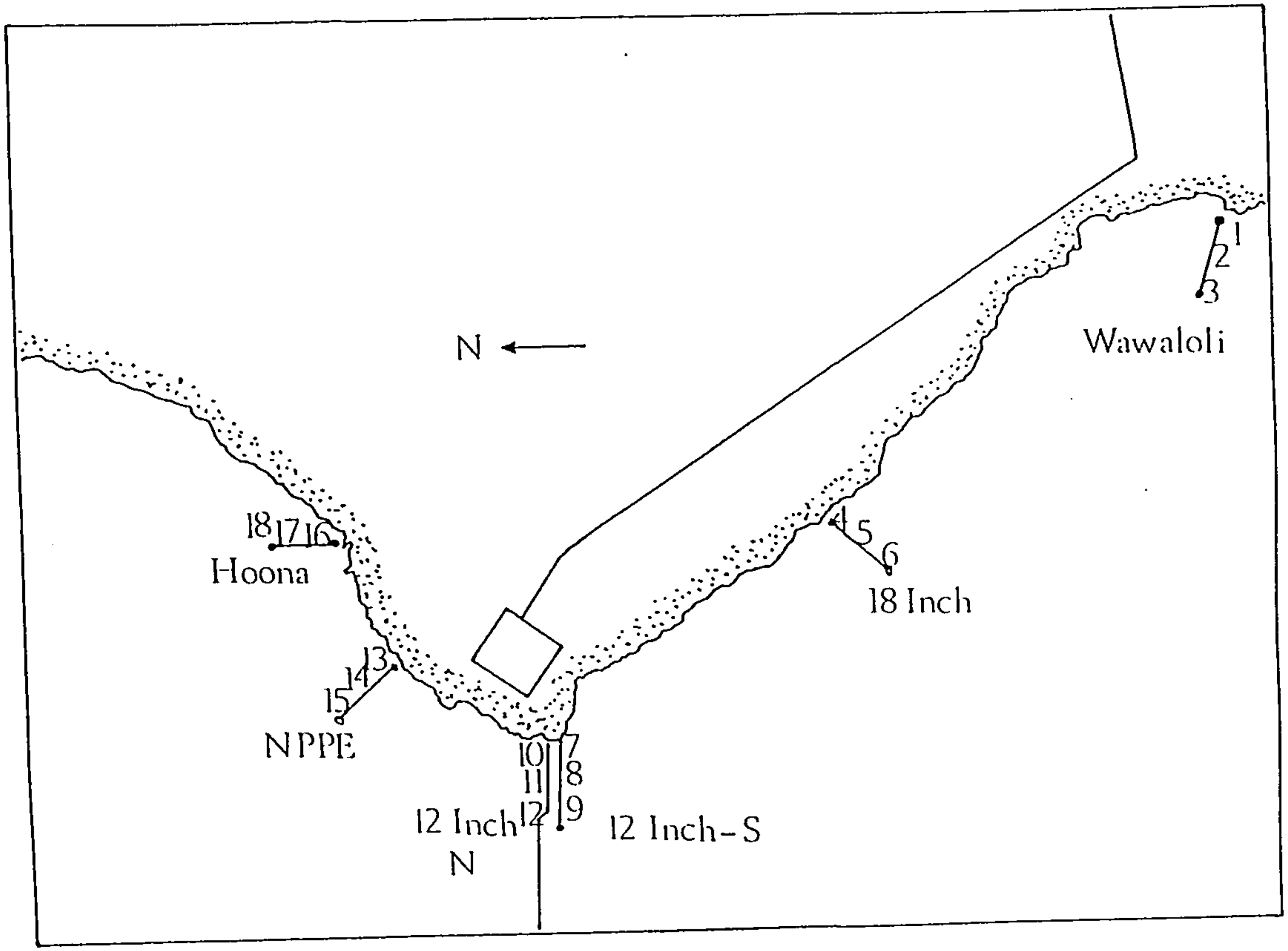
The nearshore marine communities in the vicinity of Keahole Point have, for years been recognized as some of the most biologically diverse in Hawaiian waters. In his pioneering survey work of Hawaiian fish communities, Brock (1954) noted that the fish communities of the Keahole Point area were amongst the most specious and had the greatest standing crops of any in the islands; more recent workers (Brock and Norris 1987a, 1987b, 1988; Brock and Kam 1989) have found similar results. Because of this diversity and the need to preserve the quality of nearshore waters, a comprehensive program of monitoring both water quality and the "health" of nearshore marine communities was identified as a central component of the cooperative environmental program at NELHA.

Important objectives of the marine study are to determine the baseline conditions of the nearshore communities and to quantitatively ascertain any impacts that might occur due to the discharge of cold/aquacultural water effluents into the watertable beneath adjacent on-land lava fields. Thus the ability to repeatedly sample the same communities through time is a prerequisite. Presumably impacts from this discharge to nearshore communities will come in the form of alterations in the quality of the groundwater entering the sea. If this is correct, one might expect to measure a gradient of impacts from greatest at the point of discharge dissipating with increasing distance from the source. Stations to monitor water quality, benthos and fish communities have been situated so as to capitalize on any existing gradients.

B. Methods

GK and Associates (1989) identified two areas fronting the NELHA project site that showed depressions in salinity, i.e., having groundwater input. These areas are directly fronting the northern complex of anchialine pools at Ho'ona Bay as well as to the south fronting Wawaloli Beach next to the southern boundary of the project site. These two locations served to pinpoint the locations of stations for preliminary baseline studies. An initial control site was selected in the vicinity of Honokohau Harbor and was sampled in 1989 and the first quarterly survey (Brock 1989, 1991) but has been subsequently dropped. A fourth site, the 18-inch pipe station was added to the program and first sampled in October 1991; it has been resampled in all subsequent surveys. The 18-inch pipe is located about midway along the coast of the project area between Wawaloli Beach and Keahole Point. In the May 1992 three more areas were identified, permanently marked and sampled. These sites are the 12-inch warmwater pipe (here the "12-Inch South" site) and 12-inch coldwater pipe (here the "12-Inch North" site) at Keahole Point fronting the main NELHA facility. The final routine sampling site first survey in May 1992 is directly offshore of the NPPE (Net Power Producing Experiment) located just north of the NELHA compound (see Figure 3).

FIGURE 3. Outline map depicting the approximate locations of the six study sites for marine fish community monitoring. These sites from south to north are: Wawaloli Beach, 18-inch pipeline, 12-inch warmwater pipe, 12-inch coldwater pipe, Net Power Production Experiment site (or NPPE) and Ho'ona Bay. Three transects sampling the three zones or biotopes (biotope of boulders and *Pocillopora meandrina*, biotope of *Porites lobata* and the biotope of *Porites compressa*) have been established at each of the six sites, thus 18 transects comprise the monitoring effort. Map redrawn from NELHA.



N
1
2
3
Wawaloli
4
5
6
18 Inch
18
17
16
Hoona
13
14
15
NPPE
10
11
12
12 Inch
N
7
8
9
12 Inch-S

Quantitative studies were carried out in the communities adjacent to the shore; the rationale was that it will be those communities in closest proximity to any nonpoint discharge of effluents that would be first impacted and thus the first in which change could be measured.

In the initial baseline, fish and benthic communities were sampled; four stations were established offshore of Ho'ona Bay, four stations fronting Wawaloli Beach and four stations offshore of Honokohau Harbor to serve as the control site. The October 1991 study established three transects at each location (Ho'ona Bay, 18-inch pipe, Wawaloli Beach and Honokohau) that sampled the boulder/*Pocillopora meandrina* zone (shallowest depths), the *Porites lobata* zone (in intermediate depths) and the *Porites compressa* zone (deepest depths) that are common major biotopes on the West Hawaii coast. The March 1992 survey sampled transects offshore of Wawaloli Beach, the 18-inch pipe and Ho'ona Bay and focused only on the fish communities at these locations. Additional studies were done along the 40-inch pipe path during the March 1992 survey and are summarized in a companion report. Since May 1992 the surveys reported on here have focused on fish community structure in the three zones at all six sites (Wawaloli Beach, the 18-Inch Pipe, the 12-Inch South Pipe, the 12-Inch North Pipe, the NPPE site and Ho'ona Bay).

Permanent stations have been established in each biotope or zone at each location. These stations are marked by small subsurface floats that pinpoint the transect line. Fish communities were sampled using visual assessment techniques modified from Brock (1954). Immediately following station location, the visual fish census was undertaken to estimate the abundance and biomass of fishes. Data collected included species and numbers of individuals. The fish censuses were conducted over the entire length of the 25m transect line which was paid out as the census progressed as not to frighten wary fishes. All fishes within the 4 x 25m transect area to the water's surface were counted. A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and note all fishes in the prescribed area. All quantitative studies were carried out using SCUBA.

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (Family Muraenidae) and nocturnal species, e.g., squirrelfishes (Family Holocentridae), aweoweos (Family Priancanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus, Family Scorpaenidae; the flatfishes, Family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous (e.g., opelu, Family Carangidae) may be difficult to count. Problems may arise with the bias related to the experience of the diver conducting counts when attempting to make comparisons between surveys. In spite of the above drawbacks, the visual census technique probably provides the most accurate non-destructive assessment of diurnally active fishes presently available (Brock 1982).

Data were subjected to simple nonparametric statistical procedures provided in the SAS Institute statistical package (SAS Institute Inc. 1985) Nonparametric methods were used to avoid meeting requirements of normal distribution and homogeneity of variance in the data. Data were analyzed using the Kruskal-Wallis one-way analysis of variance (ANOVA) to discern significant differences among ranked means for each measured parameter in the fish community, sample date and habitat type; this procedure is outlined by Siegel (1956) and Sokal and Rohlf (1981). The *a posteriori* Student-Newman-Keuls multiple range test (or SNK Test; SAS Institute Inc. 1985) was also used to eludicate between which dates significant differences occurred.

C. Results

Communities in closest proximity to any nonpoint source of pollution entering the sea via the groundwater would be the first to manifest problems thus we established quantitative stations to sample the fish and benthos in the boulder/*Pocillopora meandrina* zone, the *Porites lobata* zone and the *Porites compressa* zone. All of these biotopes or zones are in very close proximity of the shoreline in the Keahole Point area. The results are discussed by transect commencing with the south end of the NELHA project area.

In the earlier studies, two shoreline areas appeared to have lower salinities; these were at Wawaloli Beach on the south and Ho'ona Bay on the north. Lower salinity water was not as evident elsewhere. These low salinity sites are candidate locations where wastewater from aquaculture or OTEC studies discharged back inland in the watertable may enter the ocean. If the discharged water is to have an impact on the benthic and fish communities, the impacts would probably first become evident at locations in close proximity to the discharge.

Transect T-16 was established about 10m offshore of the pahoehoe bench in water from 2.5 to 3m in depth in the biotope of boulders and *Pocillopora meandrina*. The substratum at this station is comprised of pahoehoe overlain by basalt boulders ranging in size from 0.5 to 3m; much of the bottom is strewn with boulders providing considerable local cover. A complete listing of all fishes censused at this station is given in Appendix A.

In total 26 species of fishes (237 individuals) were censused. The most abundant species on T-16 were the yellowfin goatfish or weke'ula (*Mulloides vanicolensis*), the damselfish (*Chromis vanderbilti*), the whitebar surgeonfish or maiko'iko (*Acanthurus leucoparieus*), the ma'i'i'i (*Acanthurus nigrofuscus*), kole (*Ctenochaetus strigosus)* and the lau'ipala (*Zebrasoma flavescens*). The estimated biomass of fishes at Station T-16 was 129 g/m^2; the species contributing most heavily to this biomass include the weke'ula (*Mulloides vanicolensis*) making up 24% of the total, the maiko'iko (*Acanthurus leucoparieus*) comprising 19% of the total and the umaumalei (*Naso lituratus*) contributing 13% of the biomass at this station.

Station T-17 is situated about 45m from the shoreline at Ho'ona Bay in 7.9m of water. This station sampled the biotope of *Porites lobata*. The substratum at this station is comprised of boulders and *Porites lobata* as the dominant coral. Boulders at this site range in size from 0.5 to about 2m. Again, the census results are presented in Appendix A; 27 species (418 individuals) were censused. The most abundant fish species at Station T-17 were the damselfishes (*Chromis vanderbilti* and *C. agilis*), ma'i'i'i (*Acanthurus nigrofuscus*) and the kole (*Ctenochaetus strigosus*). The standing crop of fish at this station was estimated to be 85 g/m^2 and both the uhu (*Scarus sordidus*) and kole (*Ctenochaetus strigosus*) made up 19% of the biomass, the ma'i'i'i (*Acanthurus nigrofuscus*) provided 15% of the standing crop and the umaumalei (*Naso lituratus*) contributed 27% of the biomass present at this station.

Transect T-18 sampled the fish community of the *Porites compressa* zone about 20m seaward of Transect T-17. The substratum at this site is comprised of boulders, coral rubble and coral (*Porites compressa*) on a steep seaward facing slope. Twenty-five fish species (364 individuals) were encountered in the census of T-18; biomass was estimated to be approximately 79 g/m^2. The most abundant fishes at this station were the damselfish (*Chromis agilis*), the soldierfish or menpachi (*Myripristes kuntee*), the kole (*Ctenochaetus strigosus*) and the ma'i'i'i (*Acanthurus nigrofuscus*). The most important species contributing to the biomass of fishes at this site were the kole (*Ctenochaetus strigosus*) making up 13% of the total, the menpachi (*Myripristes kuntee*) contributing 38%, and the uhu (*Scarus sordidus*) comprising 12% of the total estimated weight at this station.

Table 5 presents a summary of the major parameters measured in the fish communities at each station for the May 1989, October 1991, March, May, October 1992, May, December 1993, May, June, October 1994, March 1995, December 1997 and June 1998 surveys. Table 6 summarizes the results of the statistical analysis comparing the grand means for the number of species, number of individuals and estimated biomass by date combining data for all stations.

The Kruskal-Wallis ANOVA pointed out a statistically significant difference among the various sample dates for the mean number of individual fish censused ($n=13$, $P>0.0003$, significant). The SNK Test noted that these differences were with sample dates with the greatest and least mean numbers of fish censused; June 1995 (477 individuals) and December 1997 (474 individuals) had significantly greater numbers of fish counted than did May 1993 (295 individuals), March 1995 (279 individuals) or June 1998 (305 individuals). Despite no significant differences using the Kruskal-Wallis ANOVA analyzing the mean number of species censused or biomass estimated on a given date, the SNK Test noted that the single highest mean number of species (October 1991 - 32 species) was statistically separable from the lowest mean (March 1995 - 25 species). Similarly, the SNK Test pointed out that the single greatest mean biomass (December 1997 - 408 g/m^2) is statistically greater than the standing crops from other dates.

Table 7 presents a summary of the statistical analysis of the variables (mean number of species, individuals and biomass) by sampling date and habitat type (boulder/*Pocillopora* zone, mid-depth *Porites lobata* zone and the deeper *Porites compressa* zone. No statistically significant differences were noted with the Kruskal-Wallis ANOVA for any variable, date or habitat zone. However, the SNK Test pointed out some significant differences in the boulder/*Pocillopora* zone. The mean number of individual fish on a census was significantly greater in the (December 1997 - 522 individuals) survey from the March 1992 survey (247 individuals) and the biomass in the boulder/*Pocillopora* zone for the December 1997 survey (656 g/m^2) was significantly greater than the mean biomass for all other sample dates (range 150 to 354 g/m^2).

Impacts to aquatic communities due to coastal development are frequently mediated through changes in water quality. These impacts are usually cumulative and most apparent in communities in closer proximity to the source(s) of the perturbation than in similar communities located further away. Because of their cumulative nature, evidence of impacts in aquatic communities becomes more obvious with the passage of time and are usually equated with decreases in the number of species, abundance of individuals, standing crop or changes in trophic structure (the latter parameter not measured in this study). In summary, the statistical analyses suggest no cumulative or progressive impacts which would be manifested by change through time, rather, the analysis has shown that the mean number of individual fish and the mean estimated standing crop of fish is greater in the December 1997 survey over previous surveys. Furthermore, these changes have occurred in the boulder/*Pocillopora* zone which is the habitat closest to shore and presumably closest to any impact due to the development at NELHA.

Thus despite the imposition of Hurricane Iniki on benthic communities in September 1992 and continuing development at NELHA, the fish communities at Keahole Point appear not to have been significantly impacted by either the storm or ongoing development coastal development based on data collected over the 79-month duration of this study.

TABLE 5. Continued.

Location	December 97 No. Spp.	December 97 No. Ind.	December 97 Biomass (g/m^2)	June 98 No. Spp.	June 98 No. Ind.	June 98 Biomass (g/m^2)
Wawaloli Beach						
Boulder	27	371	280	18	223	144
P. lobata	29	636	891	23	177	76
P. compressa	29	510	190	18	143	78
18-Inch Pipe						
Boulder	26	471	518	36	453	307
P. lobata	32	598	319	36	400	308
P. compressa	38	465	430	20	533	37
12-Inch South						
Boulder	33	678	385	29	289	177
P. lobata	29	535	211	27	302	312
P. compressa	20	157	77	33	381	331
12-Inch North						
Boulder	33	523	1637	27	231	178
P. lobata	21	364	123	29	260	114
P. compressa	34	790	183	30	300	200
NPPE Site						
Boulder	32	834	912	30	308	195
P. lobata	30	467	143	23	305	93
P. compressa	26	346	631	22	170	47
Ho'ona Bay						
Boulder	22	252	201	26	237	129
P. lobata	24	269	82	27	418	85
P. compressa	26	261	132	25	364	79

TABLE 6. Summary of the significant changes that have occurred in the fish communities at NELHA as measured by the number of species, number of individuals and biomass by date. Data were analyzed by use of non-parametric mentods: the Kruskal-Wallis ANOVA was used to discern statistically significant differences among ranked means for each variable and date and the Student-Newman-Keuls Test separated the significant dates from one another. Where significant differences exist, means are given.

DATE

Variable	Kruskal-Wallis Test P-Value	Kruskal-Wallis Test Significant?	SNK Test Significant?	SNK Test If so, What?
No. Species	P>0.07	No	YES	Only the two extremes Oct 91 (32spp) from Mar 95 (25spp)
No. Individuals	P>0.0003	YES	YES	Jun 95 (477ind) & Dec 97 (474ind) From June 98 (305 ind), May 93 (295ind) & Mar 95 (279ind)
Biomass	P>0.07	No	YES	Dec 97 (408g/m^2) from other dates Range 139 to 313g/m^2

TABLE 7. Summary of the significant changes that have occurred in the fish communities at NELHA as measured by the number of species, number of individuals and biomass in each of three habitat types: the shallow boulder/*Pocillopora* zone, the mid-depth *Porites lobata* zone, and the deeper *Porites compressa* zone. Data were analyzed by use of non-parametric mentods: the Kruskal-Wallis ANOVA was used to discern statistically significant differences among ranked means for each variable and date and the Student-Newman-Keuls Test separated the significant dates from one another. Where significant differences exist, means are given.

Boulder Zone

Variable	Kruskal-Wallis Test P-Value	Kruskal-Wallis Test Significant?	SNK Test Significant?	SNK Test If so, What?
No. Species	P>0.88	No	No	
No. Individuals	P>0.18	No	YES	Two extremes only Dec97 (522ind) from Mar92 (247ind)
Biomass	P>0.15	No	YES	Dec 97 (656g/m^2) from all other dates

Porites lobata Zone

Variable	Kruskal-Wallis Test P-Value	Kruskal-Wallis Test Significant?	SNK Test Significant?	SNK Test If so, What?
No. Species	P>0.55	No	No	
No. Individuals	P>0.07	No	No	
Biomass	P>0.71	No	No	

Porites compressa Zone

Variable	Kruskal-Wallis Test P-Value	Kruskal-Wallis Test Significant?	SNK Test Significant?	SNK Test If so, What?
No. Species	P>0.51	No	No	
No. Individuals	P>0.36	No	No	
Biomass	P>0.65	No	No	

D. Discussion

On September 11, 1992 the Hawaiian Islands were struck by Hurricane Iniki. The hurricane passed directly over Kauai and considerable damage occurred to improvements and forests of that island and the west (leeward) coast of Oahu. To a lesser extent, high surf caused damage in Kailua-Kona. Marine communities along south, east and west shores were also impacted around Oahu, Kauai, Maui, Lanai and Hawaii; this damage was primarily to coral communities. In many areas a large amount of sand and other loose material was avected out of shallow areas (depths less than 27m) into deeper water. On Oahu, storm waves emanating from the southeast were estimated to exceed 6 to 7m in height and were breaking in water of depths of at least 20m (personal observations). Damage to corals was evident during the October 1992 survey particularly in those communities south of Keahole Point but was not as severe as seen around Oahu.

Despite changes in the coral communities due to the hurricane, the measures of fish communities used in this study showed little change. This may be due to the period of time that elapsed since the storm to the October 1992 survey (50 days). Walsh (1983) did note changes in fish communities directly after a major storm event; these changes included the movement of fishes away from shallow areas, obvious abrasions and wounds on the bodies of some fishes and a general disorientation of the fishes to the substratum. Besides the obvious damage to corals, we only observed a small number of fishes with wounds that for the most part appeared to be healed. As noted above, the measures used in this study of the fish communities offshore of the NELHA did not detect any significant change to these communities suggesting that the damage that Hurricane Iniki may have inflicted to Keahole Point fish communities was transitory.

As noted above, there are several biological zones or biotopes characteristic of the Kona coast (Dollar 1975, Hobson 1974) whose presence in the Keahole area has been well documented (see Brock and Norris 1987a, 1987b, 1988; Brock and Kam 1989). The geologically young age of the Keahole Point region and its exposure to periodic high energy conditions dictates that the development of benthic communities (here primarily coral) are in an early stage of succession. Thus in mature coral reefs, the reef corals grow on a limestone or calcareous base developed over a considerable period of time; in the case of the reefs at Keahole Point and much of West Hawaii, they are young and the corals are growing on a basalt substratum. Typically, three zones are found in West Hawaii benthic communities that are defined by depth, physical conditions and dominant coral species. In the shallowest water (usually to about 30m offshore) is the *boulder/Pocillopora meandrina* zone; seaward is the *Porites lobata* reef bench zone that grades into the *Porites compressa* slope zone usually commencing at a depth of about 10m. The *P. compressa* slope zone continues deeper to depths of 30m or more.

The fish communities quantitatively assessed in this study at the six station sites (i.e., Wawaloli Beach, the 18-inch pipe, the 12-inch south pipe, the 12-inch north pipe, the area fronting NPPE and offshore of Ho'ona Bay) are quite similar. At each location one station each sampled the biotope of boulders and *Pocillopora meandrina*, the biotope of *Porites lobata* and the *Porites compressa* zone further offshore. These biotopes are near continuous features along much of the West Hawaii coast and are the zones usually closest to shore hence would be most susceptible to impact from human generated effluents discharged with groundwater.

Studies conducted on coral reefs in Hawaii and elsewhere have estimated fish standing crops to range from 20 to 200 g/m² (Brock 1954, Brock *et al.* 1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, the variation in standing crop appears to be related to the variation in local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e g., sand flats) usually result in a lower estimated standing crop of fish (5 to 20 g/m²). Goldman and Talbot (1975) noted that the upper limit to fish biomass on coral reefs is about 200 g/m². Ongoing studies (Brock and Norris 1989) suggest that with the manipulation (increasing) of habitat space or food resources (Brock 1987), local fish standing crops may approach 2000 g/m². Thus under certain circumstances, coral reefs may be able to support much larger standing crops of fishes than previously realized.

The high standing crops encountered in this study are probably related to the steep and rugged topographical relief found at most of the transect sites for most of the sampling periods (however, see below). The presence of adequate shelter coupled with strong tidal currents which transport particulate food materials may serve to sustain unusually high standing crops of fishes at specific sites.

The December 1997 survey provided some unusual results. One species, the ringtail surgeonfish or pualo (*Acanthurus blochii*) was abundant at 11 of the 18 stations occurring in schools of primarily adults. These schools were present at all shallow and mid-depth stations except for Wawaloli Beach (southern extreme of the study area) and absent at the mid and deep stations fronting Ho'ona Bay as well as at most other deep stations. These aggregated pualo contributed an average of 10% to the numbers of fish counted and 45% of the biomass. The extreme was encountered in the shallow boulder/*Pocillopora meandrina* zone at the 18-Inch Pipe (T-4 in Appendix A) where 171 pualo contributed an estimated 1,431 g/m² to the census. The widespread aggregation of *A. blochii* has not been previously encountered at Keahole Point in this study (although seen elsewhere in the Hawaiian Islands) and these fish were probably aggregated for reproductive purposes. The encounter of these aggregations in the December 1997 survey resulted in the statistically significant separation of December 1997 from most other surveys due to the high number of individual fishes and estimated standing crops censused primarily in the shallow boulder/*Pocillopora* zone.

In conclusion, this study spans a period from May 1989 to present. The data from October 1991 to present were collected from the same locations and are directly comparable. Utilizing these data, two significant changes occurred which separated the December 1997 survey from the others where the mean number of individual fish censused at a station as well as the mean estimated standing crop is significantly greater over many of the previous surveys. Further analysis shows that these significant changes have only occurred in the biotope or zone closest to shore, the boulder/*Pocillopora* zone. These changes are due to the encounter with schools of adult ringtail surgeonfish or pualo (*Acanthurus blochii*) which were very common at most of the shallow (boulder/*Pocillopora* zone) and mid-depth (*Porites lobata* zone) stations. It is surmised that these fishes were naturally aggregated for the purpose of reproduction. Other than these changes, the analysis of the fish community structure in the waters fronting Keahole Point over the period of this 79-month study do not support the contention that the development at NELHA has had a significant negative impact on the fish communities.

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APPENDIX A. Results of the quantitative visual censuses for fishes conducted at eighteen stations, three established at Wawaloli Beach [T-1 -T-3], the 18-inch pipe [T-4 - T-6], the 12-inch warmwater pipe [T-7 - T-9], the 12-inch coldwater pipe [T-10 - T-12], the NPPE site [T-13 - T-15] and Hoona Bay [T-16 - T-18] at NELHA, Keahole Point, Hawaii on 6 December 1997. Each entry in the body of the table represents the total number of individuals of each species observed during each census. Census totals and biomass estimates are given at the foot of the table.

	Wawaloli			18-Inch			12-Inch South			12-Inch North			NPPE SITE			HOONA BAY		
SPECIES	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8	T-9	T-10	T-11	T-12	T-13	T-14	T-15	T-16	T-17	T-18
MURAENIDAE																		
Gymnothorax meleagris				1										1				
HOLOCENTRIDAE																		
Adioryx spinifer								1	1									1
Myripristis amaenus											7			1				27
AULOSTOMIDAE																		
Aulostomus chinensis							1				1		1					
FISTULARIIDAE																		
Fistularia commersoni						1												
SERRANIDAE																		
Cephalopholis argus				1		1	1				2			1	1	1	1	
CARANGIDAE																		
Decapterus macarellus							2	200								12		
Caranx melampygus				2			1			2								
LUTJANIDAE																		
Lutjanus kasmira																4		
Aphareus furcatus				4	1	1			10			30	1	1	1		2	
SPARIDAE																		
Monotaxis grandoculis																1		
MULLIDAE																		
Mulloides flavolineatus					1					1								
Mulloides vanicolensis													2	2				
Parupeneus multifasciatus	1	1	2	2		11		1	5		1	1	1			1	5	
Parupeneus bifasciatus				3			2		1	2	7	3	2	1		1	1	
KYPHOSIDAE																		
Kyphosus bigibbus										1			5					
CHAETODONTIDAE																		
Forcipiger flavissimus			2	4		3	2	1	1	1	2	1			2	1	1	
Forcipiger longirostris													2					
Heniochus diphreutes							150				58							
Hemitaurichthys thompsoni								3	17	10	75							
Hemitaurichthys polylepis													1					
Chaetodon fremblii										1								
Chaetodon lunula				3										2		2		1
Chaetodon ornatissimus				4	2	2		1	4		2	2		2	2	2	2	2
Chaetodon quadrimaculatus	3	3	1	2	1		2	1	4	1	3		2		2	2		
Chaetodon multicinctus	2	2	6	6	4	10		6	4		4	6	4	6	8		4	15
Chaetodon miliaris						2							1					
POMACANTHIDAE																		
Centropyge potteri														1				
Centropyge loriculus															1			
POMACENTRIDAE																		
Dascyllus albisella																		4
Abudefduf abdominalis				16									128			73		
Plectroglyphidodon johnstonianus		1	1	1					1		1			2			1	1
Plectroglyphidodon imparipennis		1															1	
Chromis vanderbilti	67	161	67	99	240	125	145	200	109	35	146	88	246	273	132	57	139	12
Chromis ovalis																		32
Chromis verater									9		12					3		
Chromis hanui						31								9			9	22
Chromis agilis						331			18			16		15	4		33	36
Stegastes fasciolatus				2			1	1					1					

APPENDIX A. Continued.

SPECIES	Wawaloli T-1	T-2	T-3	T-4	18-Inch T-5	T-6	12-Inch South T-7	T-8	T-9	12-Inch North T-10	T-11	T-12	NPPE SITE T-13	T-14	T-15	HOONA BAY T-16	T-17	T-18
CIRRHITIDAE																		
Paracirrhites arcatus	6	3	1		2	3	2	4	14	4	7	8		2	3		2	4
Paracirrhites forsteri								2	2									2
LABRIDAE																		
Labroides phthirophagus		1																
Pseudocheilinus octotaenia		2	2			4		2	3						1			
Pseudocheilinus tetrataenia		1																1
Novaculichthys taeniourus	1					1						1					1	
Thalassoma duperrey	31	7	23	8	6	10	8	19	4	30	39	5	15	7		13	5	31
Gomphosus varius	1				2	3	1	4			2		3		1			5
Coris gaimard	1	1				1											1	2
Stethojulis balteata		1	2				1				1							
Halichoeres ornatissimus	2	2	1			1		1	2							2	1	
SCARIDAE																		
Calotomus carolinus	1	3				1												
Scarus perspicillatus				1	1	8	1			1								
Scarus sordidus			1	15	4	6	18	7	10	11		34	34	6	4	18	47	23
Scarus psittacus	4		1	2				4		2		1	2					1
Scarus rubroviolaceus	2						1		1						4			1
BLENNIIDAE																		
Cirripectes variolosus																	1	
ACANTHURIDAE																		
Acanthurus guttatus				4			8			5								
Acanthurus triostegus							1			1								
Acanthurus achilles							1		1		2		1	3				
Acanthurus glaucopareius				4						2	1							
Acanthurus leucopareius	12			2	1		4			27	9		9			4		
Acanthurus nigrofuscus	77	53	12	41	32	7	38	38	29	58	52	4	37	11	14	78	90	1
Acanthurus nigroris		5	17	12		88	2		23			19	17	10	17	4	13	27
Acanthurus thompsoni						42		7	31									176
Acanthurus olivaceus	16	5	5	3		4	2		1	5	9	3	2	2	6	1	2	
Acanthurus dussumieri					2													
Acanthurus xanthopterus						1		40	3			16						
Acanthurus blochii				171	12		125	47	57		24	70	28	21	1	58		
Ctenochaetus strigosus				60	24	34	43	11	49	45	58	12	37	87	13	56	58	
Ctenochaetus hawaiiensis							4			1	7	1	11	7		4		
Zebrasoma flavescens	7	3		42	15	31	256	23	39	102	45	13	52	54	28	56	19	5
Zebrasoma veliferum													2					
Naso hexacanthus						13		1				1			6			
Naso lituratus	6	6	6	2	8	6	3	3	4	18	7	5	15	3	4	11	14	8
Naso unicornis		3								1								
ZANCLIDAE																		
Zanclus cornutus	1			3	2	1		2		2	1	2	1				2	8
BALISTIDAE																		
Melichthys niger							6						10			6	4	
Melichthys vidua		1							1			1			1			
Sufflamen bursa	9	2	4		1	5	1	5	7	2	8	3	4	2	2		3	2
Xanthicthy mento			2			1									2			
MONACANTHIDAE																		
Pervagor melanocephalus						1												
Cantherhines sandwichiensis				1							2		1				4	
OSTRACIIDAE																		
Ostracion meleagris	1																	
TETRAODONTIDAE																		
Arothron meleagris	1													2				
Canthigaster jactator		1	1	1	3		1	1			3			1	1		1	
DIODONTIDAE																		
Diodon holocanthus				1														
Number of Individuals	252	269	157	523	364	790	834	683	465	371	598	346	678	535	261	471	467	5
Number of Species	22	24	20	33	21	34	32	29	38	27	32	26	33	29	26	26	30	29
Biomass (g/m2)	201	82	77	1637	123	183	912	891	430	280	319	631	385	211	132	518	143	1

APENDIX A. Results of the quantitative visual censuses for fishes conducted at eighteen stations, three established each at Wawaloli Beach (T-1 - T-3), the 18-inch pipe(T-4 - T-6), the 12-inch warmwater pipe (T-7 - T-9), the 12-inch coldwater pipe (T-10 - T-12), the NPPE site (T-13 - T-15) and Ho'ona Bay (T-16 - T-18) at NELHA, Keahole Point, Hawaii on 7 June 1998. Each entry in the body of the table represents the total number of individuals of each species observed during each census. Census totals and biomass estimates are given at the foot of the table.

	12-Inch North			NPPE			Ho'ona Bay		
FAMILY and Species	T-10	T-11	T-12	T-13	T-14	T-15	T-16	T-17	T-18
MURAENIDAE									
Gymnothorax eurostus	1								
HOLOCENTRIDAE									
Myripristis kuntee									53
Flammeo sammara									2
AULOSTOMIDAE									
Aulostomus chinensis					1	1			
SERRANIDAE									
Cephalopholis argus			2			1			
CARANGIDAE									
Scombroides laysan		1							
Caranx melampygus				1					
LUTJANIDAE									
Lutjanus kasmira			1			1			
Alphareus furcatus			31		1				
MULLIDAE									
Mulloides flavolineatus	4								
Mulloides vanicolensis							43		
Mulloides pflugeri	6								
Parupeneus cyclostomus					2				
Parupeneus multifasciatus	2		2	1	2	2	1	6	3
Parupeneus bifasciatus	2		2						
KYPHOSIDAE									
Kyphosus bigibbus							1		
CHAETODONTIDAE									
Forcipiger flavissimus			2	4	2			4	1
Hemitaurichthys polylepis						3			
Chaetodon unimaculatus									1

APPENDIX A. Continued.

FAMILY and Species	12-Inch North T-10	12-Inch North T-11	12-Inch North T-12	NPPE T-13	NPPE T-14	NPPE T-15	Ho'ona Bay T-16	Ho'ona Bay T-17	Ho'ona Bay T-18
CHAETODONTIDAE (Continued)									
Chaetodon lunula		1					2		
Chaetodon ornatissimus	2					2		2	2
Chaetodon quadrimaculatus	1	1		3	1				
Chaetodon multicinctus	2	2	4	1	2	6	2	6	2
POMACANTHIDAE									
Centropyge potteri									2
POMACENTRIDAE									
Dascyllus albisella								2	
Abudefduf abdominalis							13		
Plectroglyphidodon johnstonianus					1				1
Chromis vanderbilti	23	35	99	65	151	69	15	134	
Chromis ovalis		1		1					
Chromis hanui								2	2
Chromis agilis			9			5	2	32	117
Stegastes fasciolatus		1					1		
CIRRHITIDAE									
Paracirrhites arcatus		6	9	4	8	5	1	6	2
Paracirrhites forsteri				1	1			1	
Cirrhitops fasciatus		1							
LABRIDAE									
Labroides phthirophagus		1						1	1
Cheilinus rhodochrous			1						
Pseudocheilinus octotaenia			3			1		1	1
Thalassoma duperrey	11	47	23	21	16	11	2	6	8
Thalassoma fuscum		1							
Gomphosus varius	1	1	1		2		2	1	
Coris gaimard			1					1	
Stethojulis balteata			1					2	
Halichoeres ornatissimus		2	1					1	

APPENDIX A. Continued.

FAMILY and Species	12-Inch North T-10	T-11	T-12	NPPE T-13	T-14	T-15	Ho'ona Bay T-16	T-17	T-18
SCARIDAE									
Scarus perspicillatus			6	15					
Scarus sordidus	25	1	23	18	13		4	18	19
Scarus psittacus	2	11	13	17			2	1	
Scarus rubroviolaceus	1		1			1			
BLENNIIDAE									
Exallias brevis									1
Cirripectes variolosus								2	
ACANTHURIDAE									
Acanthurus guttatus	1	1							
Acanthurus triostegus	3			2			14		
Acanthurus achilles	11								
Acanthurus leucopareius	13	5		1			30		
Acanthurus glaucopareius	4								
Acanthurus nigrofuscus	45	28	23	48	60	33	40	75	48
Acanthurus olivaceus	2	2	3	5	1	1			8
Acanthurus dussumieri								1	
Acanthurus mata		1							
Acanthurus blochii		1							
Ctenochaetus strigosus	17	48	10	42	11	8	36	98	66
Ctenochaetus hawaiiensis	1	3		11	4		1		1
Zebrasoma flavescens	36	52	17	21	14	13	14	5	17
Zebrasoma veliferum	1								
Naso lituratus	11	1	7	11	5	2	5	8	2
Naso hexacanthus				1					
Naso unicornis				1			1		
ZANCLIDAE									
Zanclus cornutus		2	1	4			1		2
BALISTIDAE									
Melichthys niger				1			2		
Melichthys vidua			2	1	3	1			
Sufflamen bursa	3	2	1	2	3	2	1		2

APPENDIX A. Continued.

FAMILY and Species	12-Inch North			NPPE			Ho'ona Bay		
	T-10	T-11	T-12	T-13	T-14	T-15	T-16	T-17	T-18
BALISTIDAE (Continued)									
Xanthichthys auromarginatus					1			1	
MONACANTHIDAE									
Cantherhines sandwichiensis		1	1	2		1		1	
TETRAODONTIDAE									
Arothron meleagris				1					
Arothron hispidis							1		
Canthigaster jactator				2		1			
NUMBER OF SPECIES	27	29	30	30	23	22	26	27	25
NUMBER OF INDIVIDUALS	231	260	300	308	305	170	237	418	364
BIOMASS (g/m^2)	178	114	200	195	93	47	129	85	79

APPENDIX D: BENTHIC BIOTA MONITORING REPORTS

Note: This appendix contains portions dealing with the Ho'ona Bay transect excerpted from Dr. Steven Dollar's monitoring report for May 1998. Since this report contains cumulative data, including those from the November 1997 survey, the separate report from that survey is not attached. Black and white copies of the color photographs from both surveys are included here. The complete reports containing data from five other transects and color prints of all photographs are on file and available for review at NELHA.

BENTHIC MARINE BIOTA
MONITORING PROGRAM
AT KEAHOLE POINT, HAWAII

May 1998

Prepared for

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INTRODUCTION AND PURPOSE

Facilities at the Natural Energy Laboratory of Hawaii Authority (NELHA), and the Hawaii Ocean Science and Technology (HOST) Park employ cold, nutrient rich waters from below the thermocline for various aquaculture activities at Keahole Point, on the west coast of the Island of Hawaii. A concern regarding discharge of these waters at the shoreline and into the aquifer is the potential for environmental alteration of community structure in the adjacent marine environment and anchialine pools.

In the interest of addressing this concern and assuring maintenance of environmental quality, it has been deemed necessary to carry out a comprehensive marine environmental monitoring program (CEMP) off Keahole Point. One component of the monitoring deals with the benthic (bottom-dwelling) biological communities. The intent of the benthic component of the monitoring program is to quantitatively describe existing community structure, and to identify changes from natural and man-induced factors..This report described results of the thirteenth increment of benthic monitoring conducted by Marine Research Consultants (MRC) in May 1998. The preceding phases of monitoring by MRC were conducted from August 1991 to May 1995, and in November 1997. In the intervening years (1995-1997) monitoring between was conducted by another consultant, Oceanic Institute. However, it appears that locations of the monitoring sites were not identical between the two investigators, hence, only data from MRC are considered in the present report.

This phase of monitoring was conducted approximately six years after Hurricane Iniki struck the Hawaiian Islands in September 1992, and five years after an unusually strong northwest swell impacted the west Hawaii coastline in January 1993. Waves generated by these two storms generated surf with heights estimated at 10-15 feet in the vicinity of Keahole Point. Thus, in addition to evaluating the effects of NELHA discharge,.a key interest in the monitoring survey is to assess the impact of, and recovery from, severe wave stress on coral community structure in the vicinity of NELHA. The monitoring surveys can provide an indication of the cumulative impact of storm effects, as well as short-term recovery of coral communities.

MONITORING RATIONALE

Benthic marine community structure can be defined as the abundance, diversity, and distribution of stony and soft corals, motile benthos such as echinoderms, and macroalgae. In the context of time-series surveys, benthic assemblages are often the most useful biological assemblages for direct evaluation of environmental impacts to the marine environment. Because benthos are generally long-lived, immobile, and intimat‹ . affected by input of potential pollutants, these organisms must either tolerate the surrounding conditions within the limits of adaptability or die.

As members of the benthos, stony corals are of particular importance in nearshore Hawaiian environments. Corals compose a large portion of the reef biomass and their skeletal structures are vital in providing a complex of habitat space, shelter, and food for other species. Because corals serve in such a keystone function, coral community structure is often considered the most "relevant" parameter for evaluating impacts to the marine environment associated with activities on land. For this reason, and because alterations in coral communities are easy to identify, observable change in coral populations is a practical and direct method for obtaining the information that is required to meet existing environmental regulations.

The overall intent of the benthic monitoring program is to identify changes to biotic assemblages as a result of input of dissolved materials in waters used for aquaculture. These changes will potentially take the form of alteration in settlement and growth of the living components of the community. Such effects are likely to be difficult to decipher when superimposed over the combined effects of natural phenomenon (e.g. dislodgement, predation, sediment flow) that routinely cause alteration in the arrangement of the living, as well as nonliving components of the reef. Studies of windward reef areas have shown that while overall coral cover may remain fairly constant, there can be a high degree of spatial change as resources are continually covered and uncovered in a "temporally varying mosaic." As the study area at Keahole is known to be a high energy environment, natural factors of environmental change are likely to be substantial, and could mask changes related to the NELHA facilities.

Thus, it is essential that the sampling methodologies employed for benthic monitoring extend beyond repetitive surveys employing randomly placed quadrats on line transects. Instead, a series of permanent quadrats have been established, where intensive, rather than extensive, repetitive quantitative analyses are being routinely performed.

METHODS

All phases of the benthic monitoring program employ diver/scientists using SCUBA equipment, operating from a small boat. Three quantitative survey sites that were established in the preliminary NELHA surveys by R. Brock were utilized as monitoring sites in the initial monitoring survey in August 1991. In response to anticipated additional construction and operational activities at NELHA in the near future, three additional monitoring stations were selected and have been evaluated during all subsequent surveys. The locations of the six monitoring sites are shown in Figure 1.

For ease of identification, each survey site is labeled with a name as well as a number. Moving from south to north, Site 1 is immediately to the south of Wawaloli Beach; Site 2 is located at the 18" Pipe to the south of Keahole Point; Site 3 is on the southern side of the 12" pipe off Keahole Point; Site 4 is off the northern side of the 12" pipe; Site 5 is off the NPPE site; and Site 6 is in Ho'ona Bay. Locations of the survey sites were fixed by triangulation with conspicuous landmarks, and are easily relocated during replicate surveys.

At each of the monitoring sites, three permanent transect stations have been established. Each station is placed in one of the three major physiographic/biotic structural zones described for the Kona Coast (Dollar 1975, 1982, Dollar and Tribble 1993). These zones are characterized as the nearshore boulder zone (depth = 0-15 ft.), the reef-building platform zone (depth = 15-30 ft.), and the reef slope zone (depth = 30-60 ft.). During the initial survey, permanent transects at each site were established by placing markers into solid substratum of the ocean floor (either basalt or limestone). Marker placement was carried out by Ocean Innovators, utilizing methods and equipment developed for the purpose of permanently attaching artificial reef structures to the sea floor. The attachment procedure involved drilling a hole for anchoring an expandable eye-bolt. Small marker buoys on wire rope that float above the bottom were attached to the eye-bolts for ease in locating transect stations on subsequent surveys. During the seven years since placement of the markers, buoys have been periodically lost and replaced. As a result, locations of the transects have been constant over the course of the monitoring program.

The permanent markers defined the ends of 50 meter (160 ft.) long transects, oriented parallel to depth contours. At ten random locations along the transect line, composition of the benthos is evaluated within rectangular quadrats 1 m x 0.66 m (3 ft. x 2 ft.) in dimension. Each quadrat is photographed with a Nikonos camera with a super wide angle lens (15 mm, 94° field of view) using color print film. The camera is mounted on a tripod frame to ensure exact repeatability of quadrat area. The photographic technique provides excellent resolution of the detail of the benthic structure, to the degree that individual calices of certain corals are distinguishable. Color photographs of all quadrats attached as an appendix to this report, and are on file at NELHA.

In addition to the quadrat photographs, visual estimates of species abundance of attached and motile benthos is recorded on writing slates. Bared substratum (bare rock, sand, dead coral and coral rubble) are also evaluated in terms of areal coverage.

In the laboratory, evaluation of benthic cover of biota and substrata is performed. Area coverage of each component in the quadrat photos is determined using a overlay grid divided into 200 equally sized segments. The number of segments of each coral species and non-coral substratum type within each grid are summed to calculate area coverage. Thus, for each transect, there are the equivalent of 2,000 data points. Verification of species identification is performed using the information collected in the field. In addition, field data provides input on small organisms that are not visible in photographs. This method provides for accurate estimates of cover of organisms that cover a large percentage of the reef surface through photographic coverage, as well as occurrence of very small and/or rare organisms. Few, is any other methods provide for such accurate characterization of both extremes of benthic community structure.

The Shannon-Weaver index of diversity is also calculated for percent coral cover on each transect using estimates from area cover. The formula for calculating diversity (H') is:

$$H' = -\sum_{i=1}^{s} pi \cdot \ln pi,$$

where pi is the proportion of the ith species in the population, and s is the number of species.

RESULTS

Physical Structure

The shoreline and intertidal area of the subject property consist predominantly of basaltic boulder outcrops interspersed between narrow, steeply sloping beaches. The beaches are composed of rounded cobbles and coarse calcium carbonate sands which extend into the intertidal area. The area directly off of Keahole Point consists of a basaltic extension of the island mass that meets the ocean in steep vertical cliff faces that extend approximately 5-7 m (15-20 feet) below the ocean surface.

The structure of the offshore environment in the vicinity of Keahole Point generally conforms to the pattern that has been documented as characterizing much of the west coast of the Island of Hawaii (Dollar 1982, Dollar and Tribble 1993). The zonation scheme consists of three predominant regions, each with a characteristic coral assemblage that is adapted to the prevalent physical regime (i.e. wave stress) of the region.

Beginning at the shoreline and moving seaward, the shallowest zone at the land-sea interface is comprised of a flat basaltic terrace that is the underwater continuation of the island landmass. In areas offshore of basaltic shorelines the intertidal zone is often covered with large boulders that have entered the ocean after breaking off from the shoreline. The seaward edge of the nearshore reef terrace terminates in a vertical cliff face approximately 3-5 m (10-15 feet) in height. The face of the cliff is irregular in that it is scalloped and cut with caves and arches. In areas fronting shoreline beaches, boulder cover is not as prominent, and the intertidal area consists primarily of flat basaltic shelf. The nearshore zone receives most of the force of breaking waves and surge, and as a result is inhabited predominantly by organisms capable of withstanding these stresses on a regular basis. The predominant coral species occupying the nearshore area is *Pocillopora meandrina*, which is recognized as a "pioneering" species that is the first coral to settle on newly cleared substratum, or to occupy areas that are too harsh for other species. The shallow transects conducted at each of the six survey sites traverse the "nearshore boulder" zone.

Seaward of the nearshore boulder zone, bottom structure is composed predominantly of a gently sloping reef bench. In some areas, the bench is characterized by high relief in the form of undercut ledges and basaltic blocks and pinnacles. Fine-grained calcareous sand also occurs in pockets on the reef bench. Water depth in this mid-reef zone ranges from about 7-15 m (20 to 40 feet). As wave stress in this region is substantially less than in the shallower areas, and suitable hard substrata abounds, the area provides an ideal locale for colonization by attached benthos, particularly reef corals. The intermediate depth transects at each survey site are located on the "reef bench" zone.

The seaward edge of the reef platform (at a depth of about 15 m (45-50 feet) is marked by an sharp increase in slope to an angle of approximately 20-30 degrees. In the deep slope zone, substratum type changes from the solid continuation of the island mass to an aggregate of generally unconsolidated sand and rubble. Moving down the reef slope, coral settlement and growth ceases at a depth of approximately 35 m (100 feet); beyond this depth the bottom consists mostly of sand, with occasionally basaltic outcrops. The deep transects at each survey site are located on the upper portions of the "reef slope" zone.

While each of the survey sites has similarities to the typical scenario described above, each station also has distinctive characteristics, resulting in four relatively unique habitats. At Ho'ona Bay (Site 6) the "typical" zonation scheme is best developed in that all three zones are clearly apparent. The entire zonation scheme is compressed into a relatively narrow band (about 100-150 m wide) between the shoreline and the sand slope that extends to abyssal depths. At the 18" and 12" pipe sites (2, 3, and 4) and the NPPE site (5), the entire region from the shoreline to the reef slope is representative of the typical nearshore boulder zone, and biotic assemblages that occur in areas that are consistently subjected to intense wave scour. At the Wawaloli Beach site (1), the typical zonal structure appears to have been well-established. However, even before the impacts of Hurricane Iniki, there was substantial evidence of recent destruction of a major portion of living corals as a result of storm wave damage.

Biotic Community Structure

Reef Coral Communities

The overwhelming majority of benthic biota on the monitoring transects consisted of stony, reef-building (Scleractinian) corals. Benthic frondose macroalgae (e.g. not coralline algae) were extremely rare on survey transects, and motile invertebrates were limited to occasionally occurring echinoderms (sea urchins and sea cucumbers).

Inspection of the reef following Hurricane Iniki and the severe 1993 winter storm revealed what the monitoring scientists classified as "intermediate" impacts. Many colonies, especially *Pocillopora meandrina* sustained some branch breakage. Areas of *Porites compressa* were noticeably affected by wave energy in terms of breakage and redistribution of finger coral fragment beds on the reef slope. It must be noted, however, that most of the *P. compressa* beds in the deeper areas of the monitoring sites were already documented in previous surveys to consist largely of rubble fragments that appeared to be the result of previous storm impacts. In addition, recent breakage of corals appeared to be very patchy in spatial distribution. Patches of extensively damaged colonies occurred between areas that sustained no damage. This phenomenon has been observed repeatedly, not only in Hawaii, elsewhere in the Atlantic and Pacific where coral reefs are subject to intense storms of hurricane or cyclone intensity. It is theorized that such localized damage is a result of what has been termed "bowling". Fragments of coral skeletons or boulders dislodged by wave action causes damage to surrounding corals by impacts when the loosened material is hurled by wave forces. It appears that wave impact *per se* may play a less important role in damaging corals than such impacts from bowled fragments.

Observations of the survey region also suggested that the impacts from the storms were more intense on the southward facing reefs. Such an observation is consistent with the direction of wave propagation from Hurricane Iniki, which passed to the south of the Island. Site 6 (Ho'ona Bay), which lies to the north of Keahole Point appeared to be almost totally protected from destructive wave forces as a result of orientation to incoming swells. In summary, while the Hurricane and severe winter storm did produce observable effects to the reef environment, the effects do not appear to be "catastrophic" as the entire survey area appears to have been recently (or continually) subject to wave forces of similar magnitude from large winter surf that occurs periodically. Between the four most recent surveys, no substantial wave events occurred. Thus, differences in coral community structure may indicate if short term recovery of corals has occurred.

Inspection of the reef in 1995 at all of the survey sites (except Site 1) revealed very noticeable continued recolonization of basalt surfaces at the intermediate and deep transects. Most of the recolonization was in the form of numerous small colonies of *Porites lobata* growing as knobby projections and flat encrustations. This recolonization appears to be an initial recovery phase from the storm events that occurred in 1992-1993. Further inspection of the reef during the most recent survey in November 1997, following a two-year hiatus revealed substantial increases in coral cover, presumably as a result of uninterrupted recovery from the severe storm events.

Table 1 shows the quantitative summary of coral community structure collected during the May 1998 survey, while Appendix A shows the composition of individual quadrats that comprises transect results. Table 2 shows comparative data from the thirteen surveys in 1991-1998. Over the course of the surveys to date, 7 to 14 species of corals have been encountered on transects during surveys, while the number of coral species on a single transect has ranged from 2 to 8. In the most recent survey in May 1998 1997, 13 species were encountered on transects, with the number on a single transect ranging from 4 to 7.

Over the seven-year course of the monitoring program, coral community structure in terms of species occurrence has not shifted substantially, but does reveal an upward trend in coral cover. Mean total coral cover on all transects during each of the surveys was 17.3% (Aug 91), 18.8% (Dec 91), 17.4% (May 92), 16.8% (Oct 92), 19.3% (May 93), 21.0% (Oct 93), 21.0% (March 94), 19.3% (May 94), 23.3 (Sept 94), 23.6 (Jan 1995) and 24.4% (May 1995), 42.5% (Nov 97) and 49.4 (May 98). During the first two surveys data was collected at only three sites (9 transects), while in the last eleven surveys, six sites (18 transects) were monitored. These results suggest that there has not been a decrease in overall coral cover during the course of the monitoring program to date. Rather, there has been a substantial overall increase in overall coral cover over the entire monitoring period, with a particularly large increase between the last two surveys.

Figures 2-4 are histograms that show coral community structure (percent coral cover, species diversity, and number of species) for the thirteen monitoring surveys conducted to date at each of the transects at the six survey sites. Several dominant points are evident in examining Figures 2-4. As discussed above, with few exceptions, coral cover is highest on each transect during the most recent two surveys. On many transects, a sequential increase in cover over time is also evident (Figure 2). There is, however, no similar pattern of peaks for number of coral species number (Figure 3) or species diversity (Figure 4).

There also appears to be no consistent difference in relative coral coverage between zones at each site. At sites 1 and 2 cover is highest on the shallow or mid-depth transect and lowest on the deep transect. On the remaining four transects, cover is consistently highest on the deep transect. With respect to difference in coral coverage on each transect, the greatest difference occurred was 64.9% at Site 5 (Ho'ona Bay). During the previous surveys, Site 6 has consistently shown the greatest difference in cover between the shallow and deep transects. in November 1997, the exception of the October 1992 survey, the greatest

As stated above, one consideration of the monitoring program is to assess the impact of severe storms on coral community structure. It can be seen in Figure 2 that for total coral cover, few of the transect sites showed substantial decreases in cover following either Hurricane Iniki or the 1992 winter storm. Between May and October 1992, when Hurricane Iniki occurred, coral cover decreased on 12 of the 18 transects. Between October 1992 and May 1993, when the winter storm occurred, coral cover decreased on 5 of the 18 transects. Between May 1993 and May 1998, when no major storm events occurred, coral cover increased on all 18 transects. These comparisons suggest that the communities are recovering (or have recovered) from damage that occurred as a result of the major storms that took place during the course of the monitoring program.

Figure 4 shows plots of diversity on each transect during each survey. Diversity is an index of the equitability of distribution of individual coral species within the total coral coverage. Thus, diversity can be low when there are a high number of species but an extremely uneven distribution of cover (e.g. most species occur in very lower percentages of cover). It can be seen in Figure 4 that while many of the shallow transects had lower cover than the deeper counterparts, there is not a corresponding increase in diversity on the deeper transects. Rather, the patterns of diversity were mirror images of the estimates of coral cover. When total coral cover is high, it tends to be the result of dominance by one species, resulting in relatively low diversity.

The dominant species on all transects was *Porites lobata*, which accounted for between 48% and 72% of total coral cover in the twelve previous surveys. During the present survey, *P. lobata* comprised 46% of coral cover. Thus, while total coral cover increased substantially over the interval between the last two surveys, the percentage cover of the dominant species decreased. The second most abundant species, *Pocillopora meandrina* accounted for between 12% and 31% of coral cover in previous twelve surveys. During the most recent survey cover of *P. meandrina* comprised 31% of coral cover. Hence, the percentage cover of this species has not changed since the last survey. *Porites compressa*, accounted for between 8% and 14% of coral cover in the first twelve surveys. In May 1998, cover of *P. compressa* accounted for approximately 11% of coral cover. However, of the *Porites compressa* encountered on transects in the May 1998 survey 83% occurred at Site 6 in Ho'ona Bay, which appeared to be the most protected area from wave impact.

The remaining "rare" species encountered on transects totaled between about 0.4% and 15% of coral cover between August 1991 and November 1997. In May 1998, rare species accounted for about 12% of coral cover Thus, from the initiation of the monitoring program until May 1998, it appears that percentage cover of the most abundant species *Porites lobata* has decreased, while percentage cover of the all other species combined has not changed substantially.

Figures 5-7 shows percent cover of the five most dominant coral species (*Porites lobata, P. compressa, Pocillopora meandrina, Montipora verrucosa* and *M. patula*) at each transect station during each of the monitoring surveys. At most of the sites, community structure is similar: *P. lobata* and *P. compressa* increase in percent cover as water depth increases, while *P. meandrina* decreases in percent cover with depth. The exception to this pattern are at Sites 1 and 6, where *P. lobata* cover peaks at the mid-depth transect station. Site 1 appears to have been impacted most severely by wave impact; at the deep transect station, live coral cover was only about 15% of bottom cover during the most recent survey. At Site 6, the coral communities appear to be the most sheltered from wave attack relative to the sites on, or to the south of, Keahole Point. As a result, large colonies of *P. lobata* that occur on the reef platform at the mid-depth transect site at Site 6 are not evident at Sites 1-5.

Owing to the fragile growth form with respect to wave energy, *Porites compressa* is rare in the shallow zones, but is often the most abundant coral on the deep reef slope in west Hawaii (Dollar 1982). On many of the NELHA survey transects, however, *P. compressa* is essentially absent. Bottom cover at Sites 1-5 consisted of only very small (<2%) percentages of living *P. compressa*, even on the deep slope transects. All of these sites are located either directly off of Keahole Point, or to the south of the point, in the regions that are directly impacted by large waves impinging from both northerly and southerly swells. Examination of the bottom revealed relatively small percentages of living coral occurred on the reef slope, which consisted primarily of rubble and bare limestone. At Site 6, which appears to be sheltered from the major force of storm waves, *P. compressa* cover is relatively high at the deep transect site (54% of bottom cover), and consistent in coverage over the twelve surveys to date (see Figure 6, Tables 1 and 2).

Conversely, *Pocillopora meandrina* is adapted to areas of high wave stress, and is most abundant in the nearshore boulder zones. At Sites 2-5, off of Keahole Point, the entire reef area from the shoreline to the slope appears to be subjected to substantial wave stress. As a result, the entire reef shelf exhibits characteristics of the nearshore boulder zone with *P. meandrina* one of the dominant corals. At Site 5, off of the NPPE site, cover of *P. meandrina* is the highest of any survey area (20% cover on the shallow transect, 33% cover on the mid-depth transect). Many of the boulders on the reef shelf are virtually covered with living colonies of *P. meandrina*. While there was some evidence of breakage of branch tips, the assemblages of *P. meandrina* at Site 5 were relatively undamaged from the incidence of storm surf. On the reef slope, abundance of *P. meandrina* is very low at all sites.

One-way analysis of variance (ANOVA) statistics were performed for total coral cover (Table 3), *Porites lobata* cover (Table 4), and *Pocillopora meandrina* cover (Table 5) at each transect site. The null hypothesis for these analyses is that over the time span of the monitoring surveys, each sample area (transect) belongs to a population with equal mean coral cover. It can be seen in Table 3 that the null hypothesis is rejected ($P<0.05$) at 17 of the 18 transects.

For the most abundant species, *Porites lobata*, ANOVAs show significant differences on 15 transects, including all three transects at Sites 1, 4 and 5 (Table 4). ANOVAs performed on transect cover of *Pocillopora meandrina* revealed significant differences ($P<0.05$) on 13 transects. Site 6 (Ho'ona Bay) is the only site where none of the three transects differed significantly with respect to cover of *P. meandrina*.

In order to evaluate if significant differences in mean coral cover could be attributed to specific variations between surveys, *post hoc* Tukey multiple comparison probability tests were performed on the ANOVA statistics. Results of the Tukey multiple comparisons provide a matrix of pairwise probabilities for all samplings. Table 6 shows results of the combined matrices for all sampling sites. In each instance where there is a significant difference in ANOVA results, the Tukey results indicate the pairings which have significantly different coral cover.

It can be seen in Table 6 that cover during the two most recent surveys in 1997 and 1998 differed substantially from the surveys conducted from 1991 to 1995. Results of the Tukey tests comparing means of the November 1997 survey with previous surveys show substantial differences in cover between all surveys. Of the possible 180 comparisons, 115 were significantly different. In all cases, coral cover was higher in Nov. 1997 than in the other year of the pair. Thus, all of the statistically significant differences indicate increases in coral cover. Similarly, following the most recent survey in May 1998, of the 196 comparisons, 140 are significant. Between the last two surveys (November 1997-May 199), coral cover has increased significantly on three of the eighteen transects and decreased on one transect. Based on the pairwise Tukey comparison tests, there is no indication of statistically significant declines in coral cover over the last two years of monitoring at any of the sampling sites located off of Keahole Point. Rather, there appears to be a definite indication of increased coral cover at many of the survey sites directly off the NELHA facility.

Other Benthic Macroinvertebrates

The other dominant group of macroinvertebrates on survey transects are the sea urchins (Class Echinoidea) (see Table 7). The most common urchins are *Echinometra matheai*, *Heterocentrotus mammillatus*, and *Tripneustes gratilla*. *E. matheai* are small urchins that are generally found within interstitial spaces bored into basaltic and limestone substrata. In the May 1998 survey, *E. matheai* occurred on 17 of the 18 transects in numbers from 1 to 39 individuals. This species was generally least abundant on the reef slope transects where solid substrata was not common.

Heterocentrotus mammillatus, commonly called the "slate-pencil" sea urchin was also observed on the NELHA transects. During the May 1998 survey, *H. mammillatus* occurred only at Sites 1 and 6. In past surveys this species has consistently occurred at Sites 1 and 6, and has been consistently absent on transects at Sites 2-5.

As with coral community structure, sea urchin abundance appears to be regulated primarily by wave stress. The only species observed at Sites 2-5, located off Keahole Point was *Echinometra matheai*. The lack of other species (particularly *Heterocentrotus mammillatus* and *Tripneustes gratilla*) is likely a result of the inability of these urchins to withstand frequent wave impact capable of damaging these organisms.

Three species of sea cucumbers (Holothurians) were observed sporadically on the reef, but did not occur on transects. These species, *Holothuria atra; H. nobilis*, and *Actinopyga obesa*. Individuals of these species were distributed sporadically across the mid-reef and deep reef zones. The most common large starfish (Asteroidea) observed on the reef surface in past surveys was the crown-of-thorns starfish (*Acanthaster planci*). However, no *A. planci* were observed during the last four surveys at any of the transect sites.

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

SUMMARY

In summary, composition of coral communities off of the NELHA facility appear to be largely controlled by the degree of physical energy that impacts the area from storm waves. Results of the thirteen sequential surveys dating from 1991-1998 reveal no statistically significant decreases in coral cover that could be attributable to activities at NELHA. Rather, results of the survey set indicates substantially more coral cover at present apparently as a result of re-growth during a period when no storm waves have impacted the area. Examination of water chemistry monitoring data collected as part of the CEMP also indicates that there does not appear to be changes in marine environmental conditions from discharge that could affect mortality of benthos.

Results of the present survey indicate statistically significant changes (increases) in cover at three of the eighteen sampling stations between the November 1997 and May 1998 surveys. Coral cover decreased at one station, and showed no significant change at fourteen stations. These results indicates that the community has continued to recover from the storm damage toward what can be considered an "equilibrium climax state." Observations of the coral communities indicate that substantial recolonization by newly settled corals has progressed on areas that were probably bared as a result of intense wave action in 1992. Based on these results, it appears that the activities of the NELHA facilities do not appear to be exerting any negative effects to the benthic communities in the vicinity of Keahole Point.

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TABLE 1.A Percent coral and non-coral substratum cover, total number of species and coral diversity on transects surveyed in the vicinity of NELHA on November 23, 1997.

SITE 6 - HO'ONA BAY CORAL SPECIES	10'	25'	60'
Porites lobata	12.0	46.4	27.9
Porites compressa		18.9	44.7
Porites brighami		1.0	
Pocillopora meandrina	4.3	0.6	
Montipora verrucosa	0.4	0.7	3.2
Montipora patula		0.2	1.3
Pavona varians		0.2	
Cyphastrea ocellina	0.1		
Palythoa tuberculosa	0.8		
TOTAL CORAL COVER	17.6	68.0	77.1
NUMBER OF SPECIES	5	7	4
CORAL COVER DIVERSITY	0.86	0.80	0.88
NON-CORAL SUBSTRATA			
Basalt	82.4	0.6	0.0
Limestone	0.0	27.4	22.9
Sand	0.0	2.5	0.0
Rubble	0.0	1.5	0.0

TABLE 1.B Percent coral and non-coral substratum cover, total number of species and coral diversity on transects surveyed in the vicinity of NELHA on May 22, 1998. For survey sites, see Figure 1.

SITE 6 - HO'ONA BAY CORAL SPECIES	10'	25'	60'
Porites lobata	16.5	51.0	30.4
Porites compressa		29.4	54.3
Pocillopora meandrina	6.8	1.1	0.3
Montipora verrucosa	0.5	0.2	3.0
Montipora patula			0.3
Pavona varians		0.9	0.6
Palythoa tuberculosa	0.2		
TOTAL CORAL COVER	24.0	82.6	88.9
NUMBER OF SPECIES	4	5	6
CORAL COVER DIVERSITY	0.74	0.79	0.85
NON-CORAL SUBSTRATA			
Basalt	72.5	7.7	0.0
Limestone	1.1	6.8	11.1
Sand	0.0	1.7	0.0
Rubble	0.0	1.2	0.0

TABLE 2

TABLE 2. Cumulative coral community data for NELHA benthic monitoring program. Percentages are total coral cover and three most common species (*Porites lobata, Porites compressa, and Pocillopora meandrina*). Sp. # = number of species, Sp. div. = species diversity. For site and transect locations, see Figure 1.

SITE	DEPTH	PARAMETER	SURVEY 1 Aug-91	SURVEY 2 Dec-91	SURVEY 3 May-92	SURVEY 4 Oct-92	SURVEY 5 May-93	SURVEY 6 Oct-93	SURVEY 7 Mar-94	SURVEY 8 May-94	SURVEY 9 Sep-94	SURVEY 10 Jan-95	SURVEY 11 May-95	SURVEY 12 Nov-97	SURVEY 13 May-98
6 - HO'ONA BAY	10'	% CORAL	15.6	15.1	15.1	24.8	12.0	7.5	9.0	6.8	10.9	10.8	11.0	17.6	24.0
		% P. l.	11.5	12.3	10.0	18.3	7.5	4.8	7.2	4.7	6.2	9.1	6.3	12.0	16.5
		% P. c.			0.2		0.3								
		% P. m.	4.1	2.4	4.4	3.9	3.9	1.5	1.1	0.9	2.1	1.7	2.4	4.3	6.8
		Sp. #	2	3	4	5	6	3	5	6	3	2	3	5	4
		Sp. div.	0.58	0.55	0.79	0.85	0.87	0.90	0.73	1.02	0.98	0.44	0.98	0.86	0.74
	25'	% CORAL	33.1	42.1	30.8	27.8	30.7	26.0	38.1	16.6	25.7	28.7	23.4	68.0	82.6
		% P. l.	29.3	37.4	25.4	22.1	22.8	21.3	35.2	13.1	23.0	24.9	20.3	46.4	51.0
		% P. c.	2.9	4.1	3.5	5.0	6.8	2.3	2.1	4.1	1.1	3.5	3.0	18.9	29.4
		% P. m.	0.7	0.6	1.7	0.6	1.0	2.3	0.3	1.2		0.1	0.1	0.6	1.1
		Sp. #	4	3	4	3	3	4	6	5	4	4	3	7	5
		Sp. div.	0.42	0.39	0.58	0.57	0.66	0.61	0.35	0.81	0.44	0.43	0.41	0.80	0.79
	60'	% CORAL	31.8	34.7	39.1	35.1	45.9	40.8	55.0	41.5	49.0	46.3	43.4	77.1	88.9
		% P. l.	11.8	12.5	20.0	12.7	18.8	18.7	18.9	19.2	20.8	23.3	17.4	27.9	30.4
		% P. c.	20.0	20.0	18.0	21.7	25.3	19.9	35.2	19.1	25.3	21.8	23.3	44.7	54.3
		% P. m.		0.5	0.3	0.1	0.3	1.1	0.1	0.7	0.4	0.3	0.5		0.3
		Sp. #	2	7	5	5	6	4	5	7	5	6	6	4	6
		Sp. div.	0.37	0.93	0.83	0.76	0.86	0.90	0.74	1.02	0.92	0.82	0.95	0.88	0.85

TABLE 3. ANOVA summary table for total cover at sites in the vicinity of NELHA sampled in December 1991, May and October 1992, May and October 1993, March, May, and September 1994, January and May 1995, November 1997 and May 1998. Sites 1, 2 and 6 were surveyed on Twelve dates (N = 120); sites 3, 4 and 5 were surveyed on eleven dates (N = 110). For site locations, see Figure 1.

SITE	DEPTH	SOURCE OF VARIATION	*SS*	*df*	*MS*	*F*	*P-value*
1 - WAWALOLI	15'	Between Groups	8226.82	11	747.87	16.629	0.000
		Within Groups	4857.20	108	44.97		
	20'	Between Groups	11125.32	11	1011.39	5.913	0.000
		Within Groups	18473.94	108	171.06		
	35'	Between Groups	4468.34	11	406.21	6.185	0.000
		Within Groups	7093.13	108	65.68		
2 - 18" PIPE	20'	Between Groups	16927.19	11	1538.84	16.265	0.000
		Within Groups	10218.06	108	94.61		
	25'	Between Groups	19022.90	11	1729.35	11.855	0.000
		Within Groups	15754.08	108	145.87		
	45'	Between Groups	3044.17	11	276.74	1.604	0.108
		Within Groups	18629.58	108	172.50		
3 - 12" PIPE S.	20'	Between Groups	5347.02	10	534.70	5.666	0.000
		Within Groups	9343.35	99	94.38		
	30'	Between Groups	9606.74	10	960.67	5.427	0.000
		Within Groups	17524.95	99	177.02		
	45'	Between Groups	32411.42	10	3241.14	23.991	0.000
		Within Groups	13374.73	99	135.10		
4 - 12" PIPE N.	20'	Between Groups	10620.07	10	1062.01	10.211	0.000
		Within Groups	10296.65	99	104.01		
	25'	Between Groups	9158.91	10	915.89	5.411	0.000
		Within Groups	16758.23	99	169.28		
	50'	Between Groups	20166.94	10	2016.69	15.232	0.000
		Within Groups	13107.65	99	132.40		
5 - NPPE	20'	Between Groups	18199.12	10	1819.91	10.033	0.000
		Within Groups	17958.03	99	181.39		
	30'	Between Groups	16802.22	10	1680.22	6.587	0.000
		Within Groups	25253.50	99	255.09		
	50'	Between Groups	32319.07	10	3231.91	14.707	0.000
		Within Groups	21754.98	99	219.75		
6 - HO'ONA BAY	10'	Between Groups	3827.24	11	347.93	3.837	0.000
		Within Groups	9792.05	108	90.67		
	25'	Between Groups	40739.89	11	3703.63	9.503	0.000
		Within Groups	42089.61	108	389.72		
	60'	Between Groups	30793.82	11	2799.44	19.904	0.000
		Within Groups	15189.58	108	140.64		

TABLE 4. ANOVA summary table for *Porites lobata* cover at sites in the vicinity of NELHA sampled in December 1991, May and October 1992, May and October 1993, March, May and September 1994, January and May 1995, November 1997 and May 1998. Sites 1, 2 and 6 were surveyed on twelve dates (N = 120); sites 3, 4 and 5 were surveyed on eleven dates (N = 110). For site locations, see Figure 1.

SITE	DEPTH	SOURCE OF VARIATION	SS	df	MS	F	P-value
1 - WAWAOLI	15'	Between Groups	2750.908	11	250.0823	8.8783	0.000
		Within Groups	3042.131	108	28.16788		
	20'	Between Groups	5161.59	11	469.24	2.751	0.004
		Within Groups	18424.48	108	170.597		
	35'	Between Groups	1505.33	11	136.85	3.749	0.000
		Within Groups	3942.38	108	36.50		
2 - 18" PIPE	20'	Between Groups	3190.21	11	290.02	5.949	0.000
		Within Groups	5265.28	108	48.75		
	25'	Between Groups	2166.56	11	196.96	6.923	0.000
		Within Groups	3072.48	108	28.45		
	45'	Between Groups	1115.47	11	101.41	0.668	0.765
		Within Groups	16385.48	108	151.72		
3 - 12" PIPE S.	20'	Between Groups	2133.07	10	213.31	6.110	0.000
		Within Groups	3456.15	99	34.91		
	30'	Between Groups	1147.75	10	114.78	1.105	0.366
		Within Groups	10279.98	99	103.84		
	45'	Between Groups	2402.66	10	240.27	4.516	0.000
		Within Groups	5267.08	99	53.20		
4 - 12" PIPE N.	20'	Between Groups	983.32	10	98.33	2.508	0.010
		Within Groups	3881.55	99	39.21		
	25'	Between Groups	2285.26	10	228.53	2.501	0.010
		Within Groups	9045.20	99	91.37		
	50'	Between Groups	4330.81	10	433.08	5.219	0.000
		Within Groups	8214.93	99	82.98		
5 - NPPE	20'	Between Groups	7242.10	10	724.21	10.713	0.000
		Within Groups	6692.33	99	67.60		
	30'	Between Groups	4045.91	10	404.59	5.178	0.000
		Within Groups	7735.35	99	78.13		
	50'	Between Groups	11325.04	10	1132.50	7.933	0.000
		Within Groups	14133.45	99	142.76		
6 - HO'ONA BAY	10'	Between Groups	2175.38	11	197.76	3.078	0.001
		Within Groups	6937.95	108	64.24		
	25'	Between Groups	14318.91	11	1301.72	3.109	0.001
		Within Groups	45215.43	108	418.6613		
	60'	Between Groups	3026.123	11	275.1021	1.8089	0.061
		Within Groups	16425.28	108	152.0859		

TABLE 5. ANOVA summary table for *Pocillopora meandrina* cover at sites in the vicinity of NELHA sampled in December 1991, May and October 1992, May and October 1993, March, May and September 1994, January and May 1995, November 1997 and May 1998. Sites 1, 2 and 6 were surveyed on twelve dates (N = 120); sites 3, 4 and 5 were surveyed on eleven dates (N = 110). For site locations, see Figure 1.

SITE	DEPTH	SOURCE OF VARIATION	*SS*	*df*	*MS*	*F*	*P-value*
1 - WAWAOLI	15'	Between Groups	1624.368	11	147.6698	8.8351	0.000
		Within Groups	1805.106	108	16.71395		
	20'	Between Groups	1448.62	11	131.69	15.206	0.000
		Within Groups	935.35	108	8.660648		
	35'	Between Groups	437.62	11	39.78	3.134	0.001
		Within Groups	1371.13	108	12.70		
2 - 18" PIPE	20'	Between Groups	2502.32	11	227.48	4.325	0.000
		Within Groups	5680.85	108	52.60		
	25'	Between Groups	5415.42	11	492.31	7.681	0.000
		Within Groups	6922.07	108	64.09		
	45'	Between Groups	1651.43	11	150.13	11.803	0.000
		Within Groups	1373.70	108	12.72		
3 - 12" PIPE S.	20'	Between Groups	966.02	10	96.60	3.759	0.000
		Within Groups	2544.20	99	25.70		
	30'	Between Groups	5648.50	10	564.85	13.501	0.000
		Within Groups	4141.78	99	41.84		
	45'	Between Groups	14217.75	10	1421.78	30.018	0.000
		Within Groups	4689.03	99	47.36		
4 - 12" PIPE N.	20'	Between Groups	4671.58	10	467.16	8.361	0.000
		Within Groups	5531.58	99	55.87		
	25'	Between Groups	1942.12	10	194.21	6.284	0.000
		Within Groups	3059.55	99	30.90		
	50'	Between Groups	1889.77	10	188.98	16.248	0.000
		Within Groups	1151.43	99	11.63		
5 - NPPE	20'	Between Groups	7779.70	10	777.97	0.961	0.482
		Within Groups	80162.15	99	809.72		
	30'	Between Groups	2954.75	10	295.48	2.034	0.037
		Within Groups	14378.03	99	145.23		
	50'	Between Groups	840.37	10	84.04	2.434	0.012
		Within Groups	3418.33	99	34.53		
6 - HO'ONA BAY	10'	Between Groups	334.72	11	30.43	1.880	0.050
		Within Groups	1747.78	108	16.18		
	25'	Between Groups	53.38	11	4.85	1.562	0.120
		Within Groups	335.53	108	3.11		
	60'	Between Groups	10.07	11	0.92	0.785	0.654
		Within Groups	125.93	108	1.17		

TABLE 7. Cumulative sea urchin data for NELHA benthic monitoring program. For site and transect locations, see Figure 1.

SITE	TRANSECT	SPECIES	SURVEY 1 Aug '91	SURVEY 2 Dec '91	SURVEY 3 May '92	SURVEY 4 Oct '92	SURVEY 6 May '93	SURVEY 6 Oct '93	SURVEY 7 Mar '94	SURVEY 8 May '94	SURVEY 9 Sep '94	SURVEY 10 Jan '95	SURVEY 11 May '95	SURVEY 12 Nov '97	SURVEY 13 May '98
1	15'	E. matheai	21	36	14	8	11	24	14	20	24	31	26	22	31
		H. mammillatus	2			1		1					2		1
		T. gratilla				1							1	1	2
	20'	E. matheai	54	9	40	30	17	34	29	25	31	35	41	35	39
		H. mammillatus	4				1	1							
	35'	E. matheai	14	6		3	1	1	6	3	4	6	3	2	1
		H. mammillatus	4	1										1	1
		T. gratilla			2		1								
2	20'	E. matheai	6	19	2	4	3	8	4	6	3	2	4	3	6
	25'	E. matheai	3	8	6	3	11	13	6	14	21	28	24	27	32
		E. aciculatus					1		1	1					
	45'	E. matheai	12	4	9	8	7	6	2	11	7	6	4	4	2
3	20'	E. matheai			2	3	2	1		1	2	1	2	3	4
	30'	E. matheai			15	4	6	11	8	6	3	2	2	2	3
	45'	E. diadema												1	2
	45'	E. matheai			2	1	1	1	1	1	1	4	1	3	2
4	20'	E. matheai			3	2	7	4	2	4	3	4	4	2	2
	25'	E. matheai			9	15	7	11	6	6	4	3	2	4	3
	50'	E. matheai			2	0	1	1	1	4	2	2	3	3	6
5	20'	E. matheai			7	7	7	4	4	3	1	2	6	4	6
	30'	E. matheai			1	4	1	1	6	8	3	4	41	27	38
	50'	E. matheai			1	4			2	4	1	3			
6	10'	E. matheai	19	4	23	9	4	12	6	11	16	19	12	11	14
		H. mammillatus	8	2	2		2	1	2						
		E. diadema	1				1								
	25'	E. matheai	16	39	20	4	1	9	7	6	3	4	3	2	3
		H. mammillatus	15	7	3	4		1	1	1	1	2	2	2	4
	60'	E. matheai	12	7			1	1			1	3	4	2	2
		H. mammillatus	8	4		1	2		1	1	1	1	1	1	3
		T. gratilla	1				3	1							
		E. diadema	1												
		TOTAL	201	145	162	116	99	147	109	135	132	160	187	162	205

APPENDIX A-8. Percent cover of coral and non-coral substrata on transects surveyed at Site 6 - HO'ONA BAY in the vicinity of NELHA in May 1998. Each transect consists of 10 quadrats. For site and transect locations see Figure 1

TRANSECT SITE:	HO'ONA BAY	MEAN CORAL COVER	24 %
TRANSECT ID #:	6-1-10	STD. DEV.	13.0
DATE:	5/22/98	SPECIES COUNT	4
		SPECIES DIVERSITY	0.725

SPECIES	QUADRAT										SPECIES TOTAL
	1	2	3	4	5	6	7	8	9	10	
Porites lobata	24.0	14.0	6.0	12.0	8.0	31.0	16.0	14.0	13.0	21.0	165.0
Pocillopora meandrina	11.0	4.0	1.0	3.0	2.0	26.0	2.0	4.0	3.0	12.0	63.0
Montipora verrucosa		5.0									5.0
Palythoa tuberculosa		2.0									2.0
QUAD CORAL TOTAL	35.0	25.0	7.0	15.0	10.0	57.0	18.0	18.0	22.0	33.0	240.0
NON-CORAL SUBSTRATA	QUADRAT 1	2	3	4	5	6	7	8	9	10	SUBSTRATA TOTAL
Basalt	54.0	70.0	91.0	82.0	88.0	37.0	82.0	80.0	75.0	65.0	725.0
Limestone	4.0	3.0				4.0					11.0
Sand											0.0
Rubble											0.0

TRANSECT SITE:	HO'ONA BAY	MEAN CORAL COVER	82.6 %
TRANSECT ID #:	6-2-25	STD. DEV.	19.9
DATE:	5/22/98	SPECIES COUNT	5
		SPECIES DIVERSITY	0.787

SPECIES	QUADRAT										SPECIES TOTAL
	1	2	3	4	5	6	7	8	9	10	
Porites lobata	72.0	89.0	92.0	90.0	30.0	31.0	27.0	35.0	26.0	18.0	510.0
Porites compressa	8.0		2.0	4.0	61.0	60.0	57.0	36.0	56.0	10.0	294.0
Pocillopora meandrina		1.0		4.0	4.0	2.0					11.0
Montipora verrucosa		2.0									2.0
Pavona varians						3.0	6.0				9.0
QUAD CORAL TOTAL	80.0	92.0	94.0	98.0	95.0	96.0	90.0	71.0	82.0	28.0	825.0
NON-CORAL SUBSTRATA	QUADRAT 1	2	3	4	5	6	7	8	9	10	SUBSTRATA TOTAL
Basalt	7.0									70.0	77.0
Limestone	13.0	8.0	6.0	2.0	5.0	4.0	10.0		18.0	2.0	68.0
Sand								17.0			17.0
Rubble								12.0			12.0

TRANSECT SITE:	HO'ONA BAY	MEAN CORAL COVER	88.9 %
TRANSECT ID #:	6-3-60	STD. DEV.	9.9
DATE:	5/22/98	SPECIES COUNT	6
		SPECIES DIVERSITY	0.855

SPECIES	QUADRAT										SPECIES TOTAL
	1	2	3	4	5	6	7	8	9	10	
Porites lobata	54.0	54.0	6.0	11.0	31.0	45.0	18.0	14.0	21.0	50.0	304.0
Porites compressa	12.0	28.0	92.0	80.0	55.0	28.0	77.0	75.0	65.0	30.0	543.0
Pocillopora meandrina								2.0		1.0	3.0
Montipora verrucosa	4.0	12.0	1.0	9.0				4.0			30.0
Montipora patula	3.0										3.0
Pavona varians			1.0		2.0		2.0	1.0			6.0
QUAD CORAL TOTAL	73.0	94.0	100.0	100.0	88.0	73.0	97.0	97.0	86.0	81.0	889.0
NON-CORAL SUBSTRATA	QUADRAT 1	2	3	4	5	6	7	8	9	10	SUBSTRATA TOTAL
Basalt											0.0
Limestone	27.0	6.0			12.0	27.0	3.0	3.0	14.0	19.0	111.0
Sand											0.0
Rubble											0.0

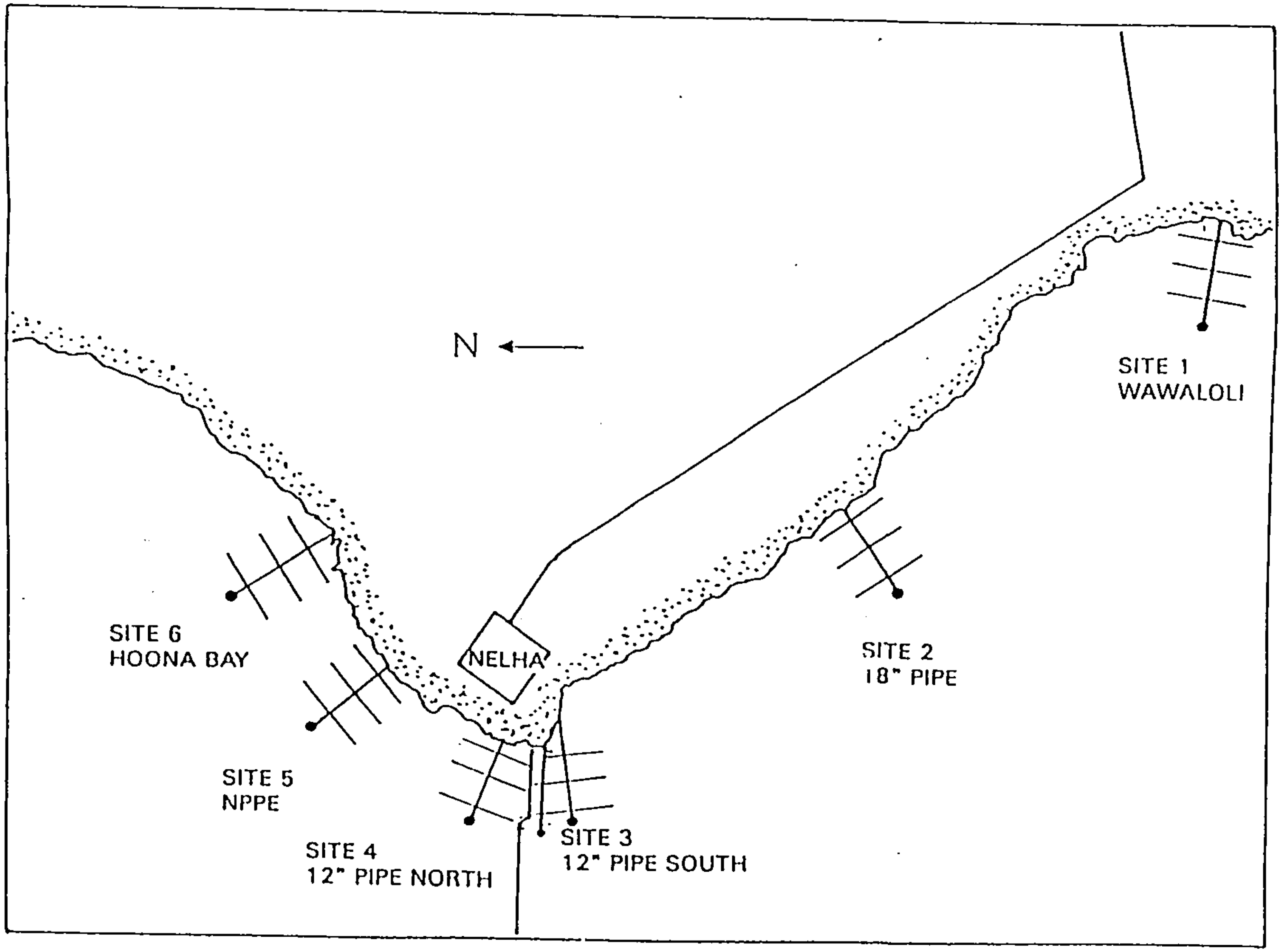


FIGURE 1. Map of Keahole Point showing location of NELHA and six benthic monitoring sites depicted as lines perpendicular to the shoreline. At each site, three 150 foot long transect stations are surveyed, as indicated by short lines parallel to the shoreline.

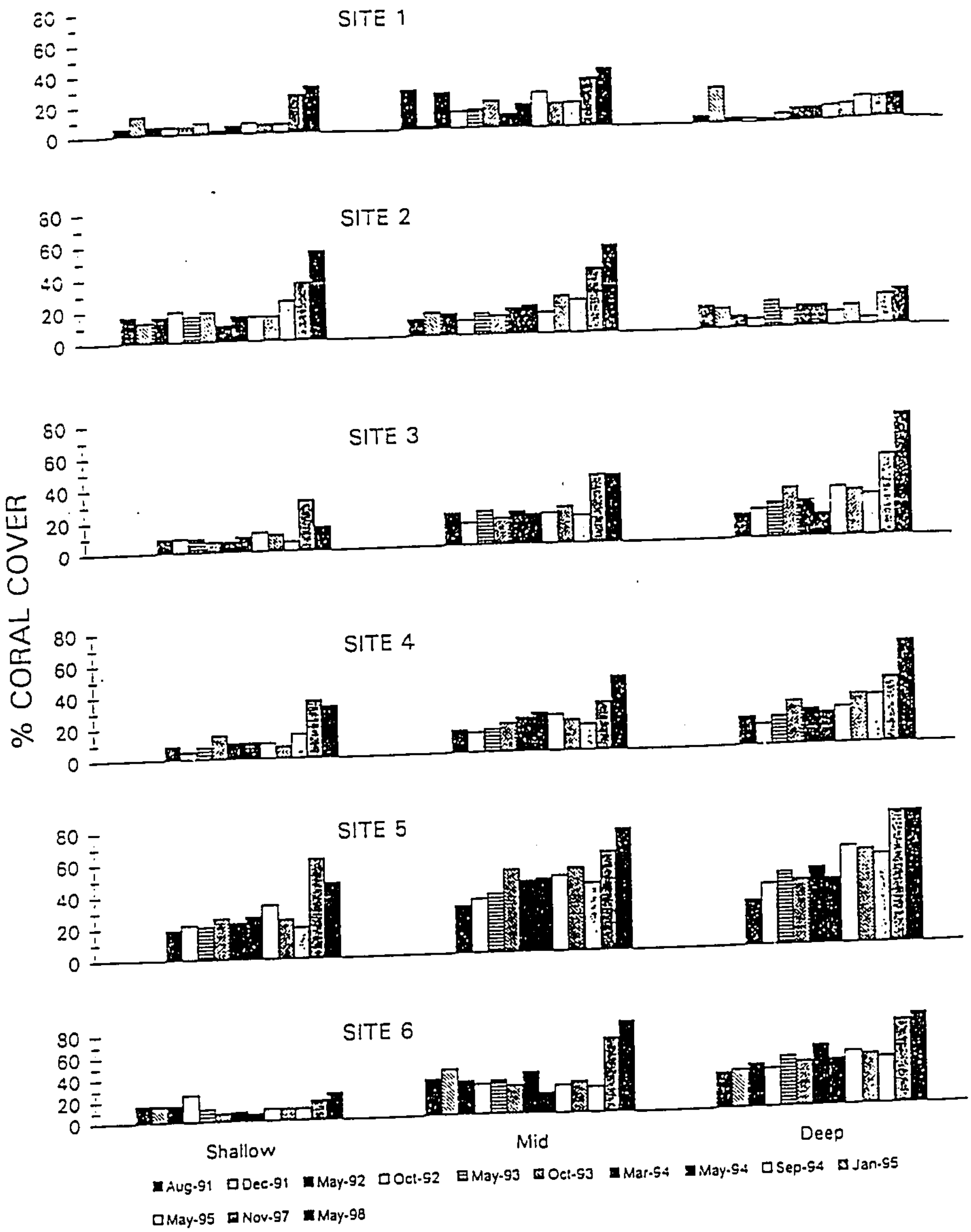


FIGURE 2. Bar graphs of percentage of total coral cover from three depths at six marine monitoring sites located in the vicinity of NELHA surveyed since August 1991 (Note: sampling suspended between June 1995 and October 1997). Sites 3, 4, and 5 were not surveyed in August or December 1991. For location of survey sites, see Figure 1.

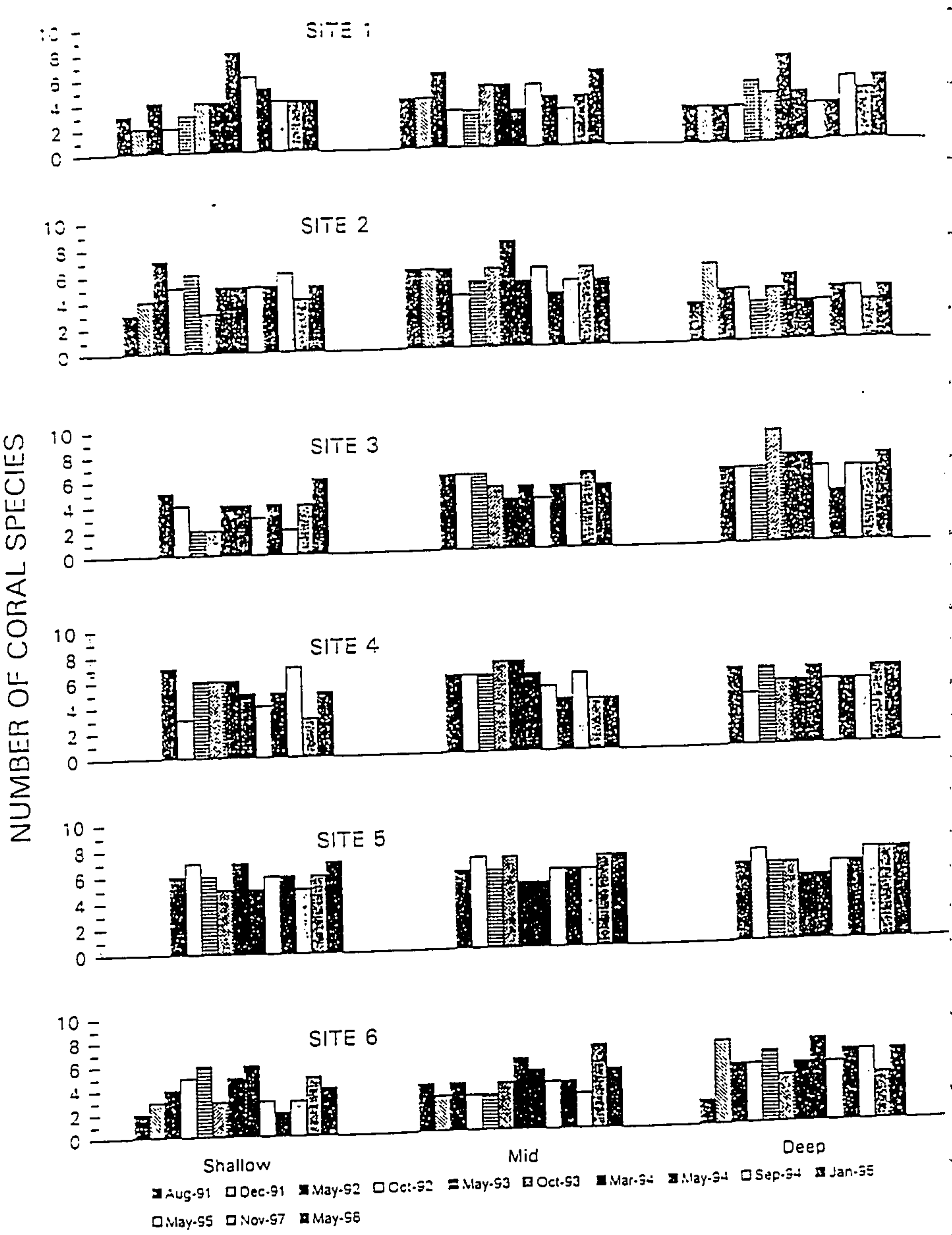


FIGURE 3. Bar graph of total number of coral species from three depths at six marine monitoring sites located in the vicinity of NELHA surveyed since August 1991 (Note: sampling suspended between June 1995 and October 1997). Sites 3, 4, and 5 were not surveyed in August or December 1991. For location of survey sites, see Figure 1.

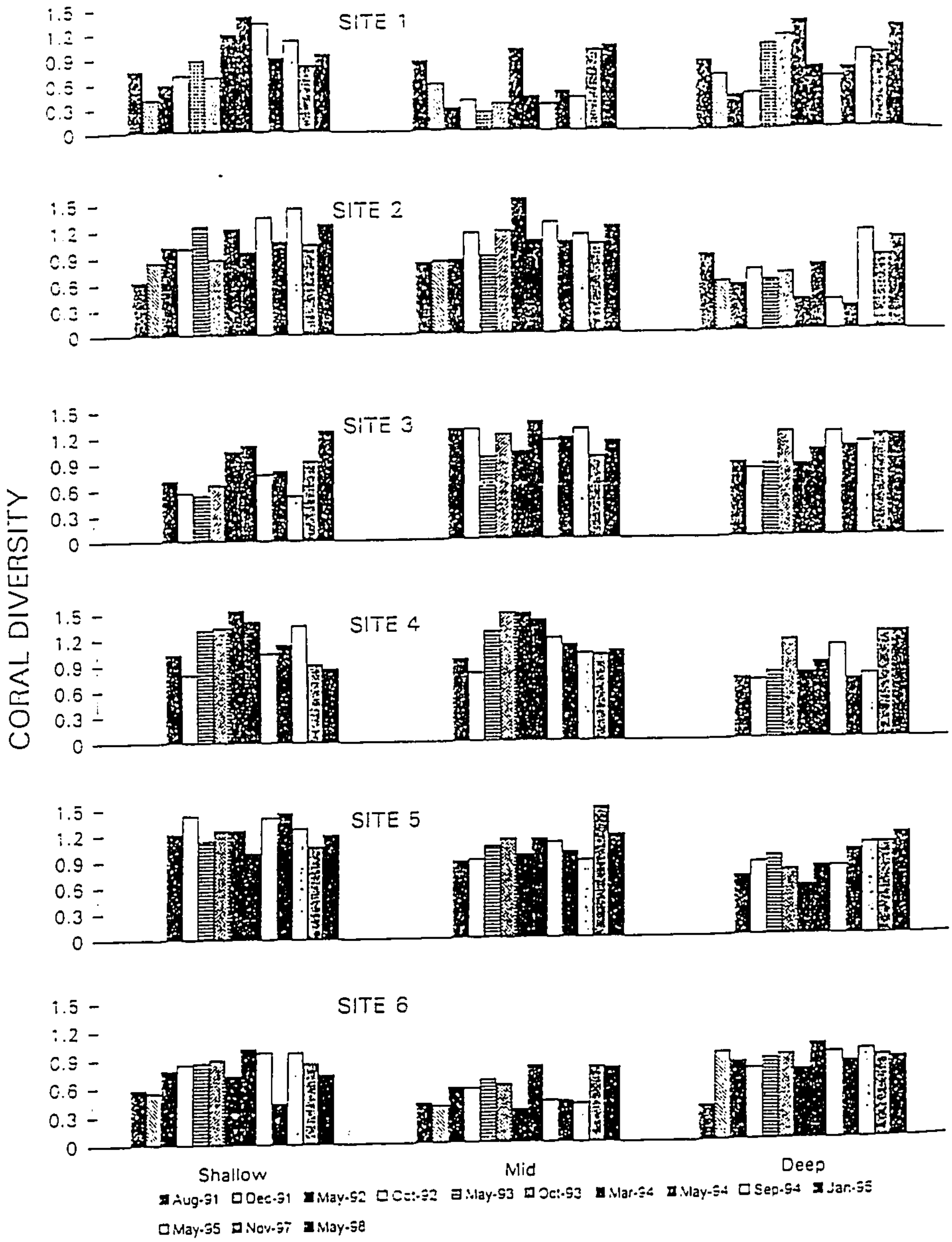


FIGURE 4. Bar graph of coral species diversity from three depths at six marine monitoring sites located in the vicinity of NELHA surveyed since August 1991 (Note: sampling suspended between June 1995 and October 1997). Sites 3, 4, and 5 were not surveyed in August or December 1991. For location of survey sites, see Figure 1.

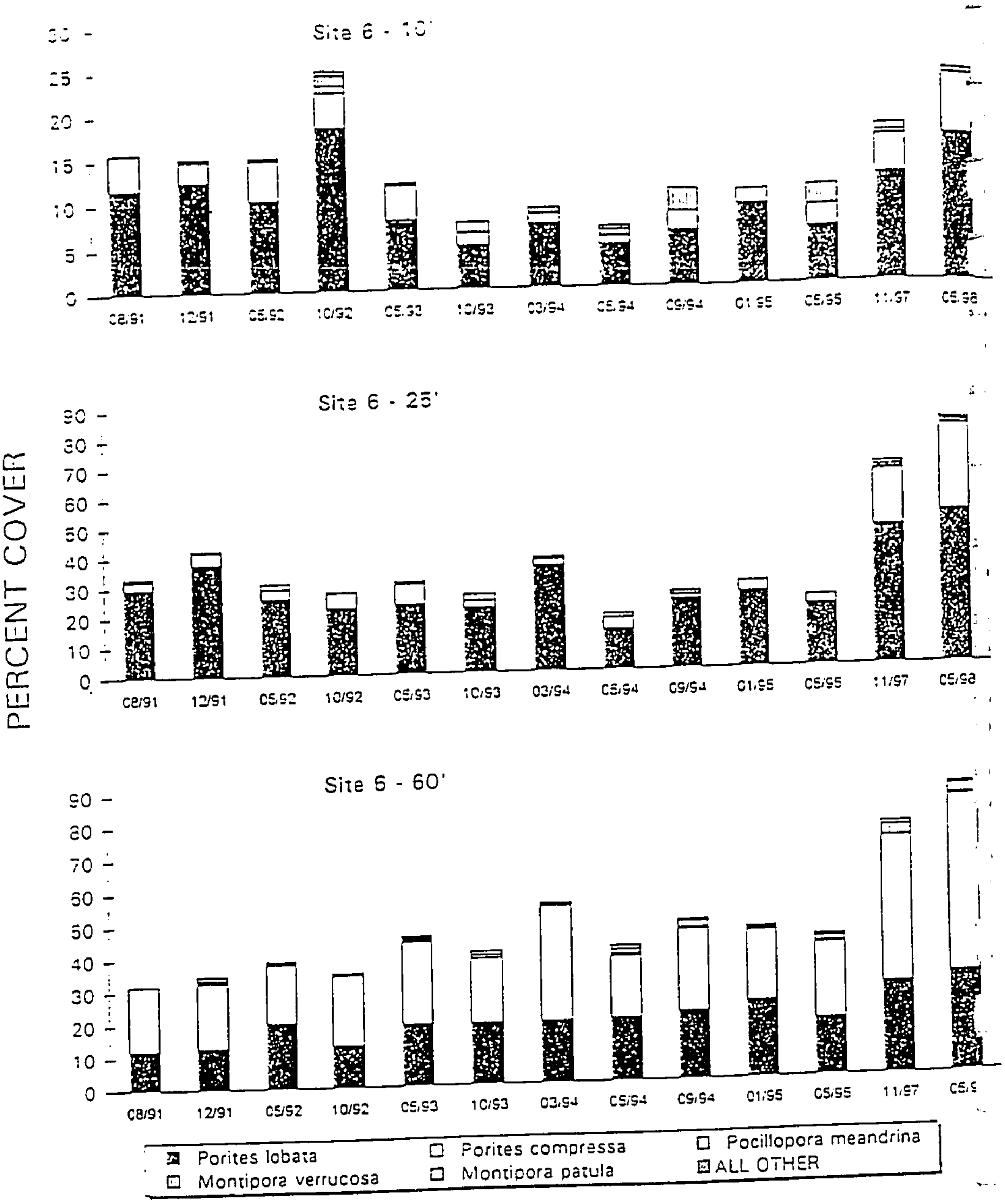
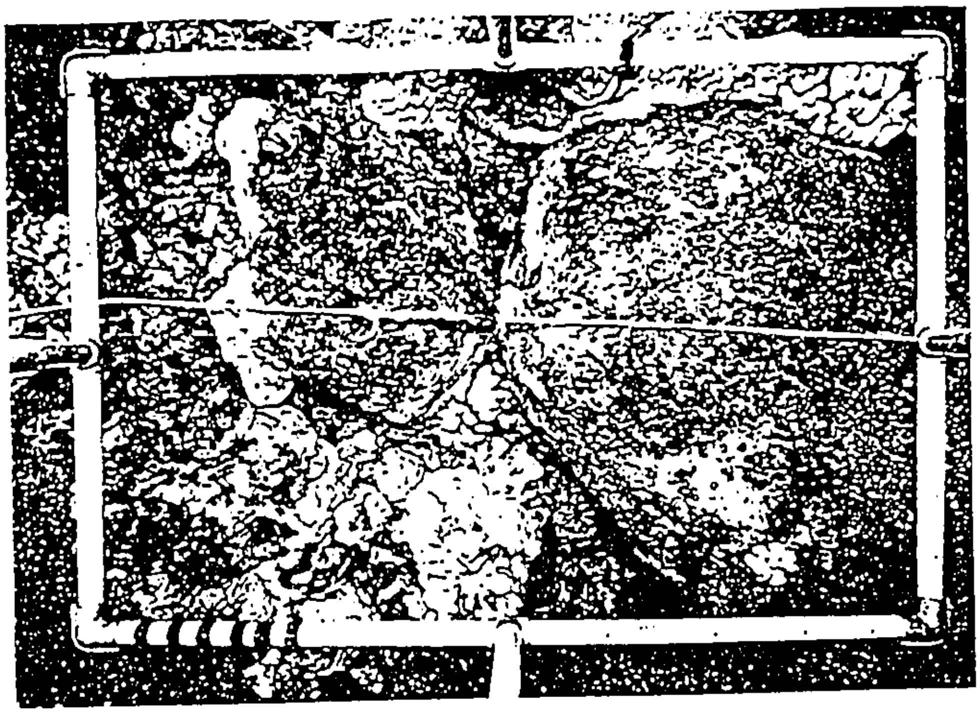
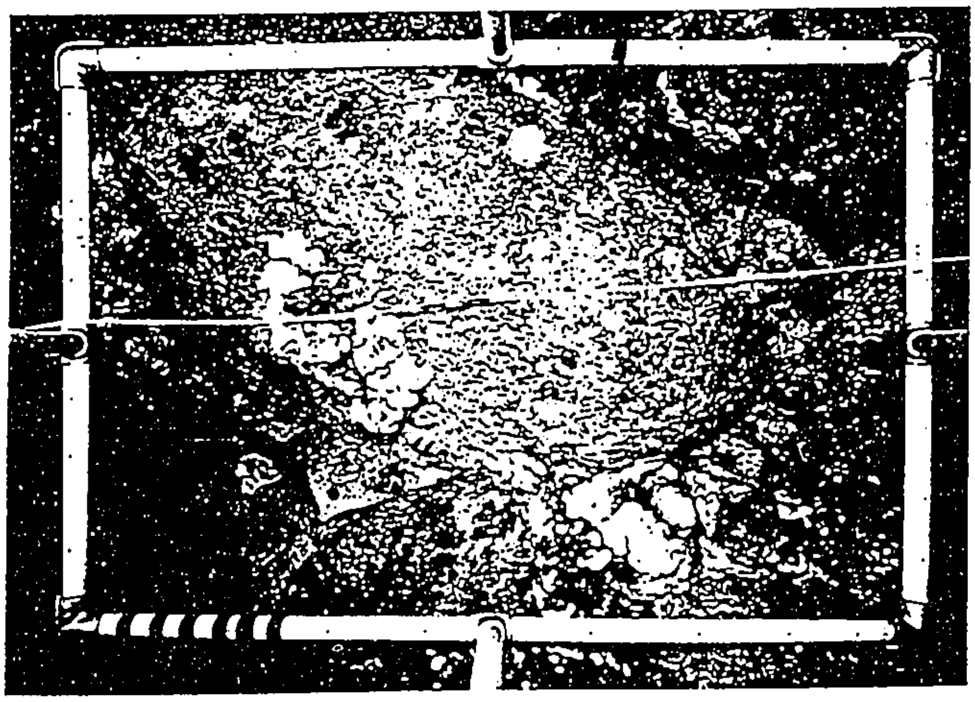


FIGURE 10. Bar graph showing percent cover of major coral species at three depths along the transect at Site 6. Surveys were conducted since August 1991 (Note: Sampling suspended between June 1995 and October 1997). Cover estimates are calculated as mean cover for ten random quadrats. Note y-axis scale change for shallow transect. For location of Site 6, see Figure 1.

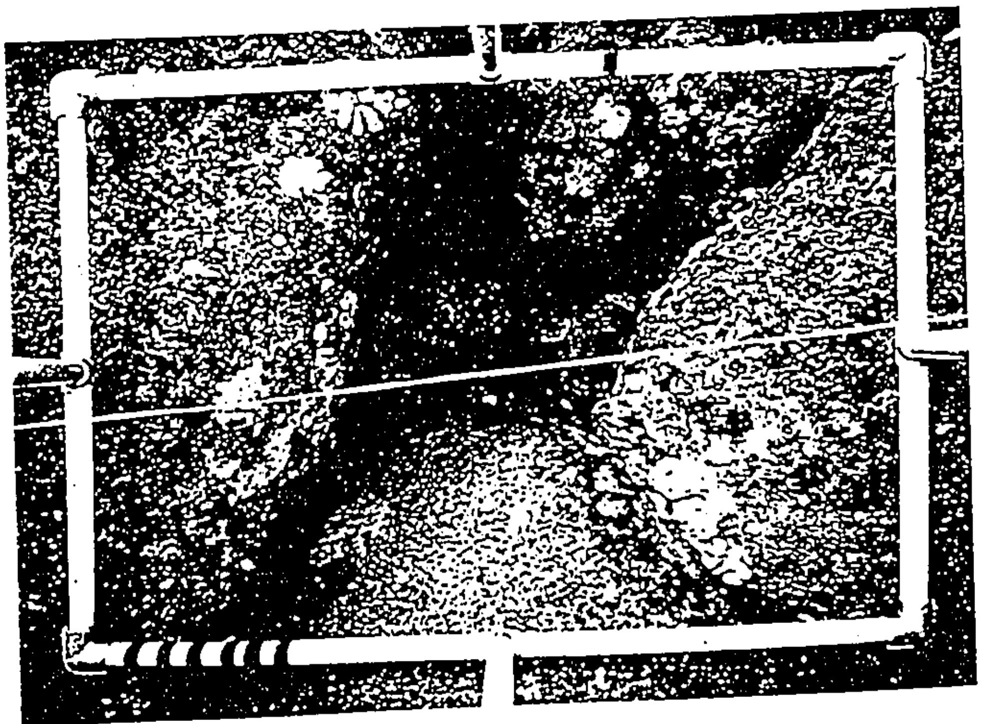


TRANSECT 6-10' - Frame 1



TRANSECT 6-10' - Frame 2

TRANSECT 6-10' - Frame 3



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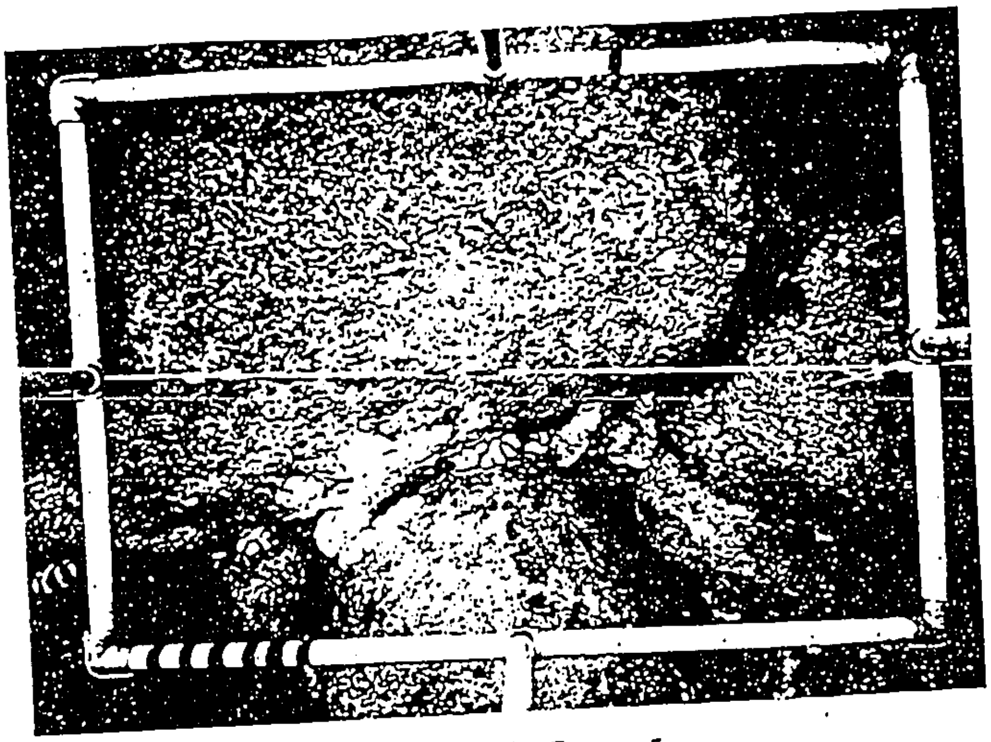

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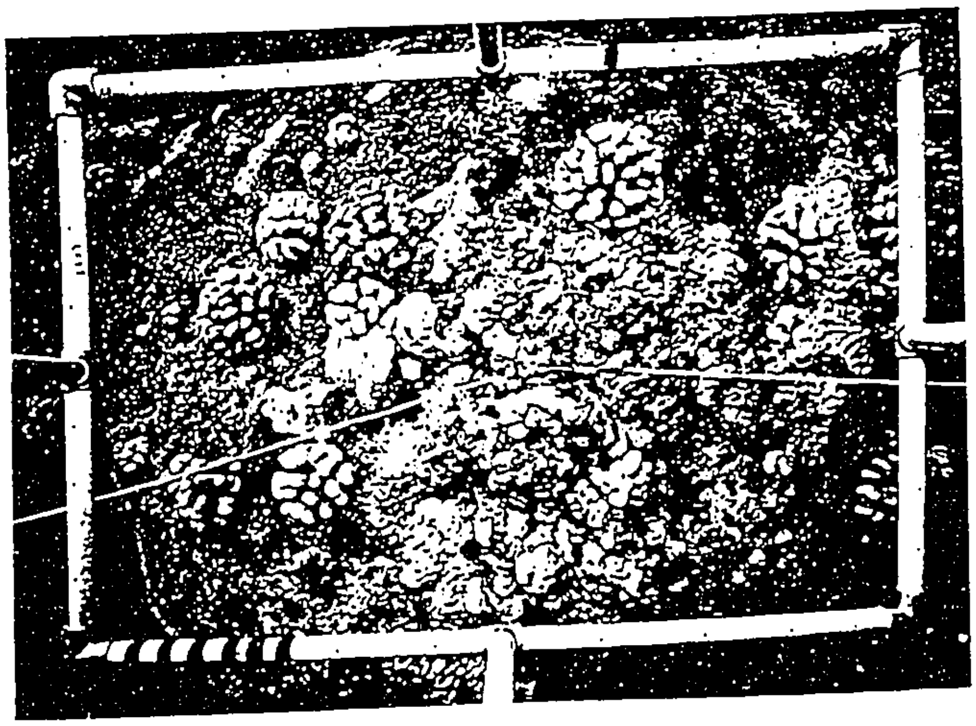
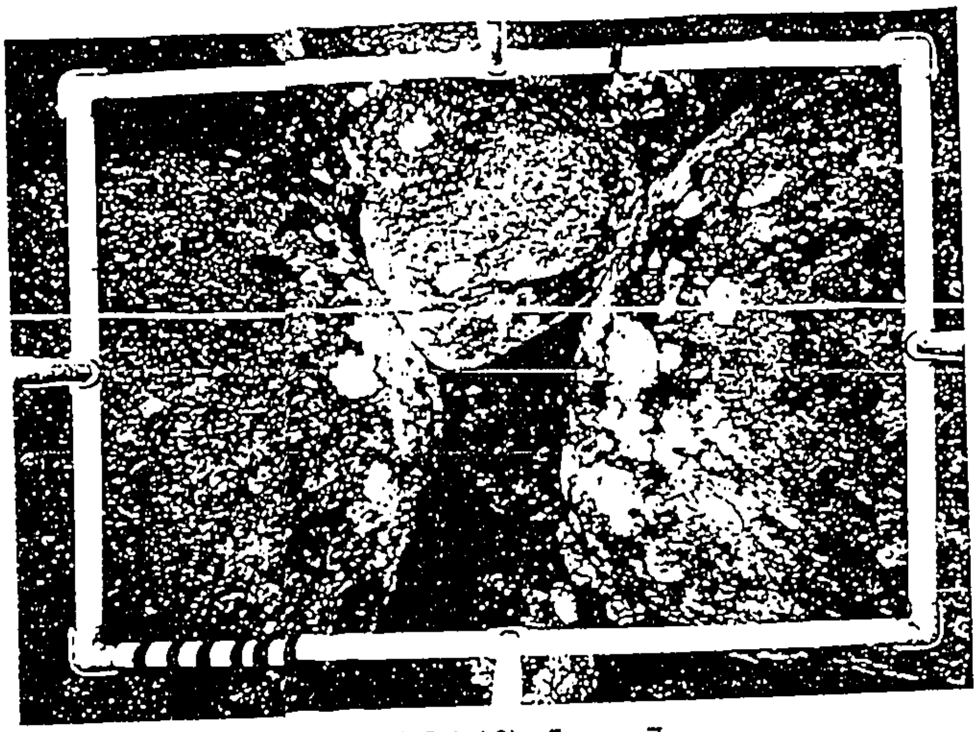


TRANSECT 6-10' - Frame 6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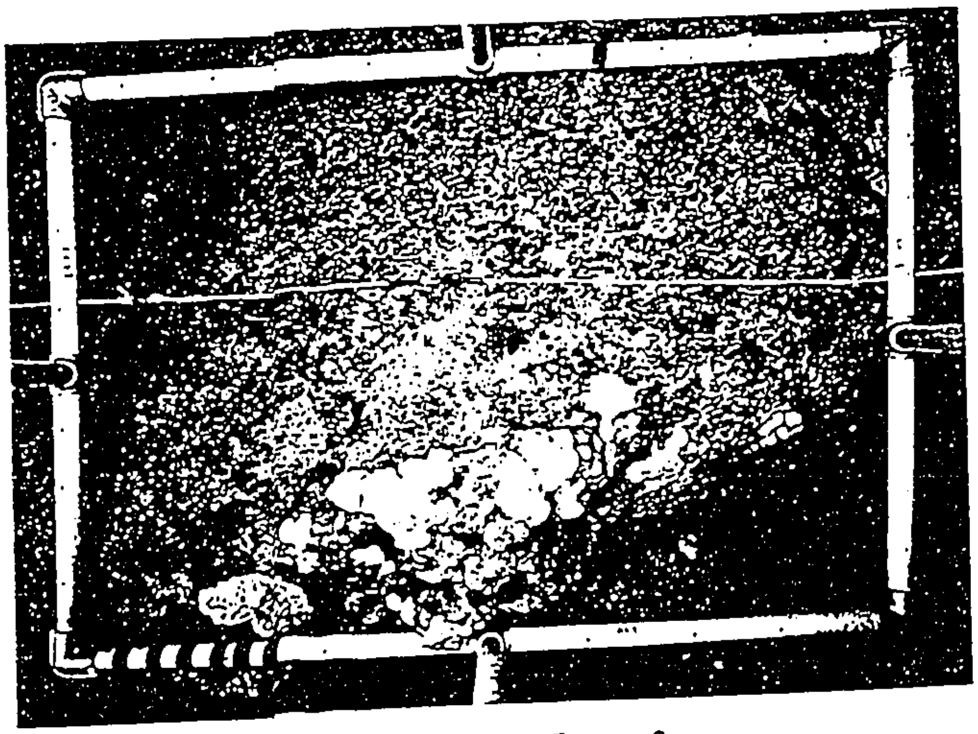
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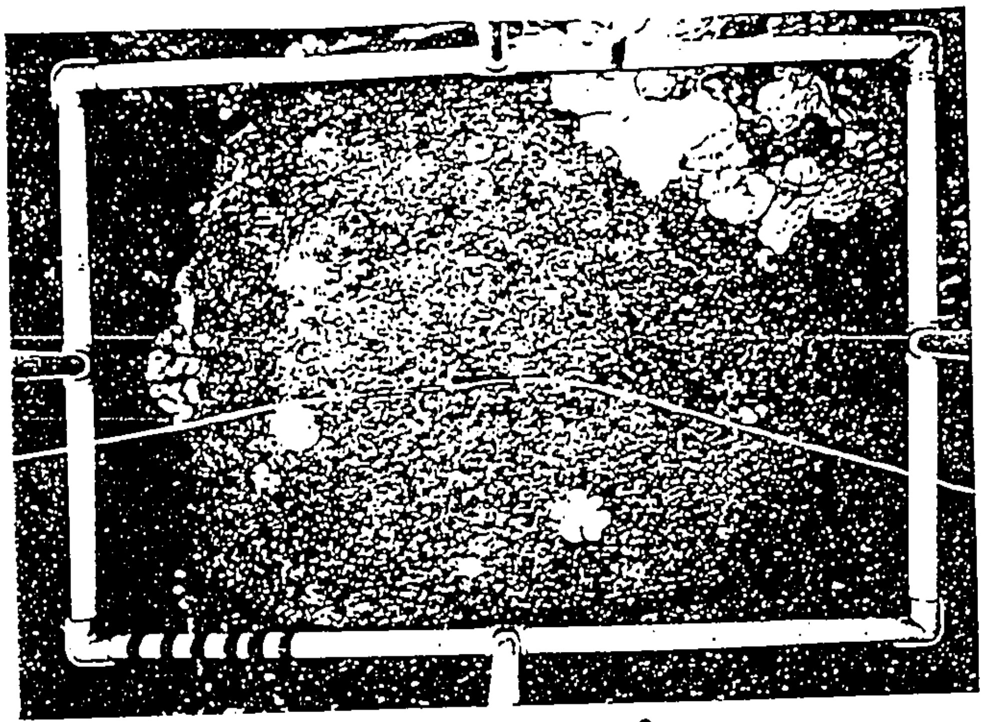

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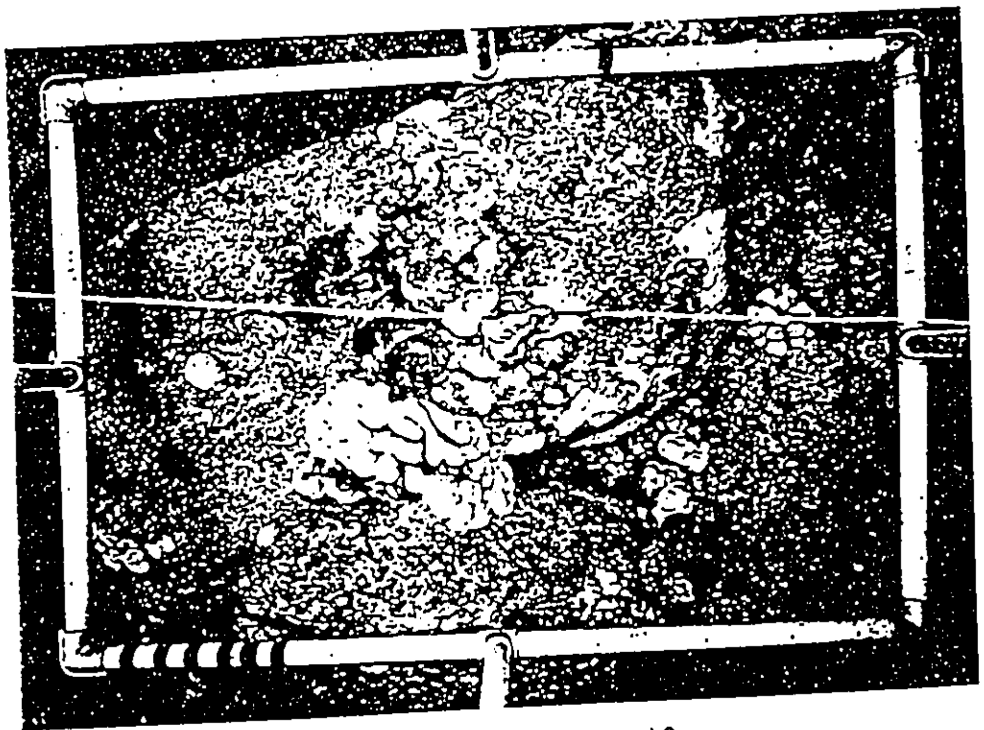

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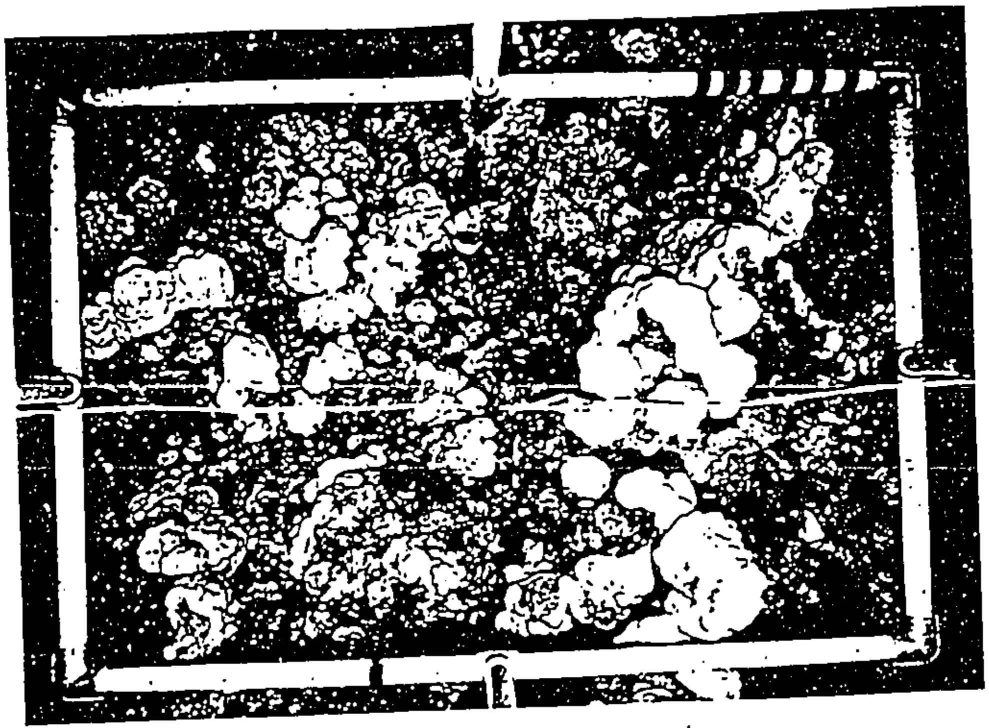
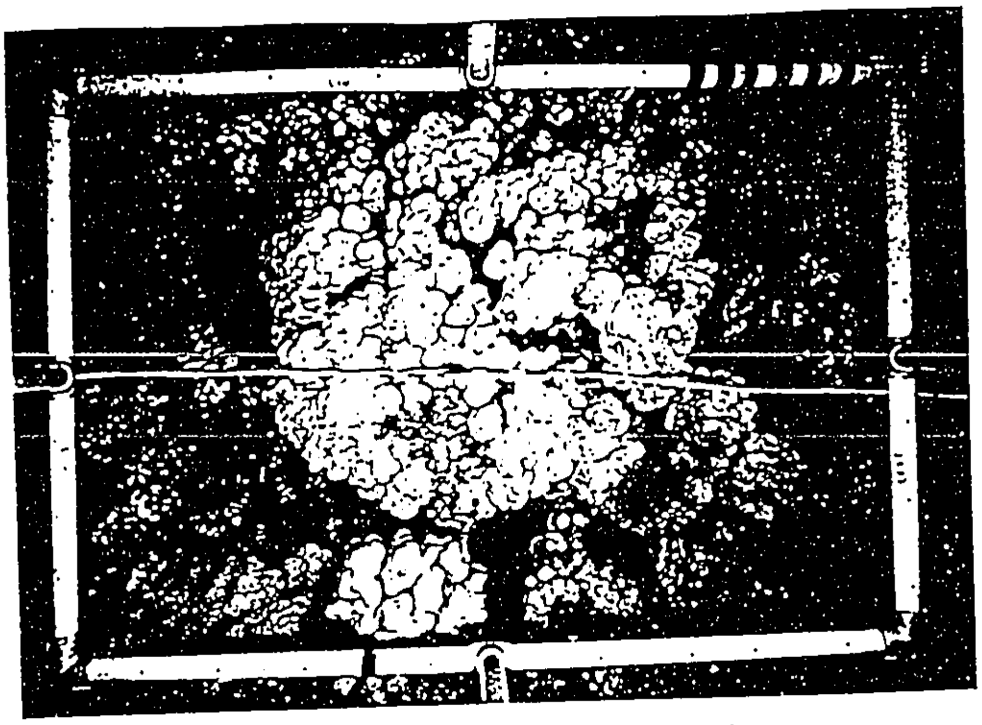


TRANSECT 6-25'- Frame 1

TRANSECT 6-25'- Frame 2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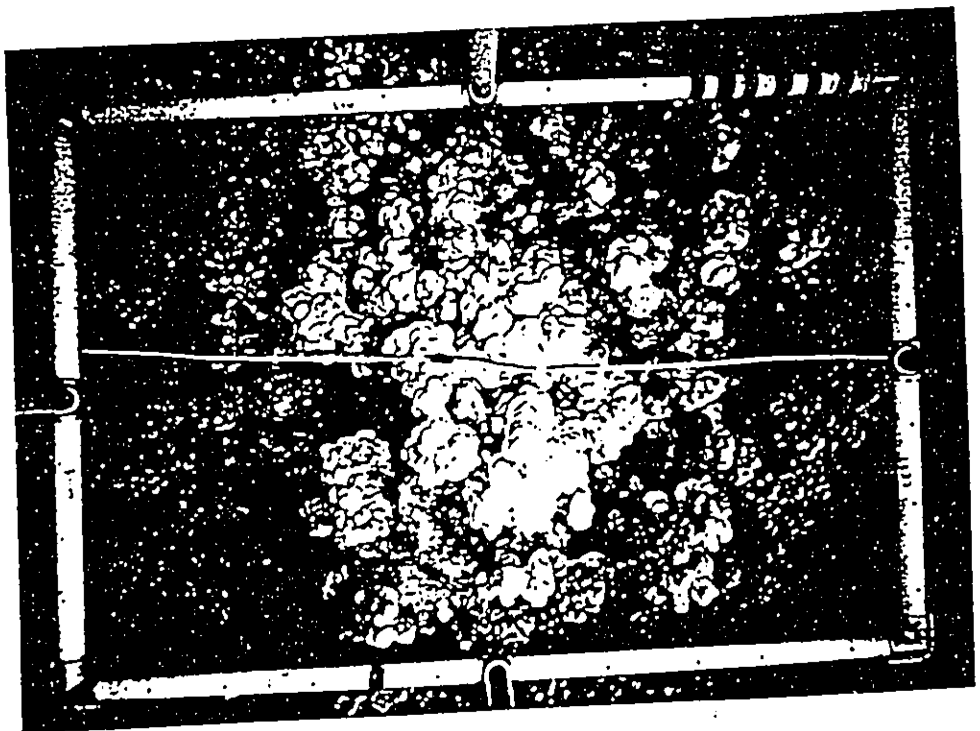
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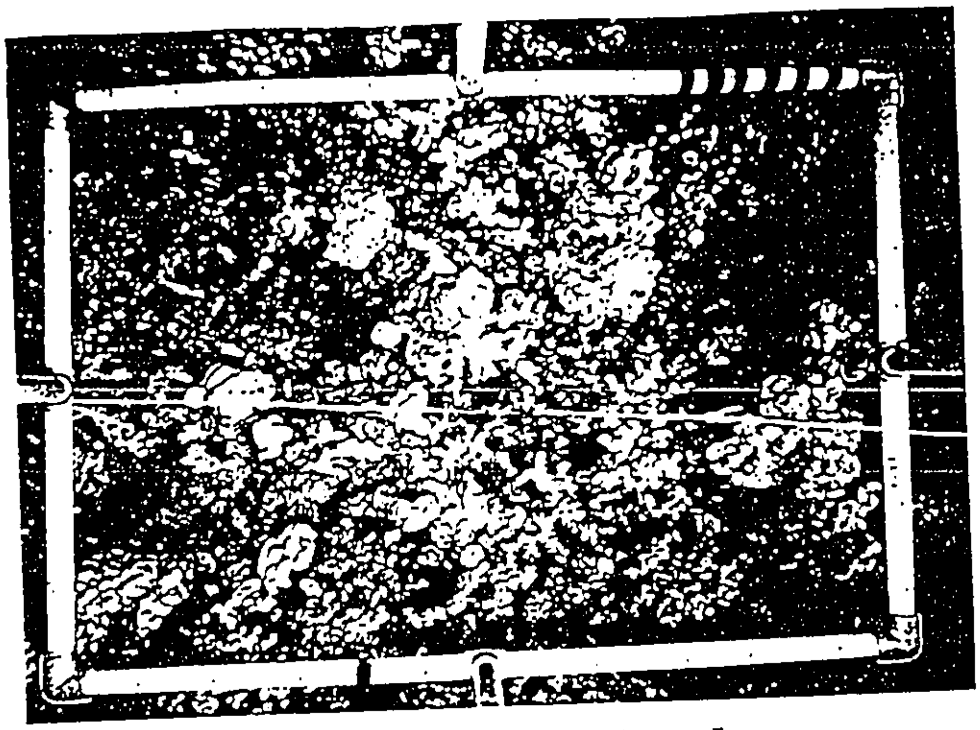

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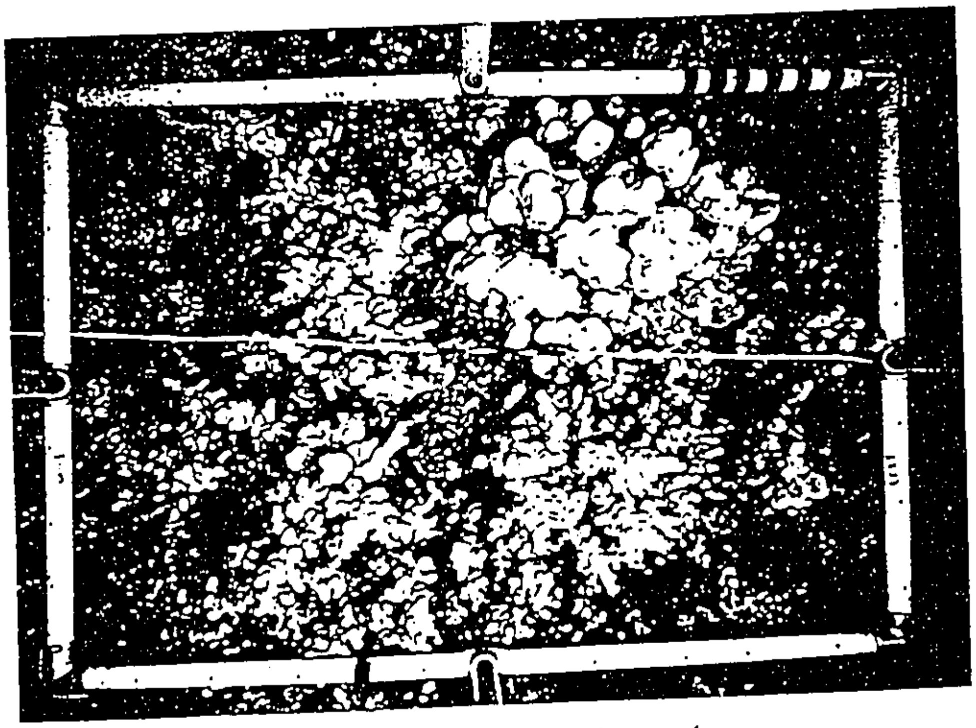

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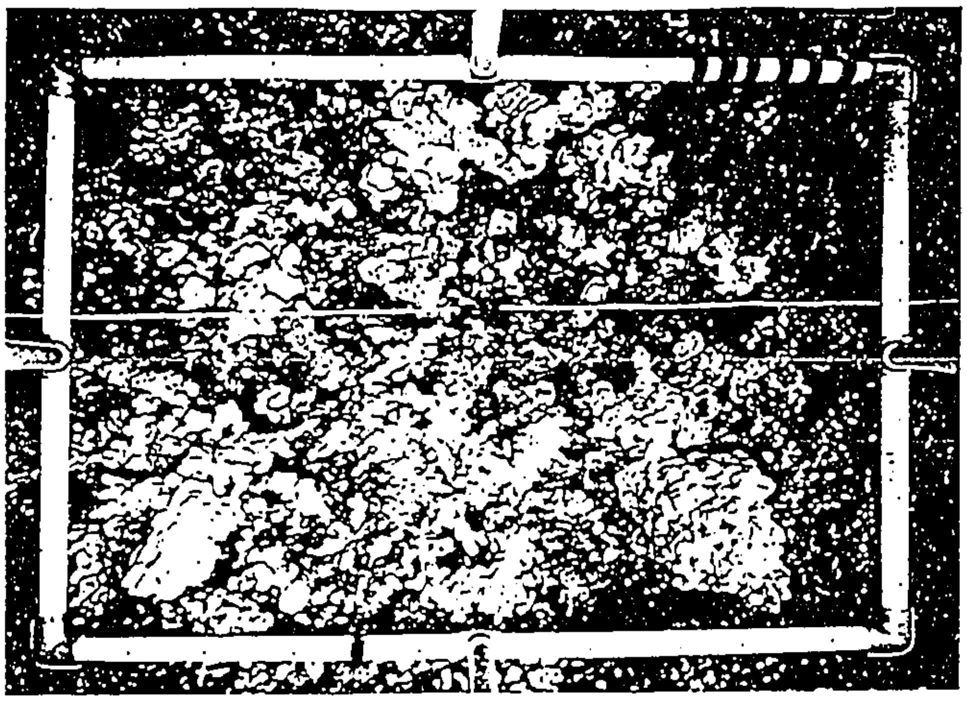

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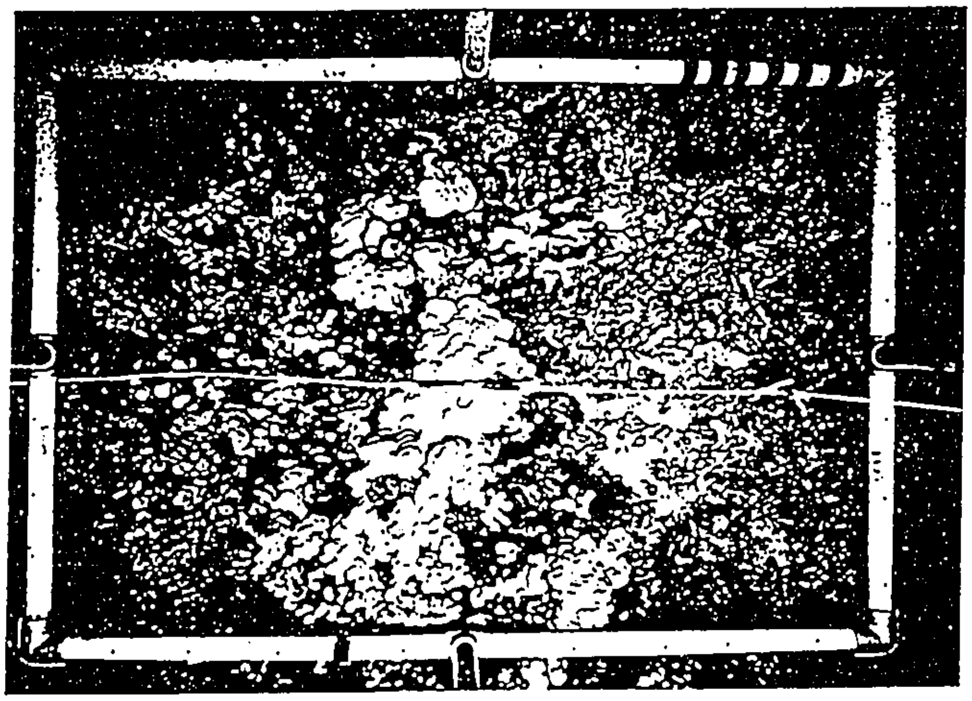

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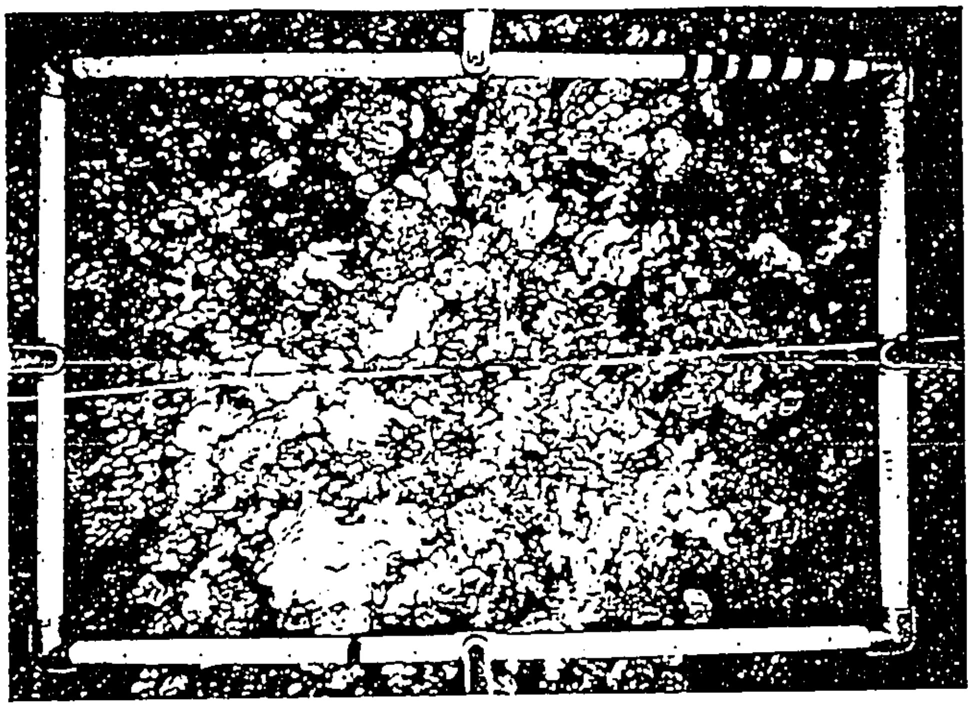

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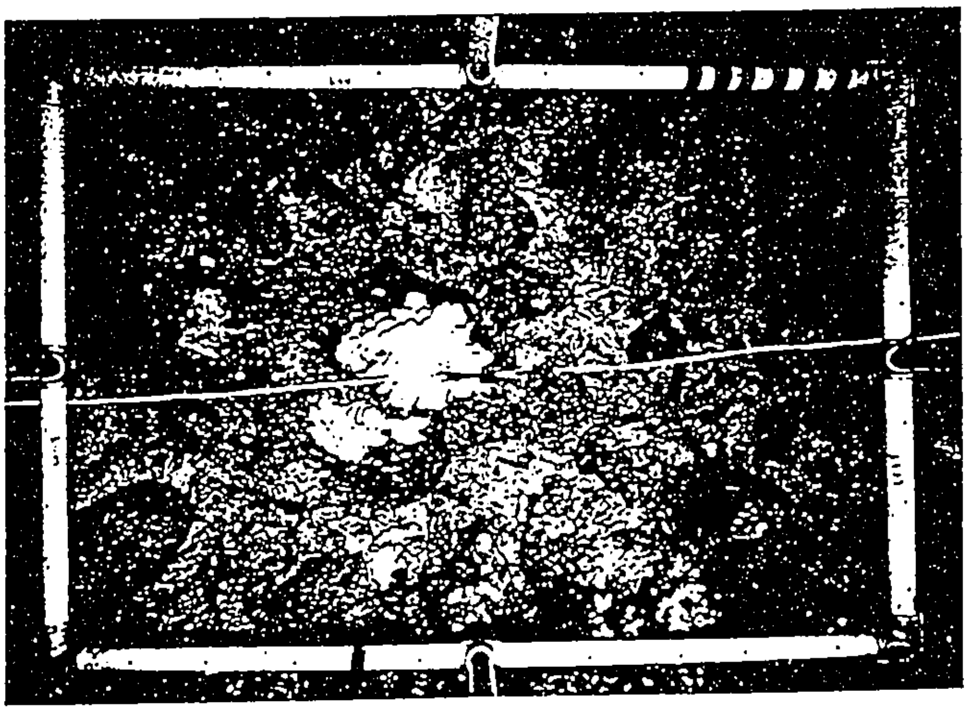

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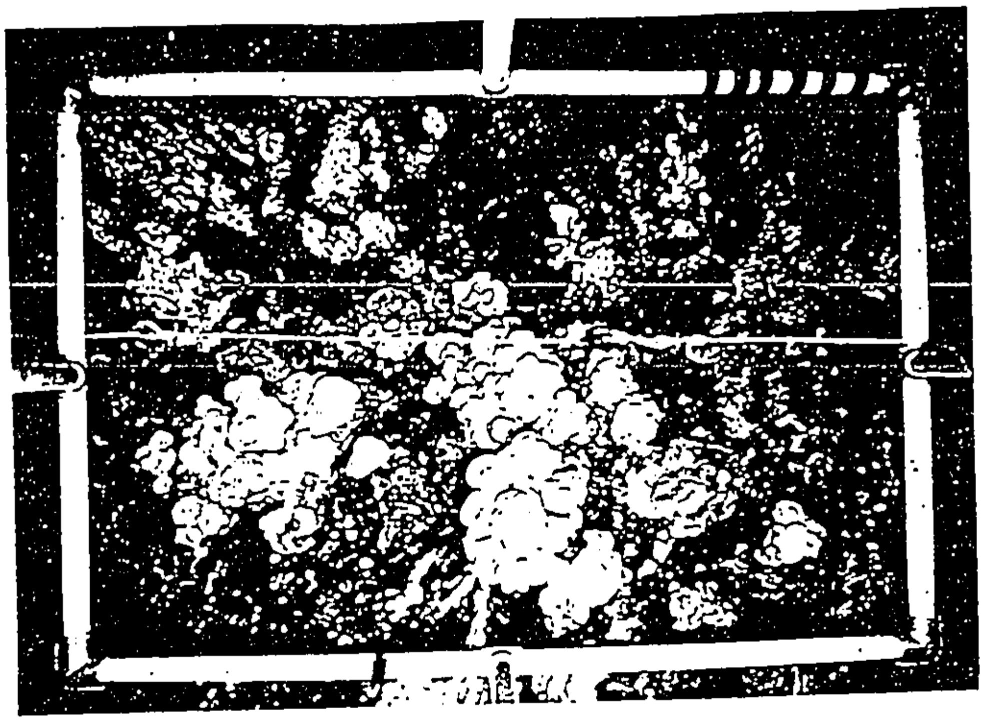

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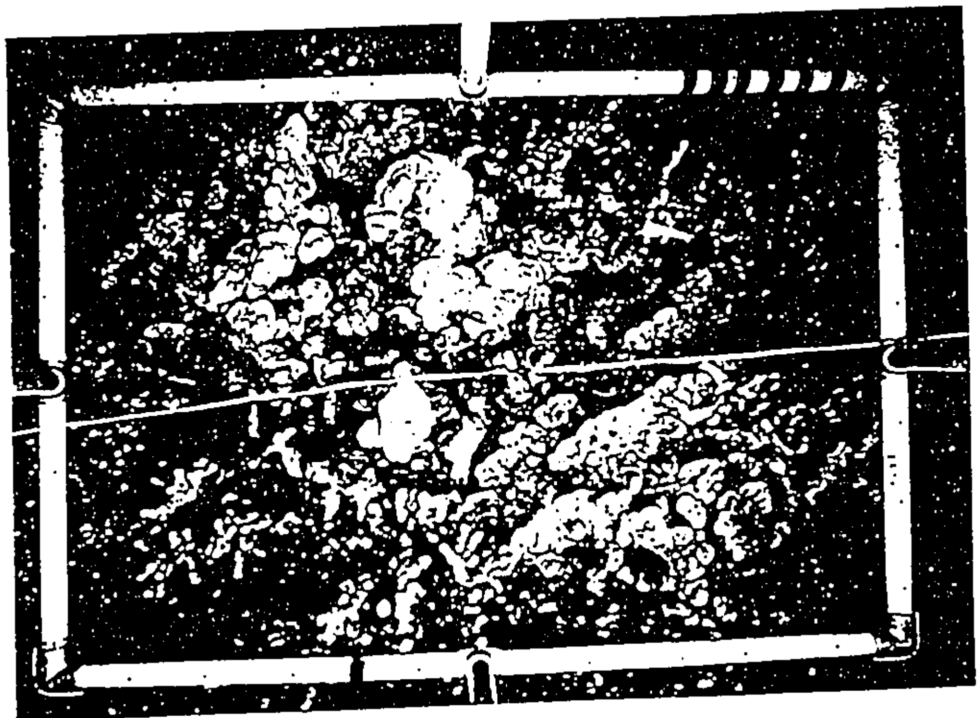

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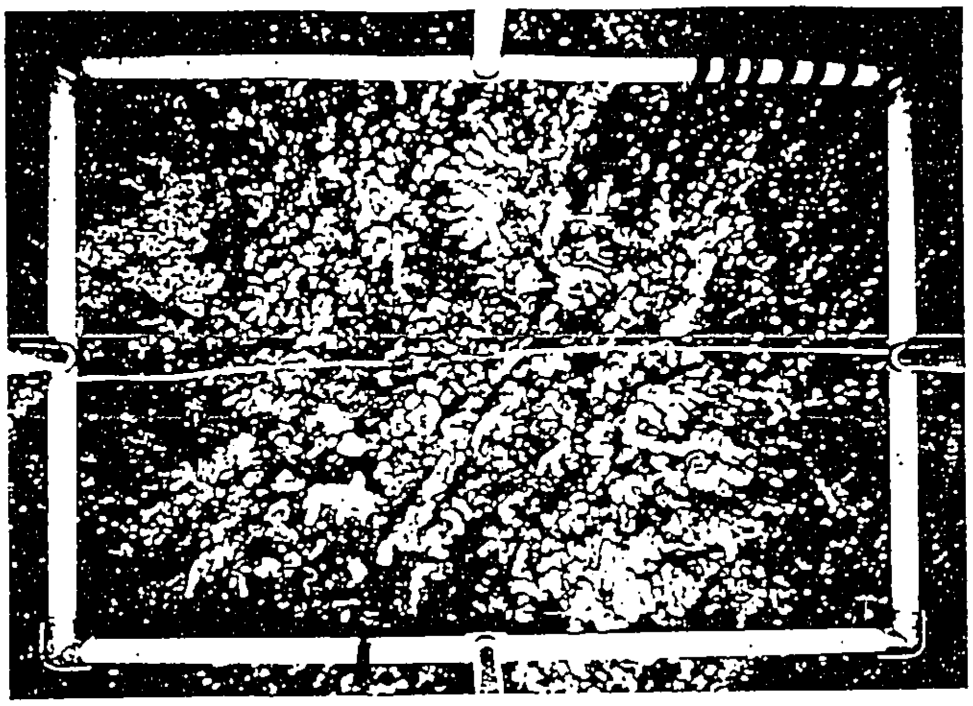

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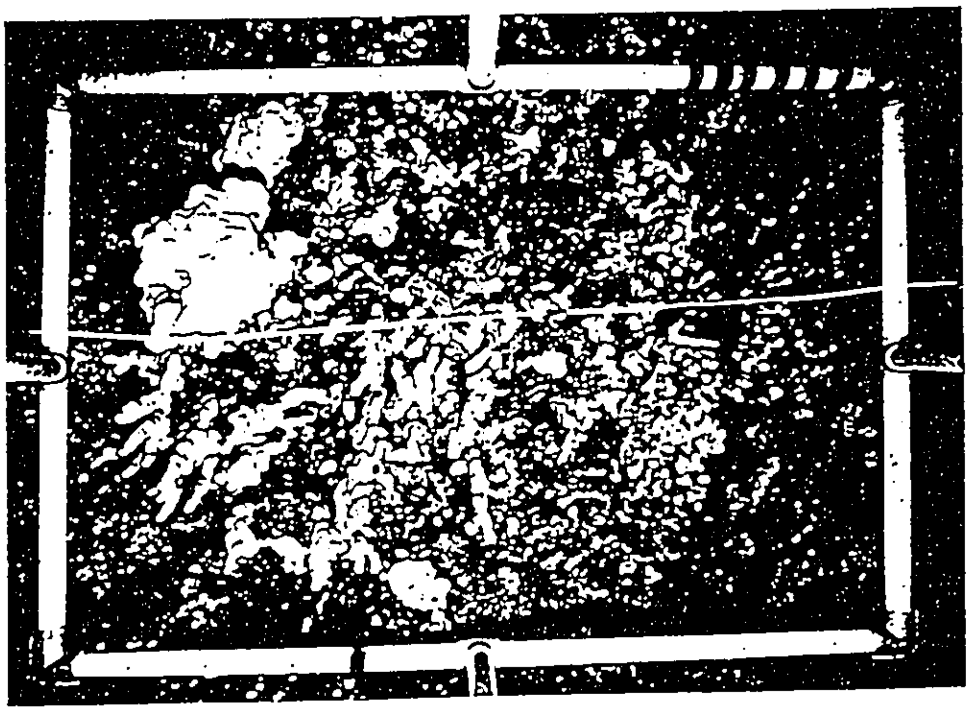

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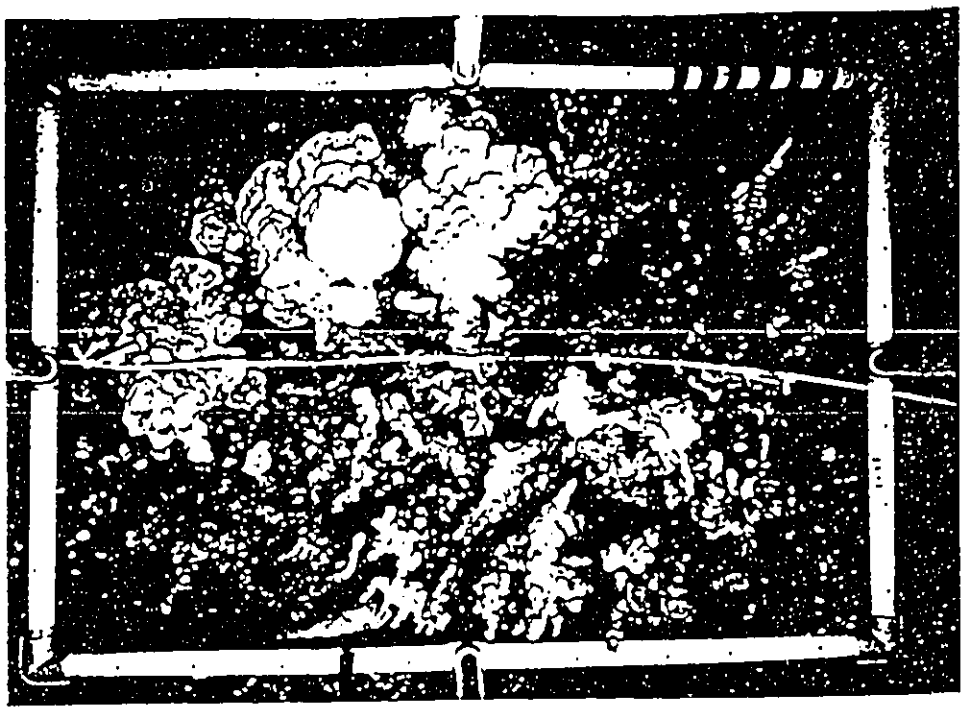

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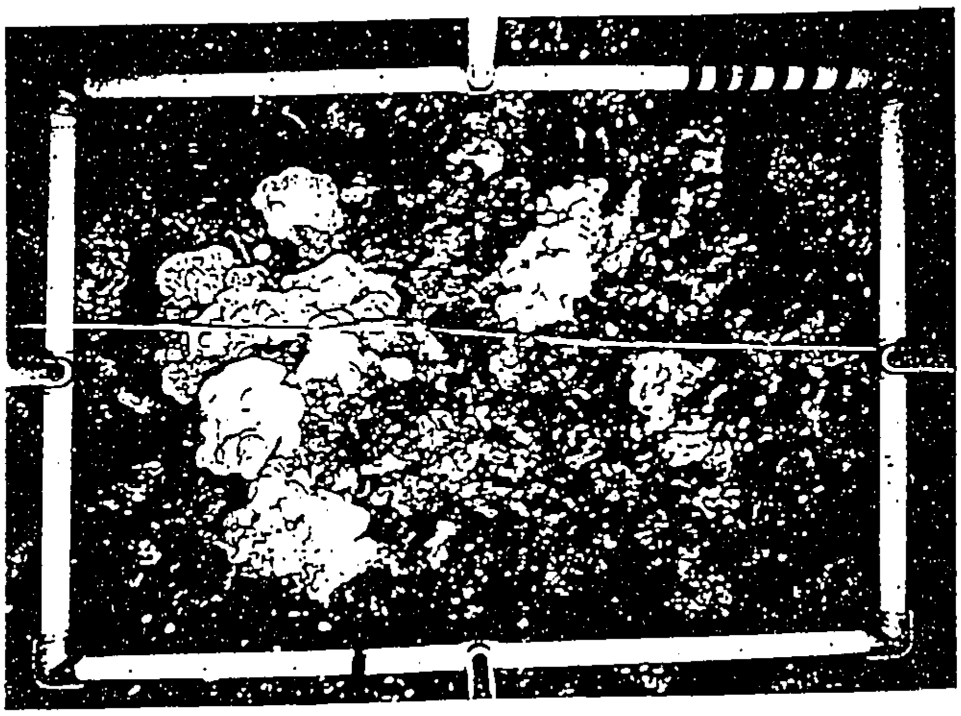

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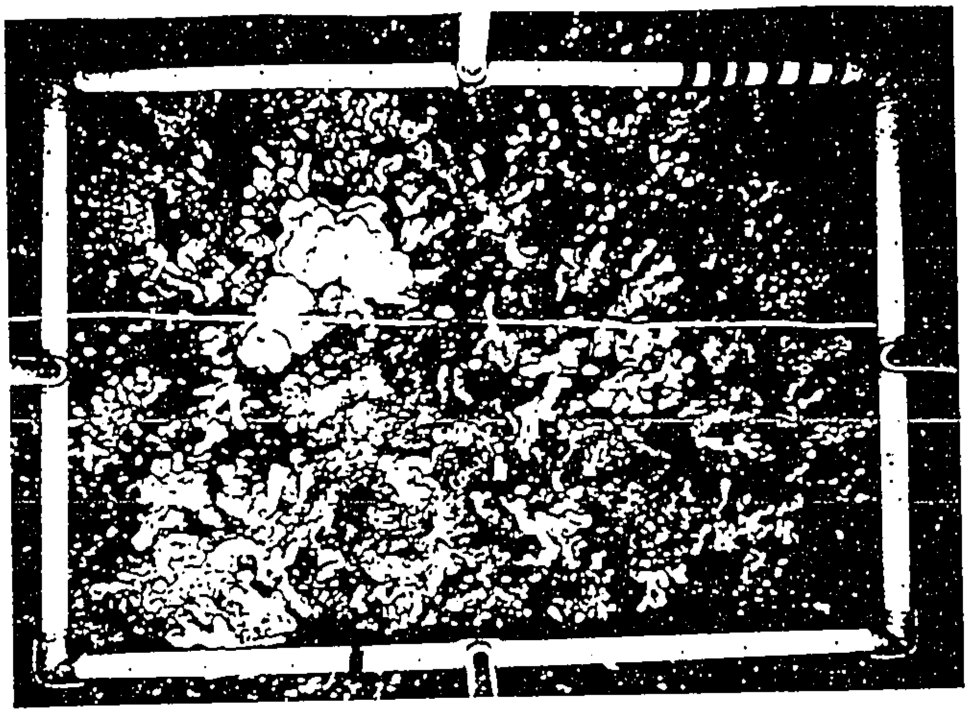

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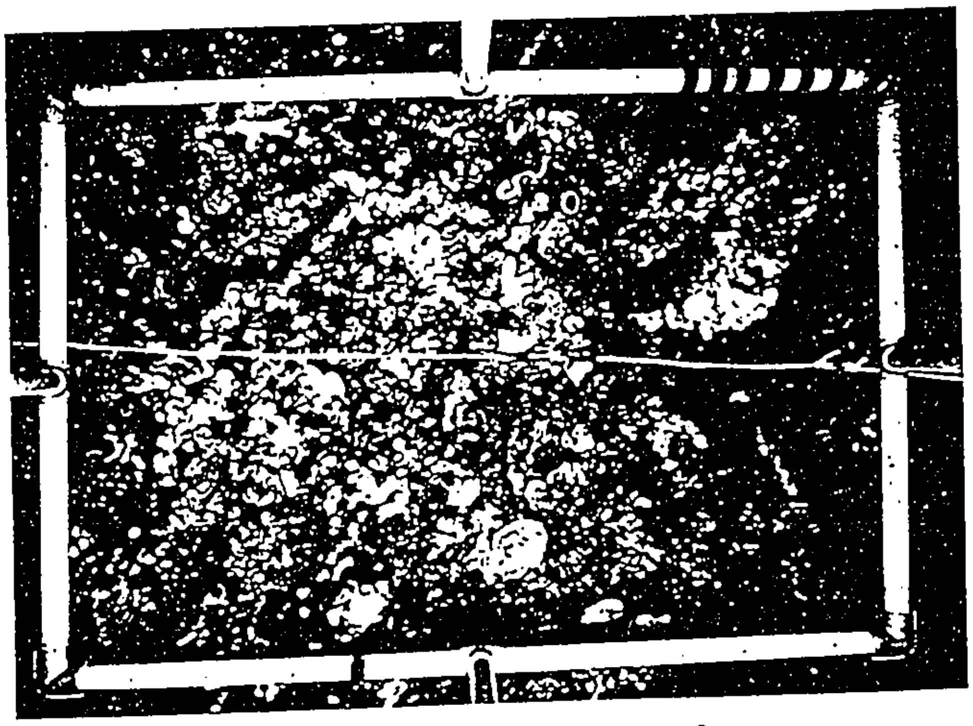

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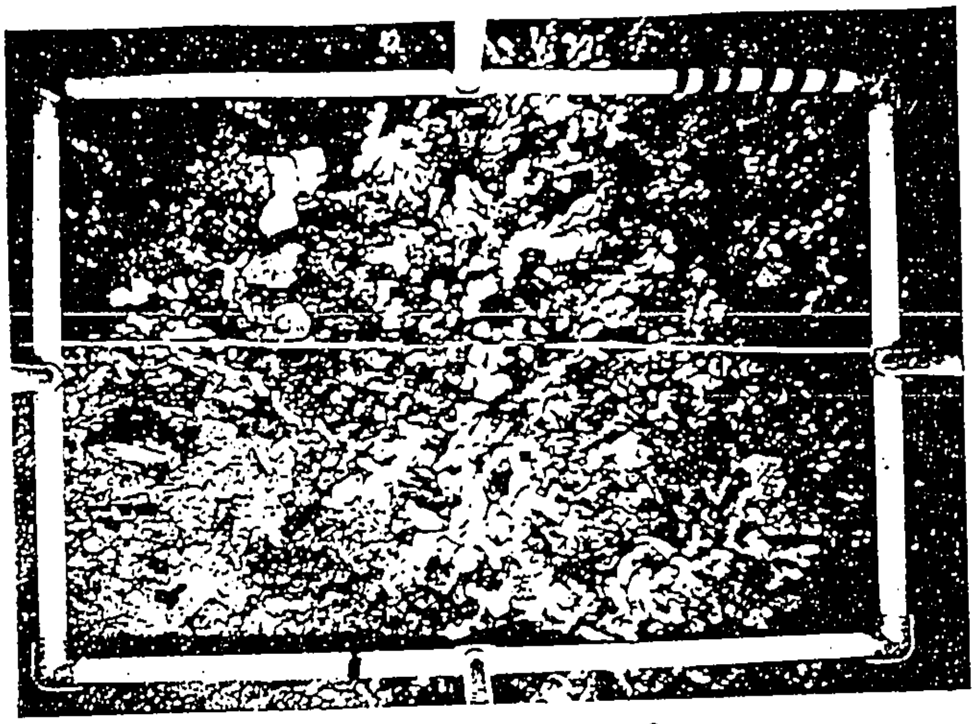

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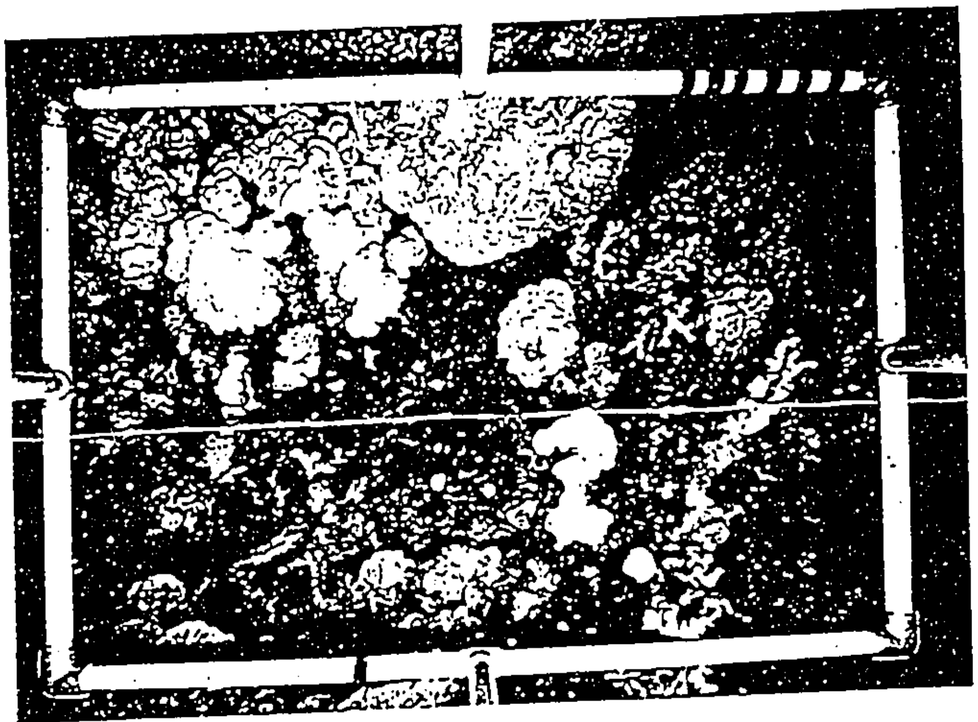

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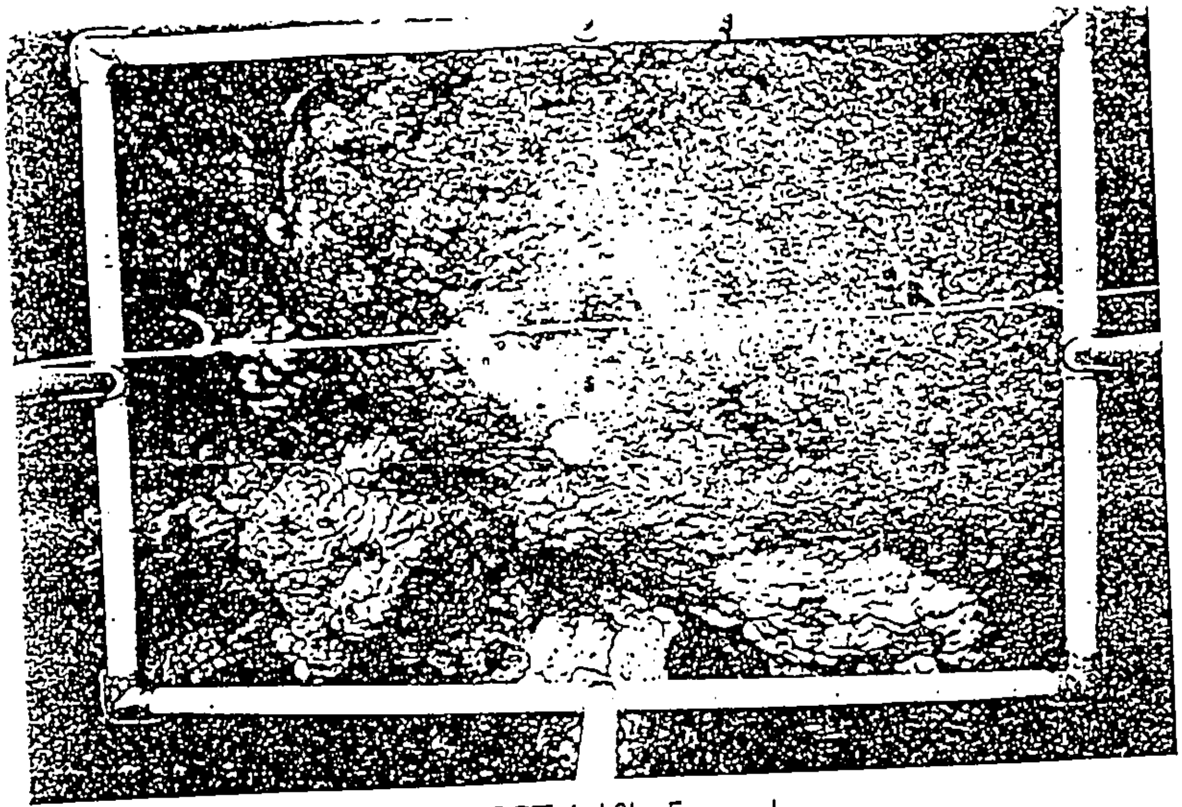

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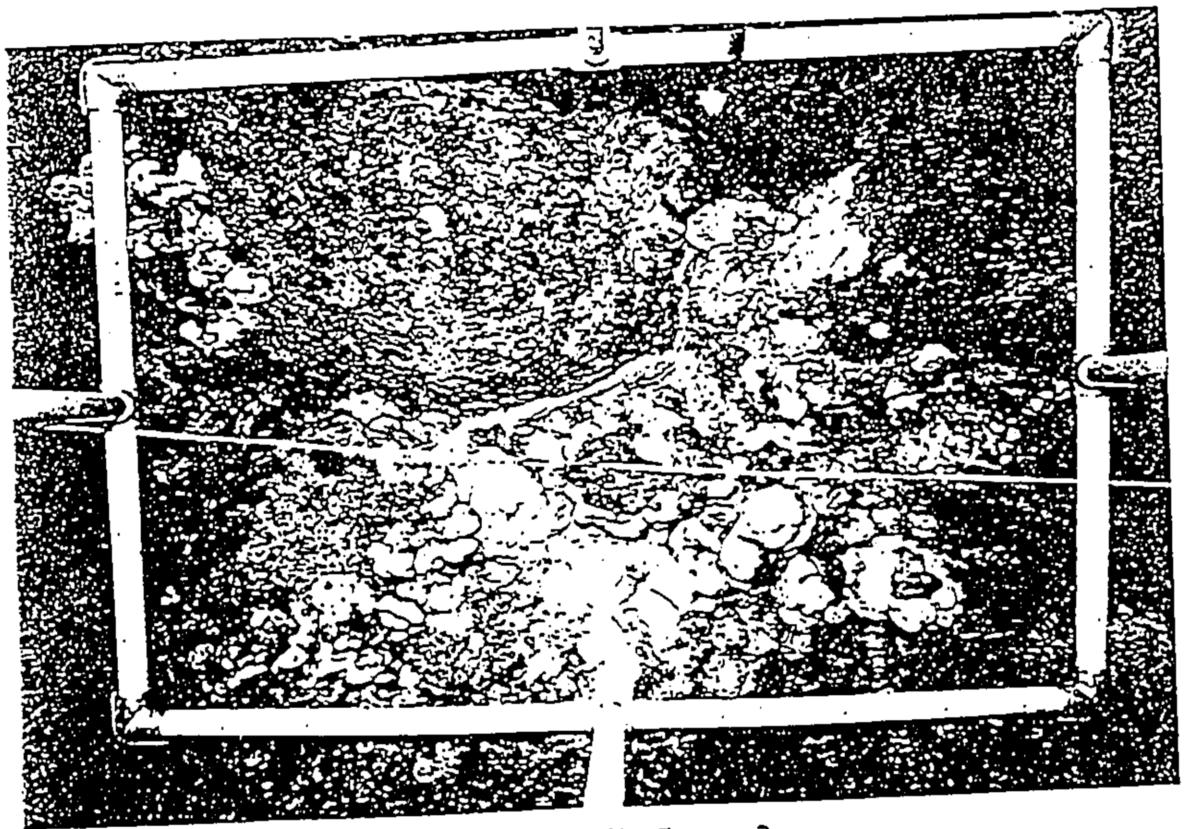

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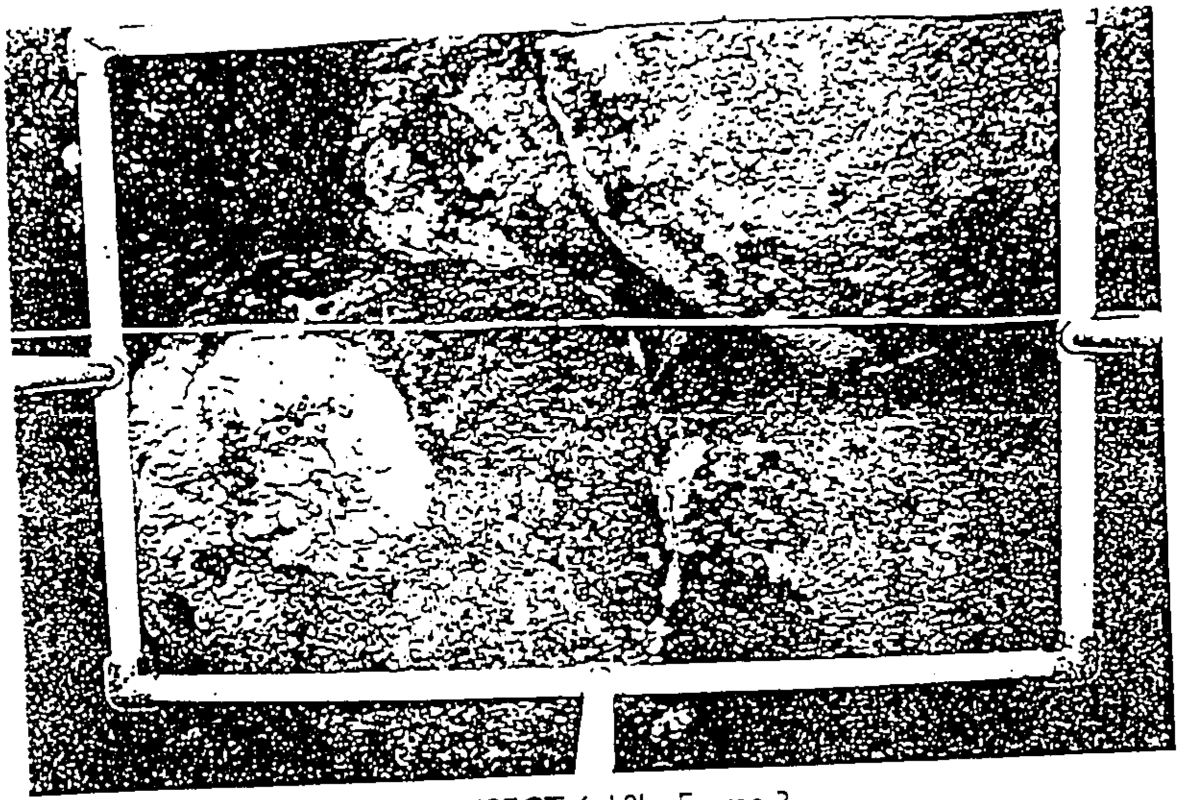

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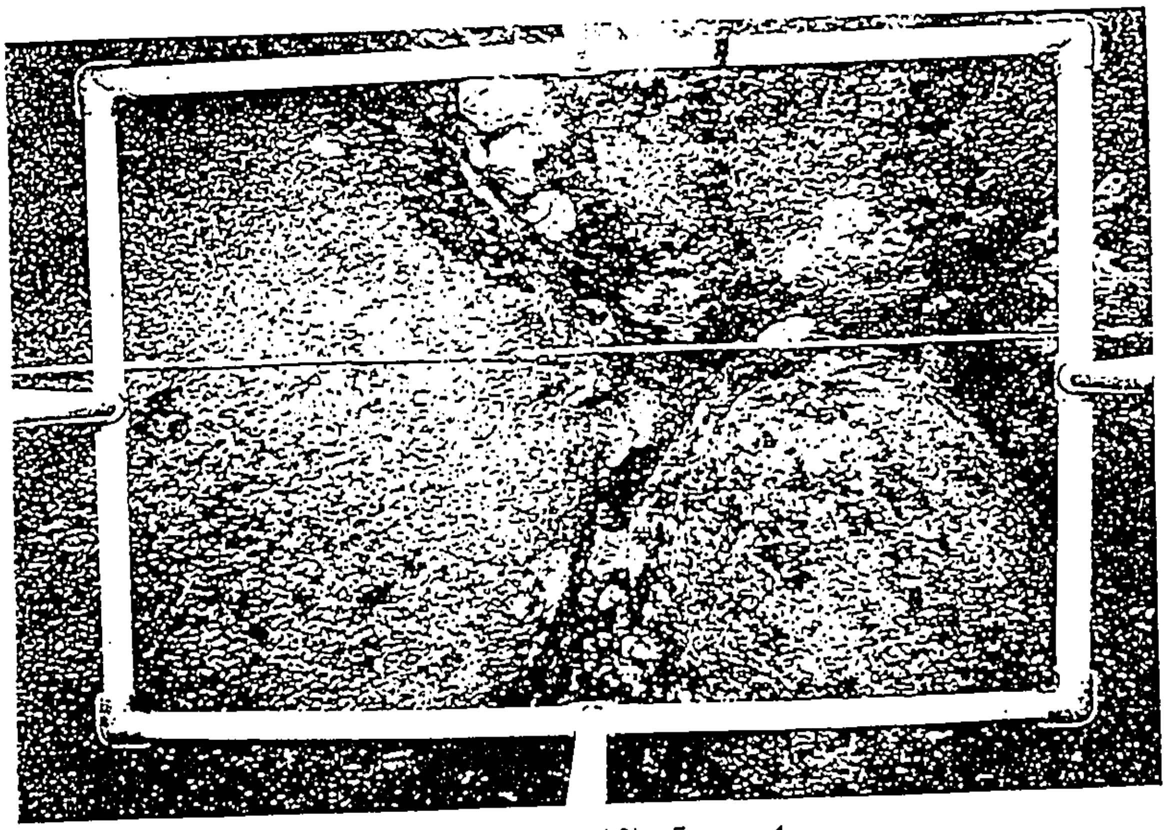

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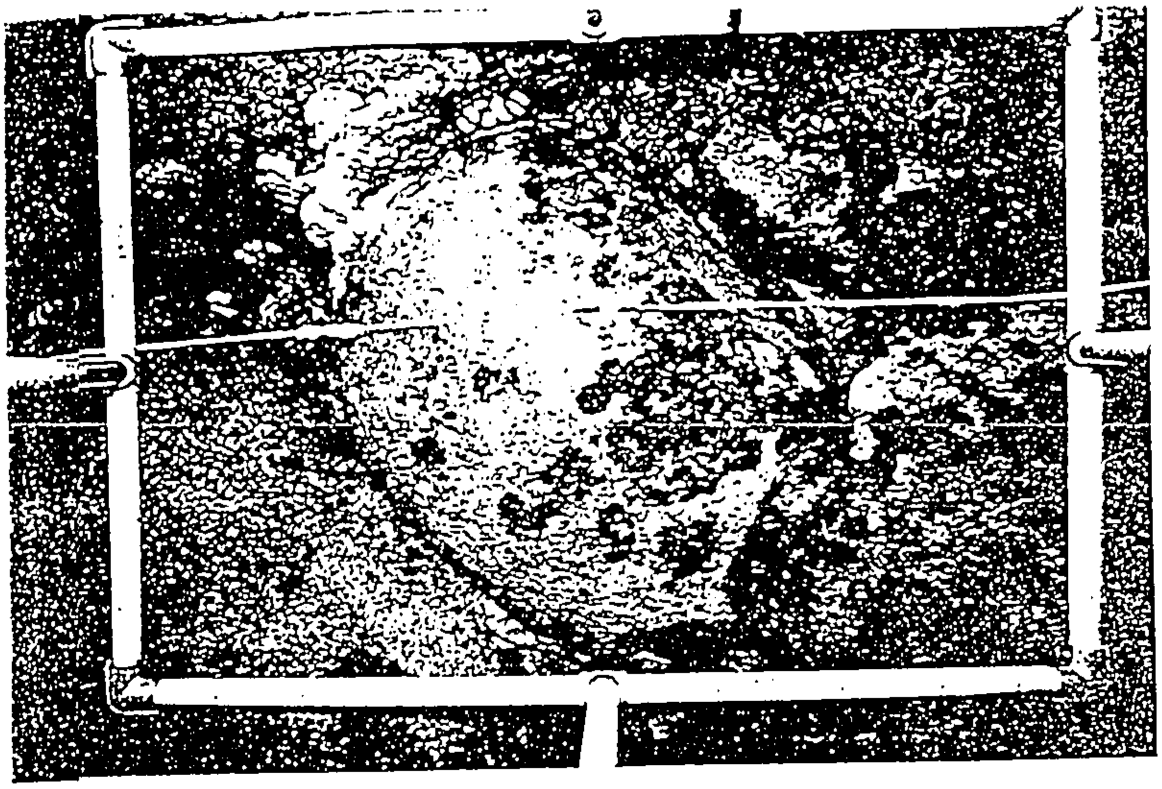

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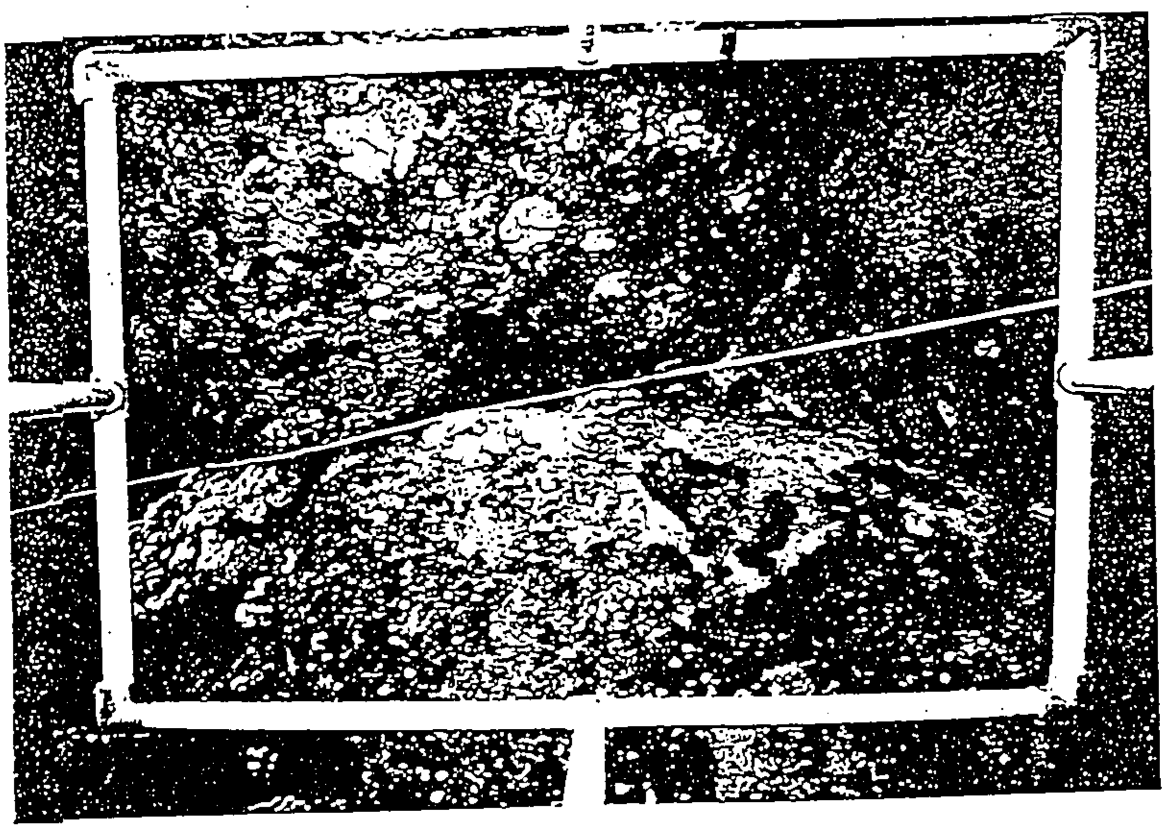

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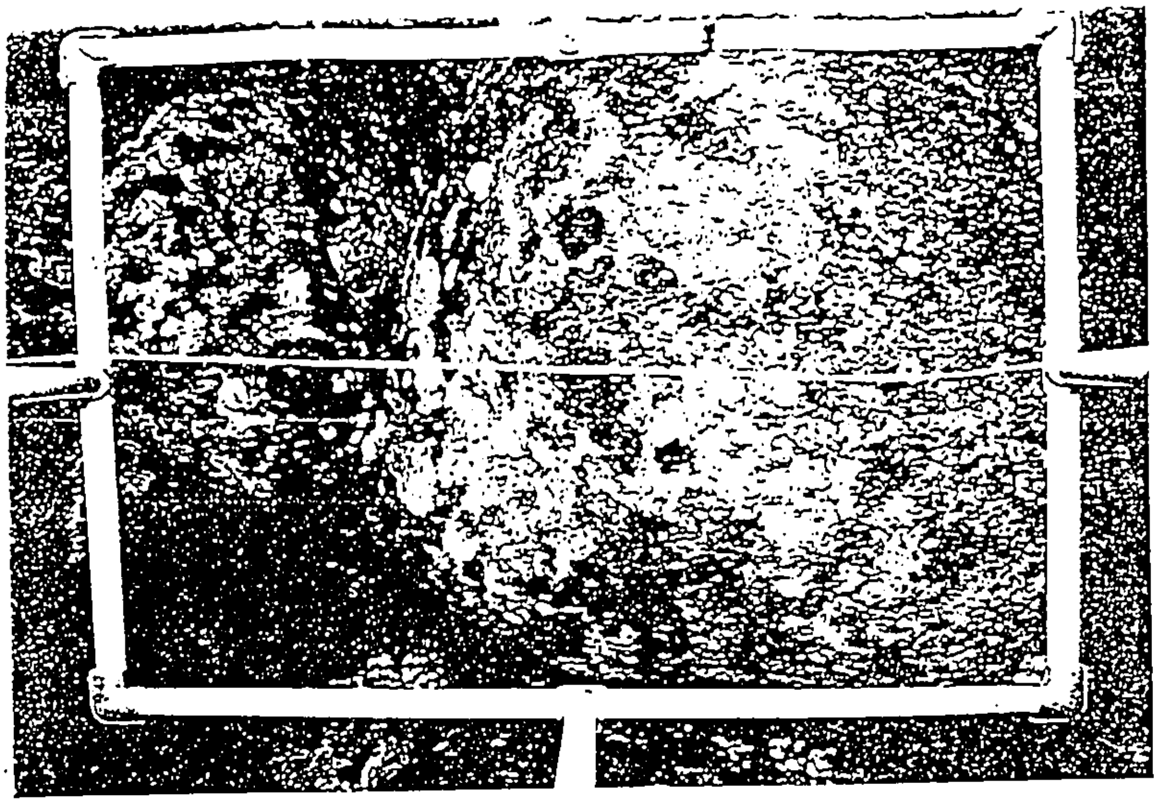

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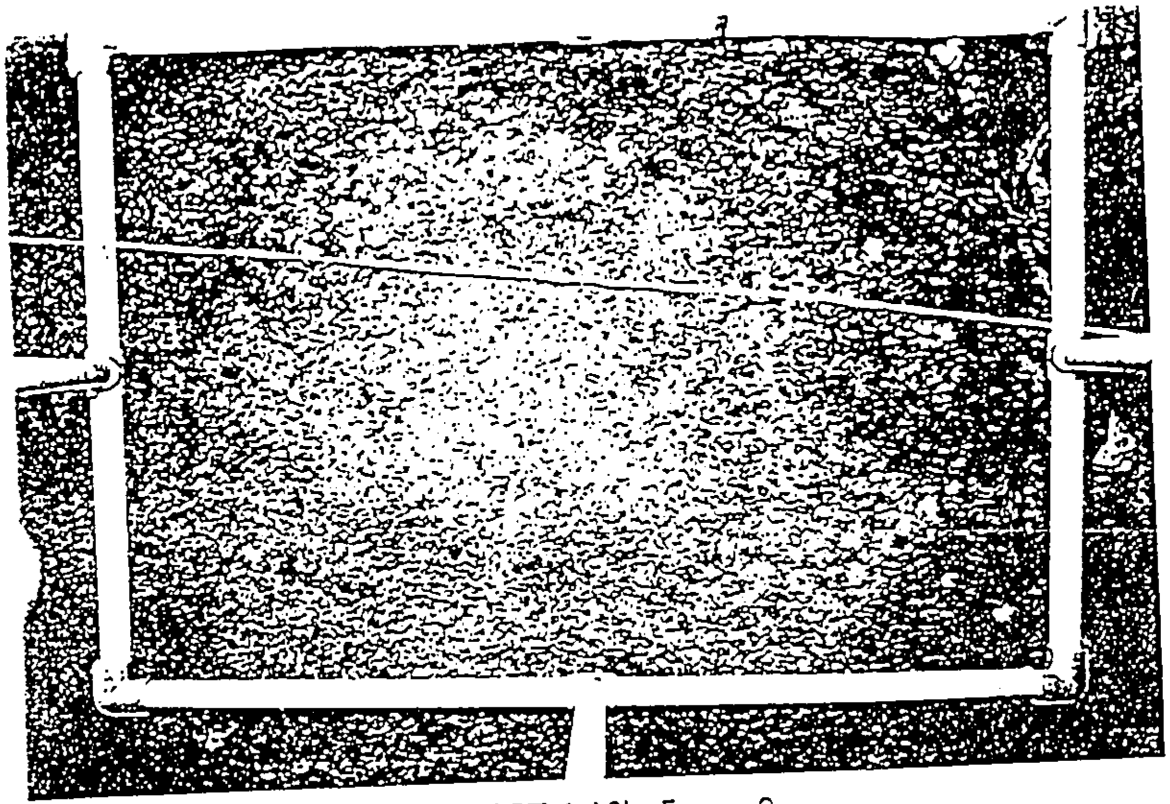

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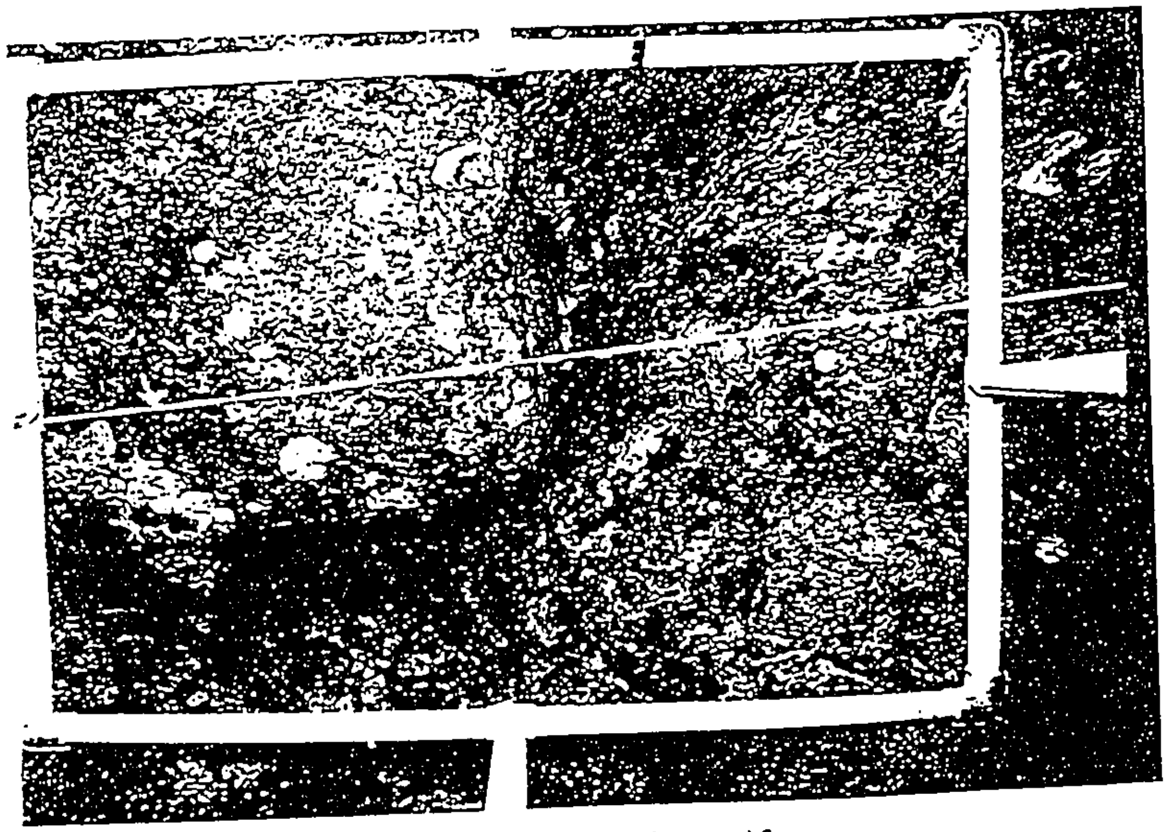

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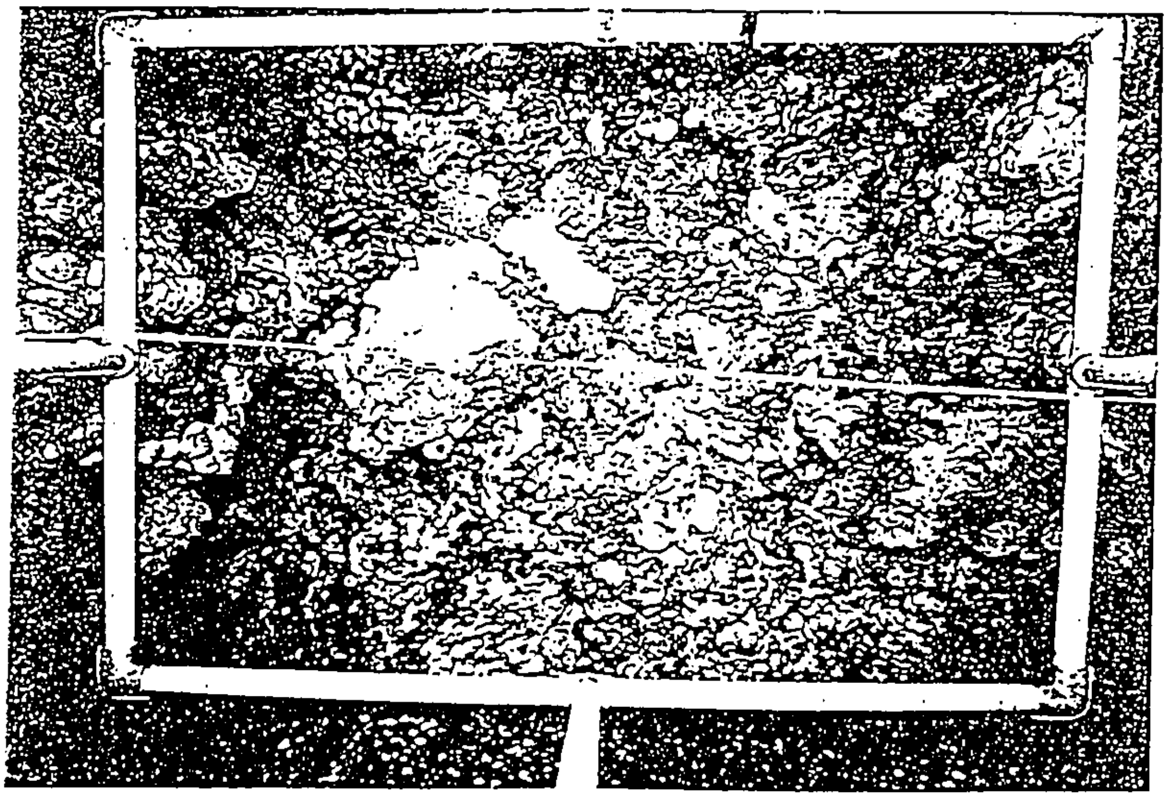

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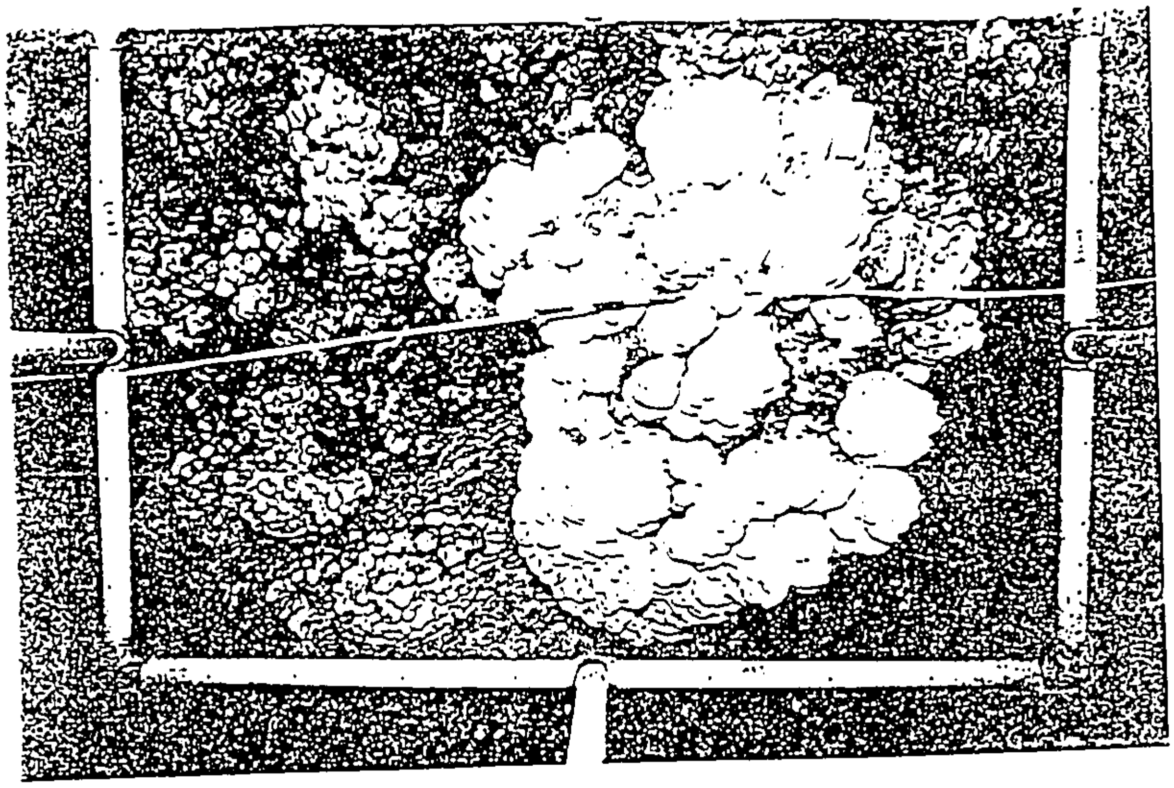

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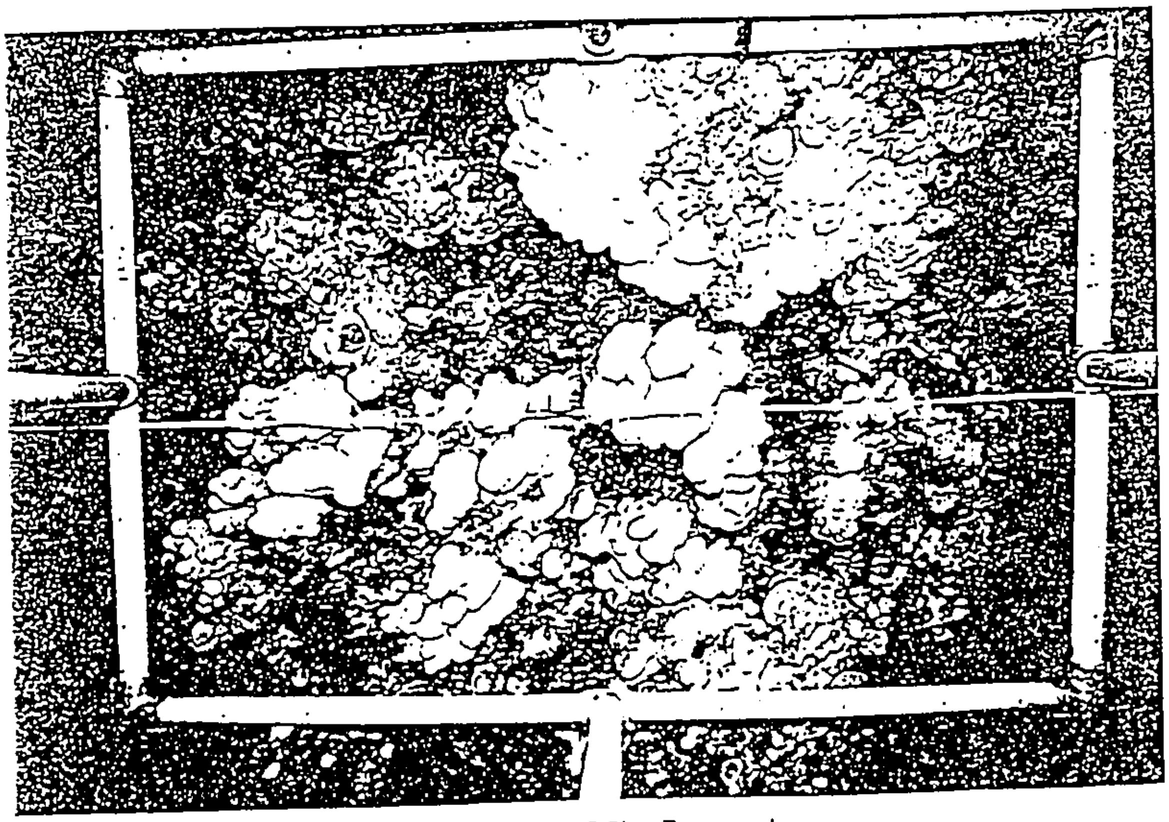

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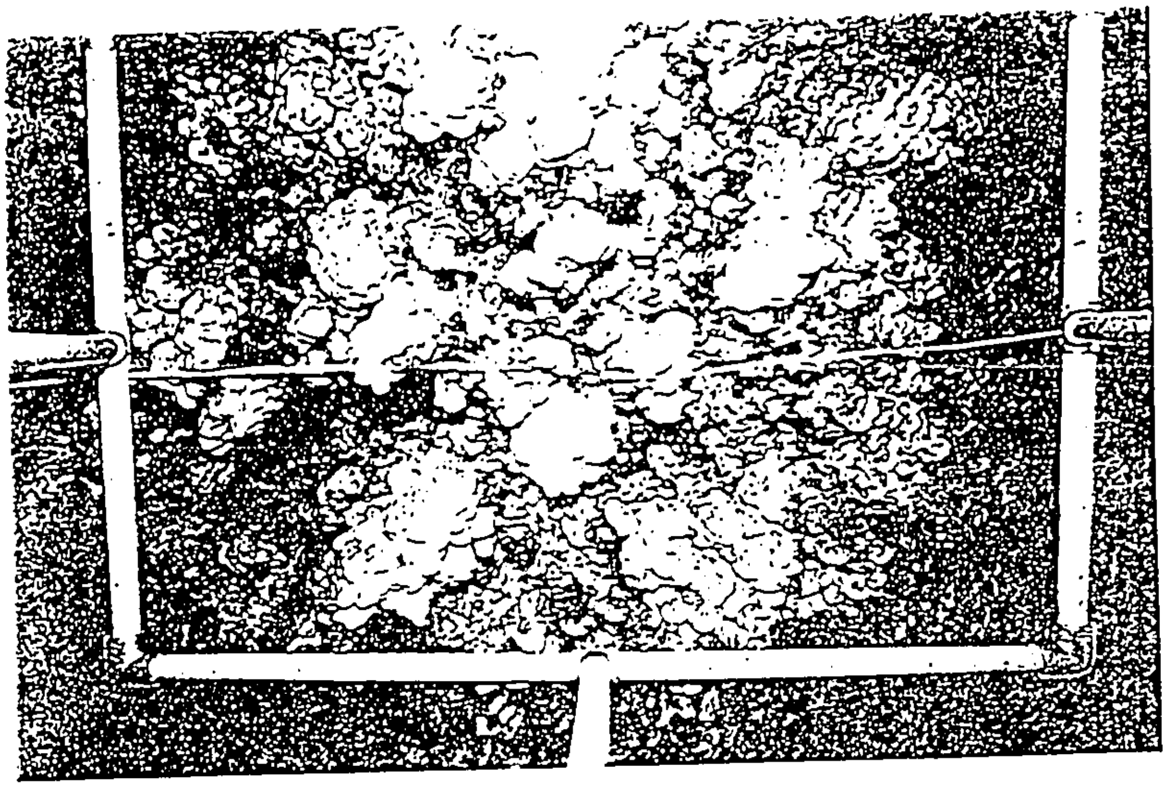
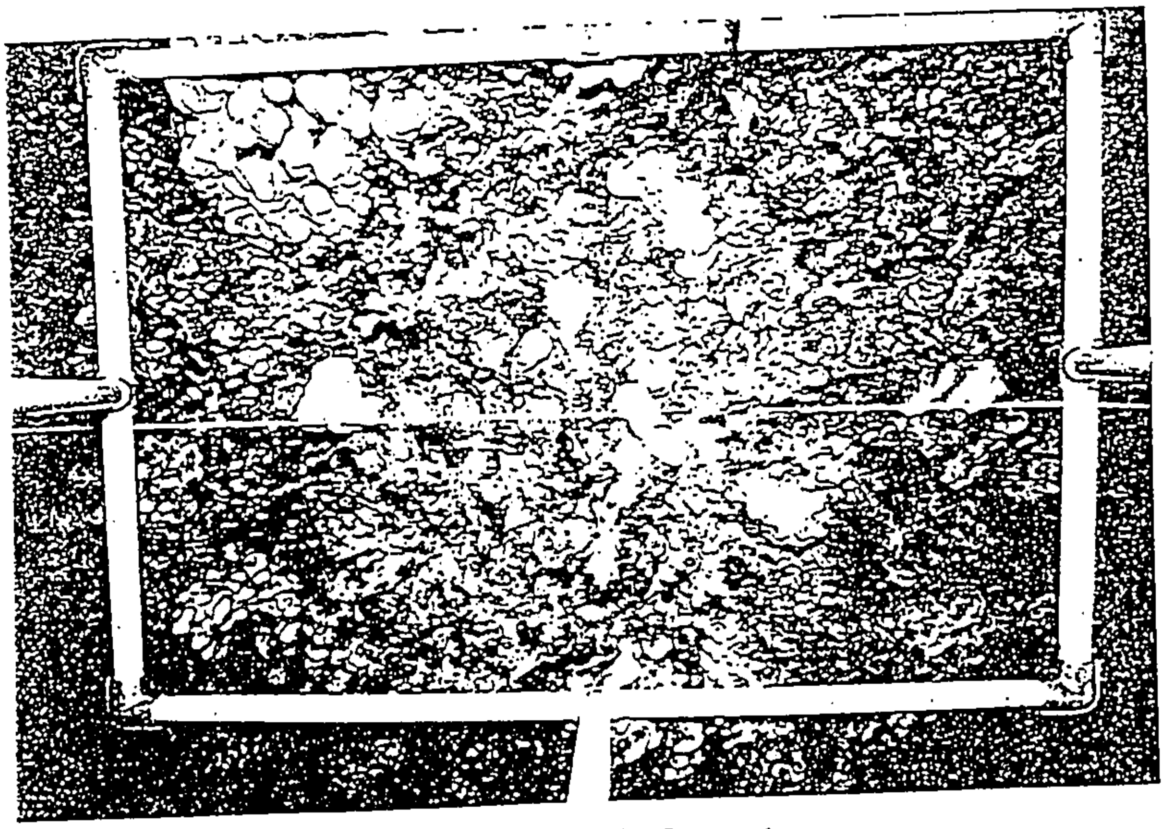


TRANSECT 6-25' - Frame 5



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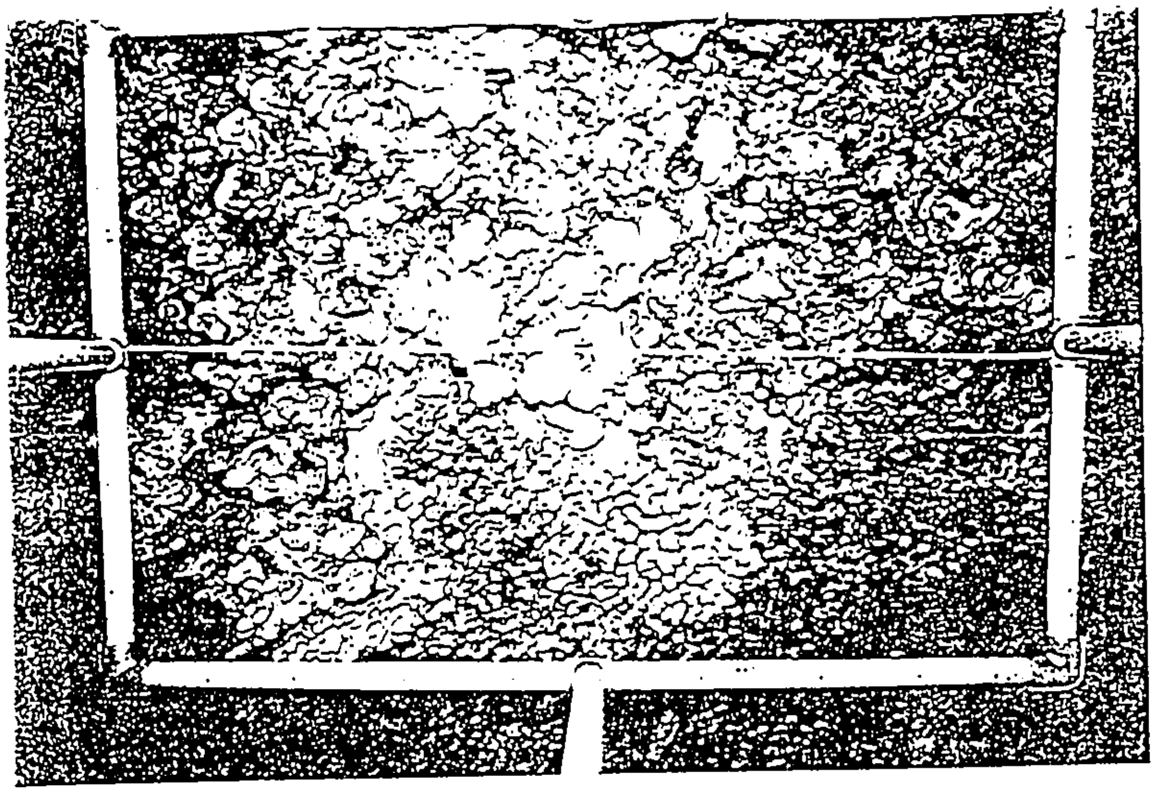

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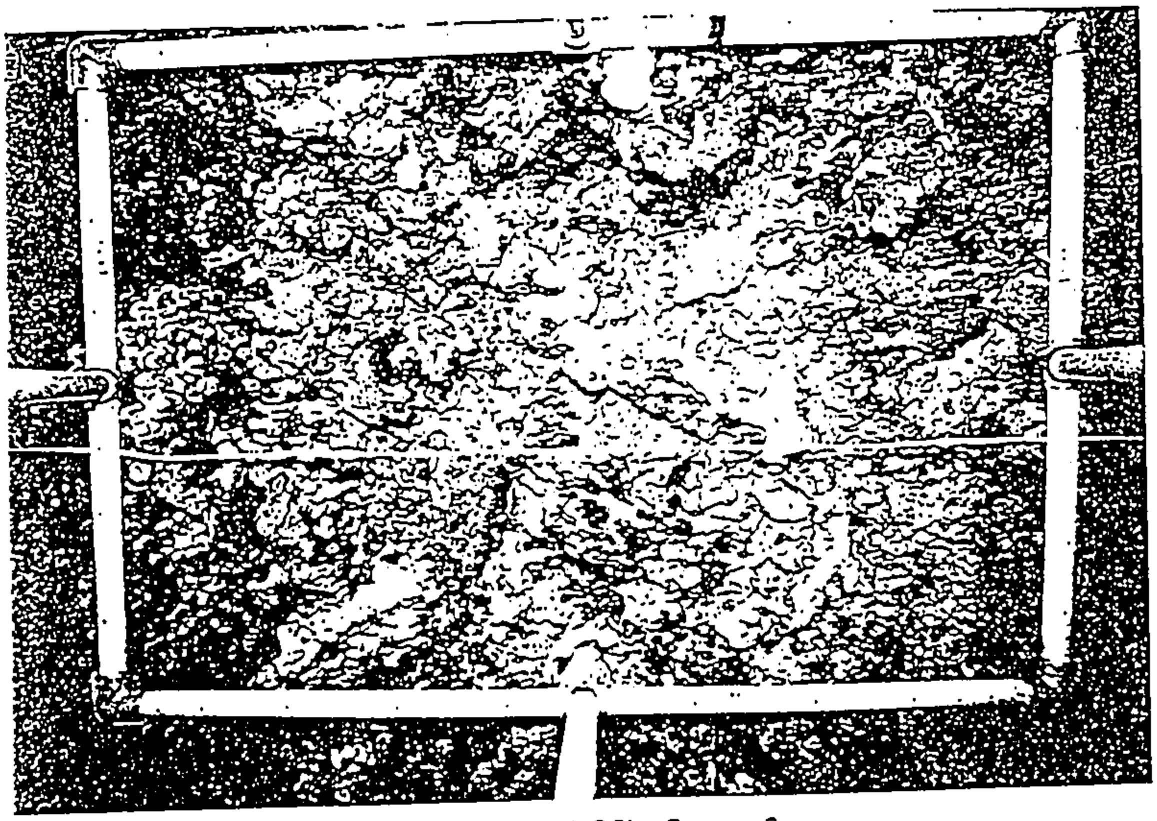

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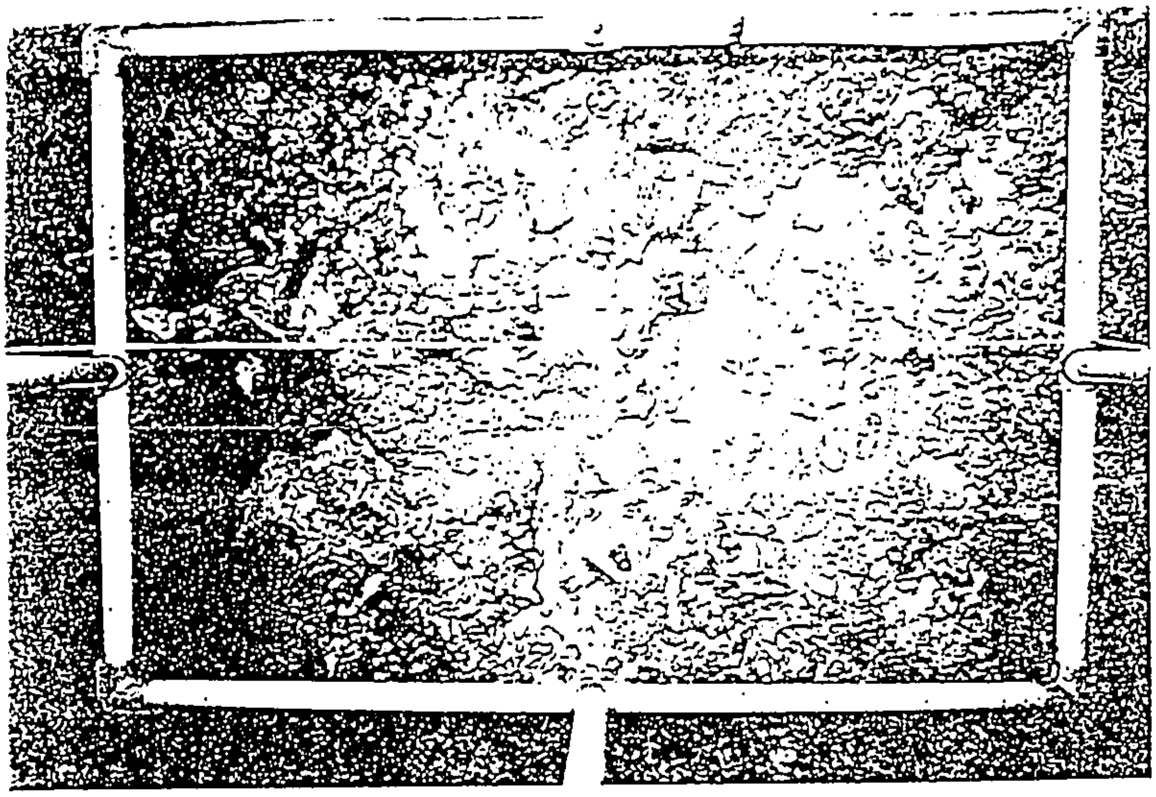

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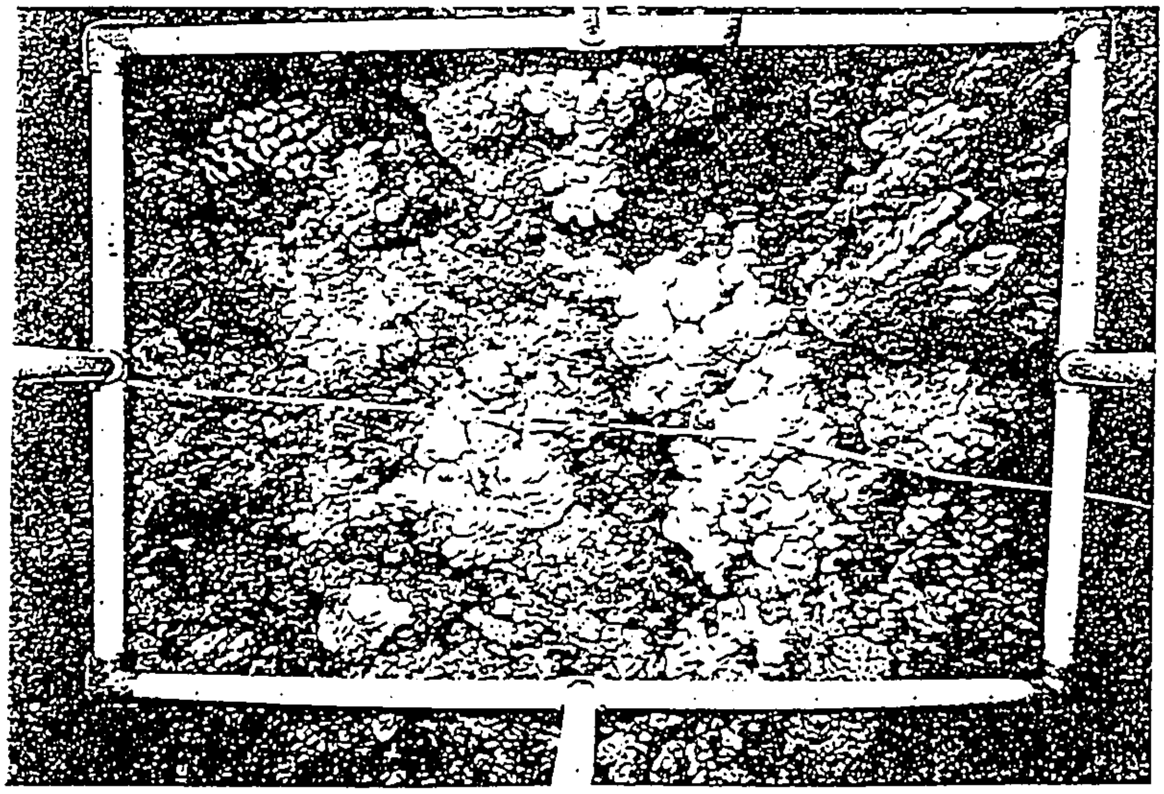

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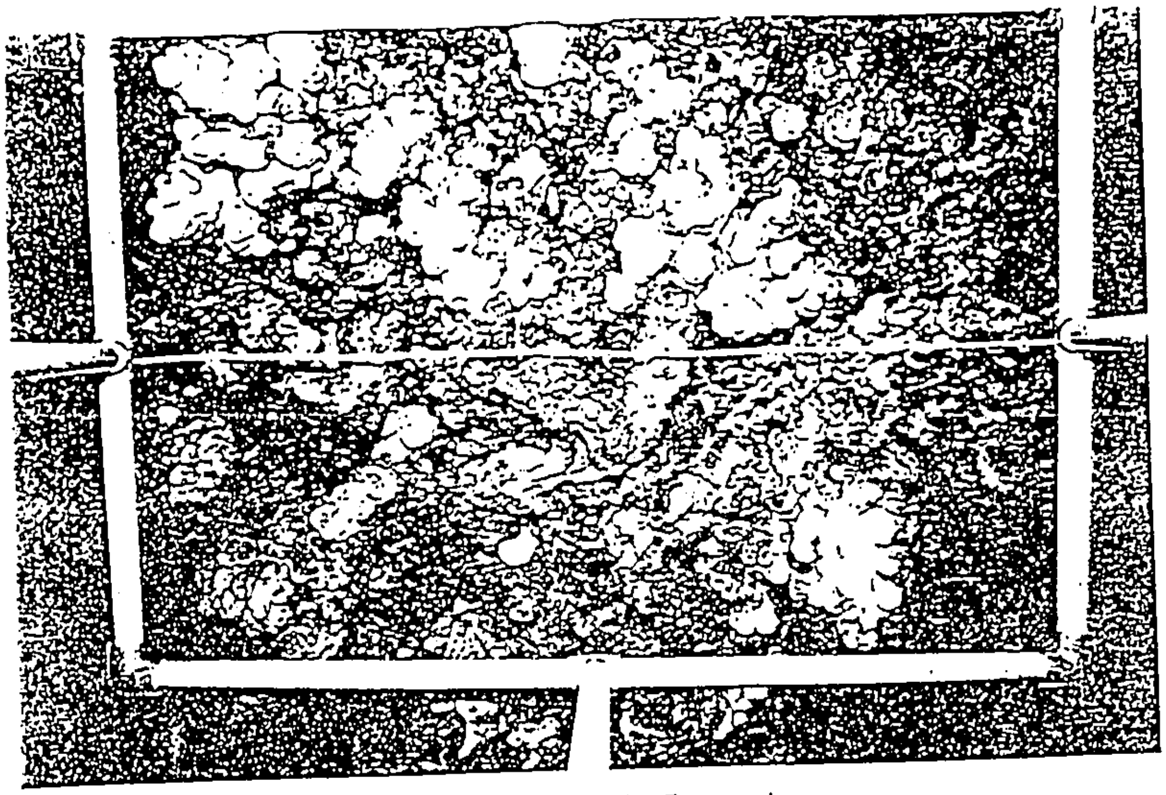

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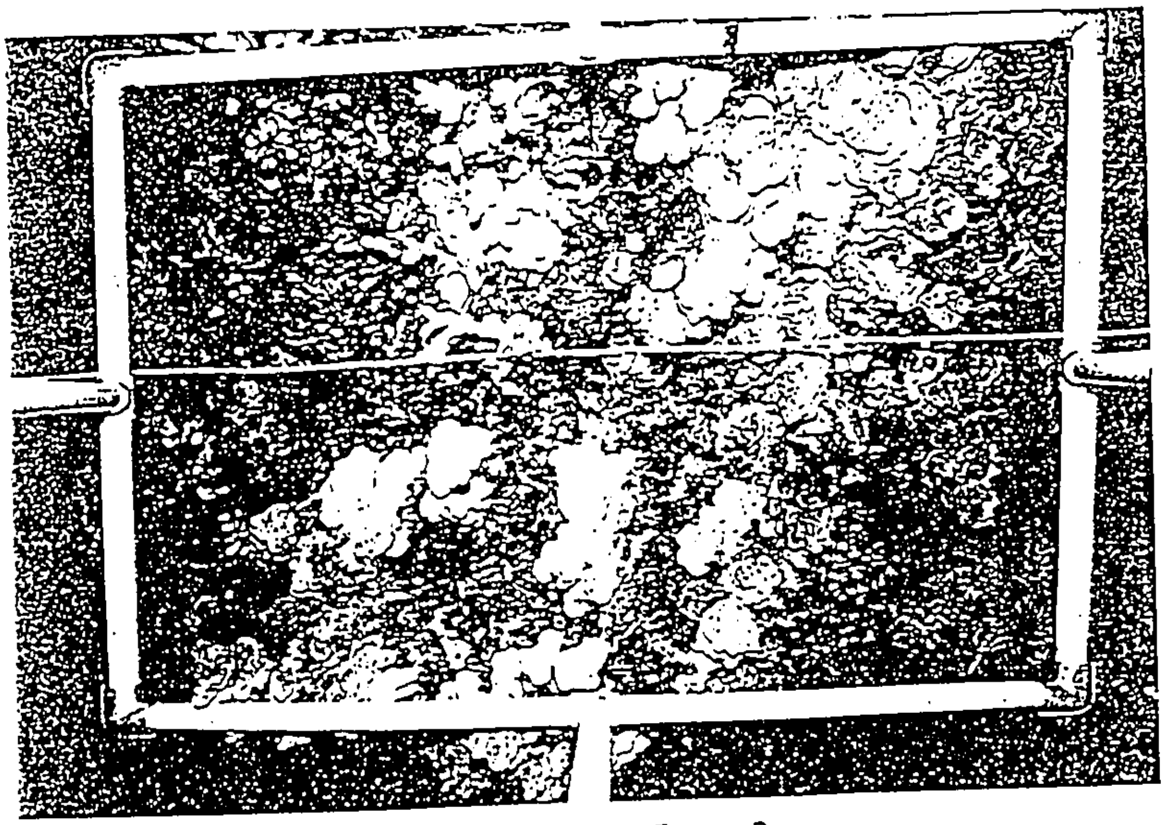

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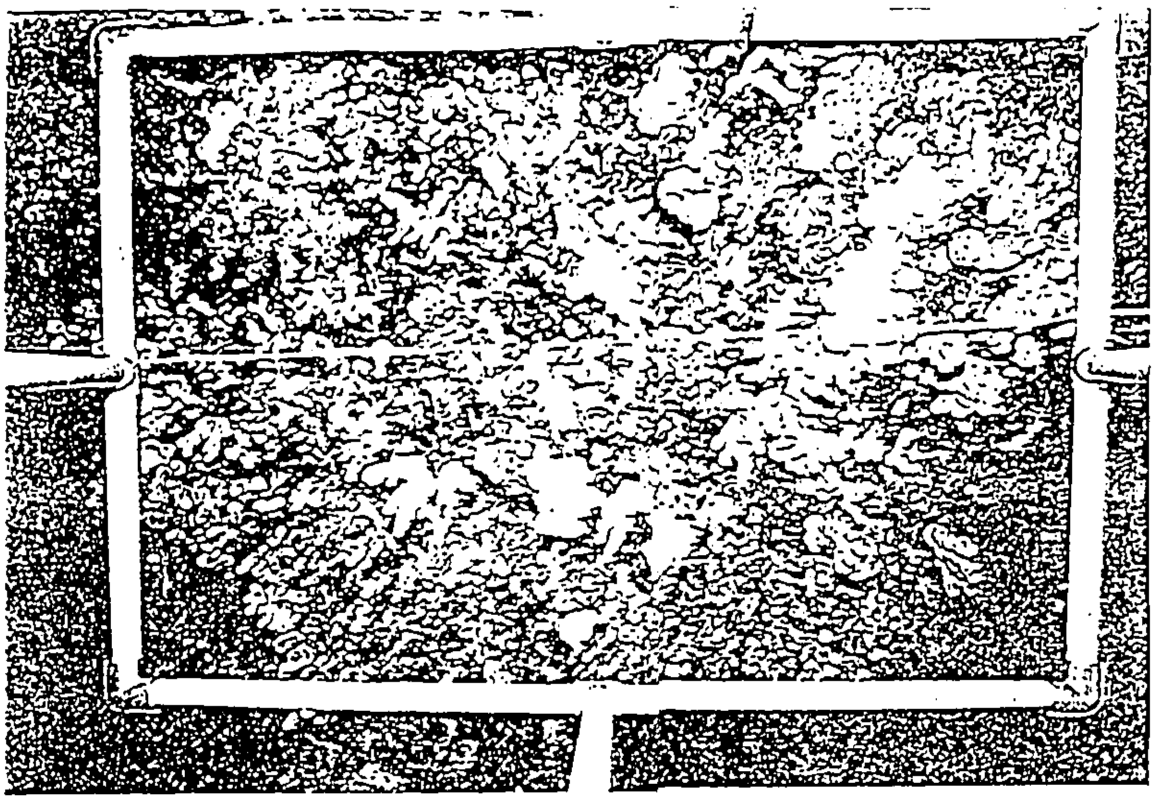

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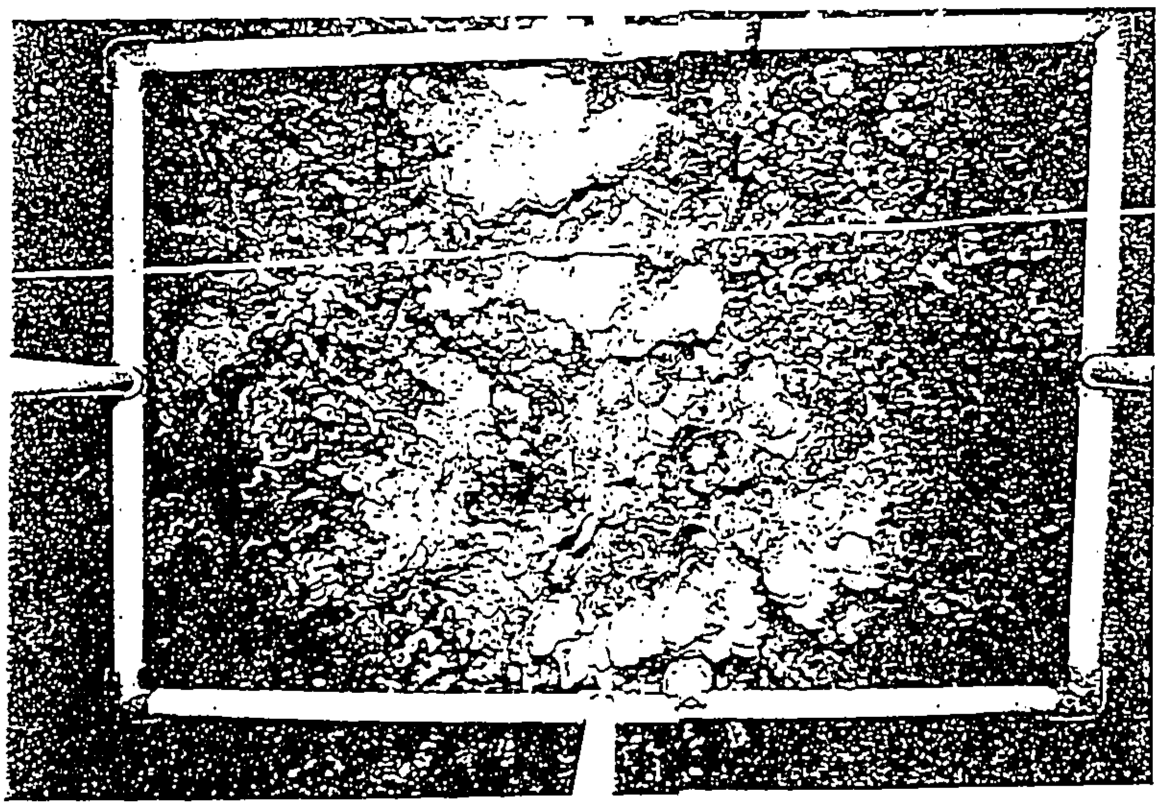

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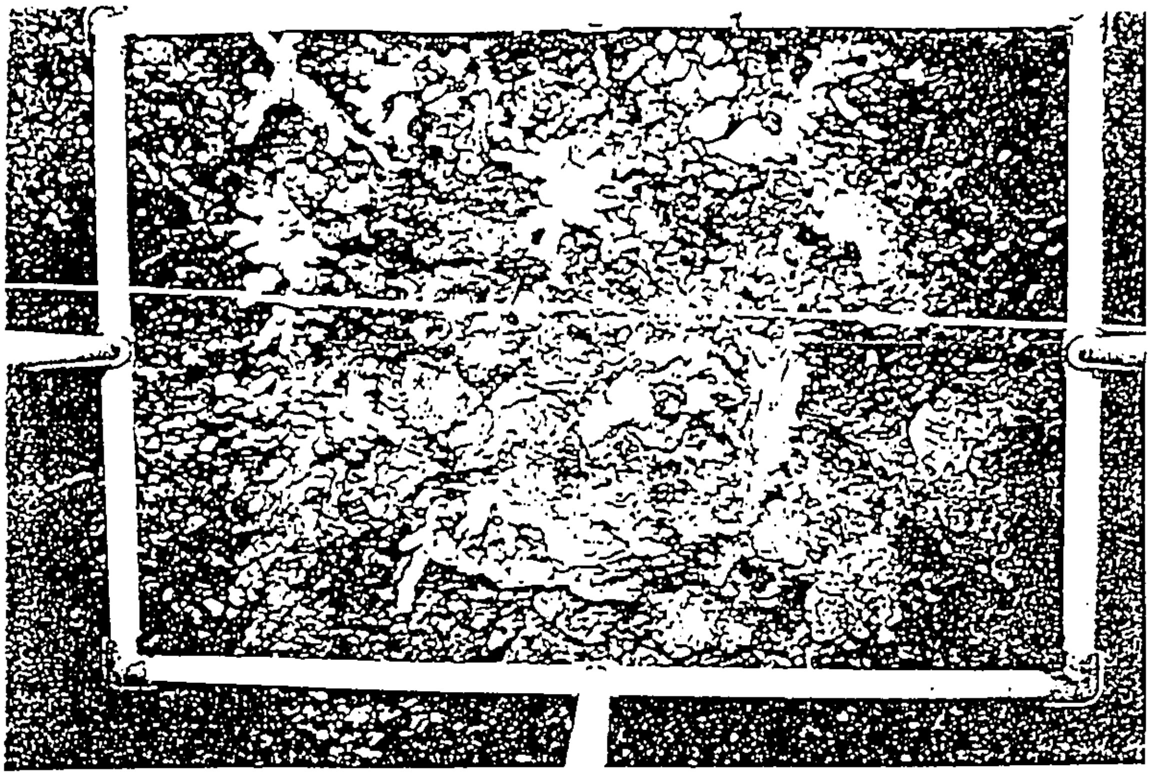

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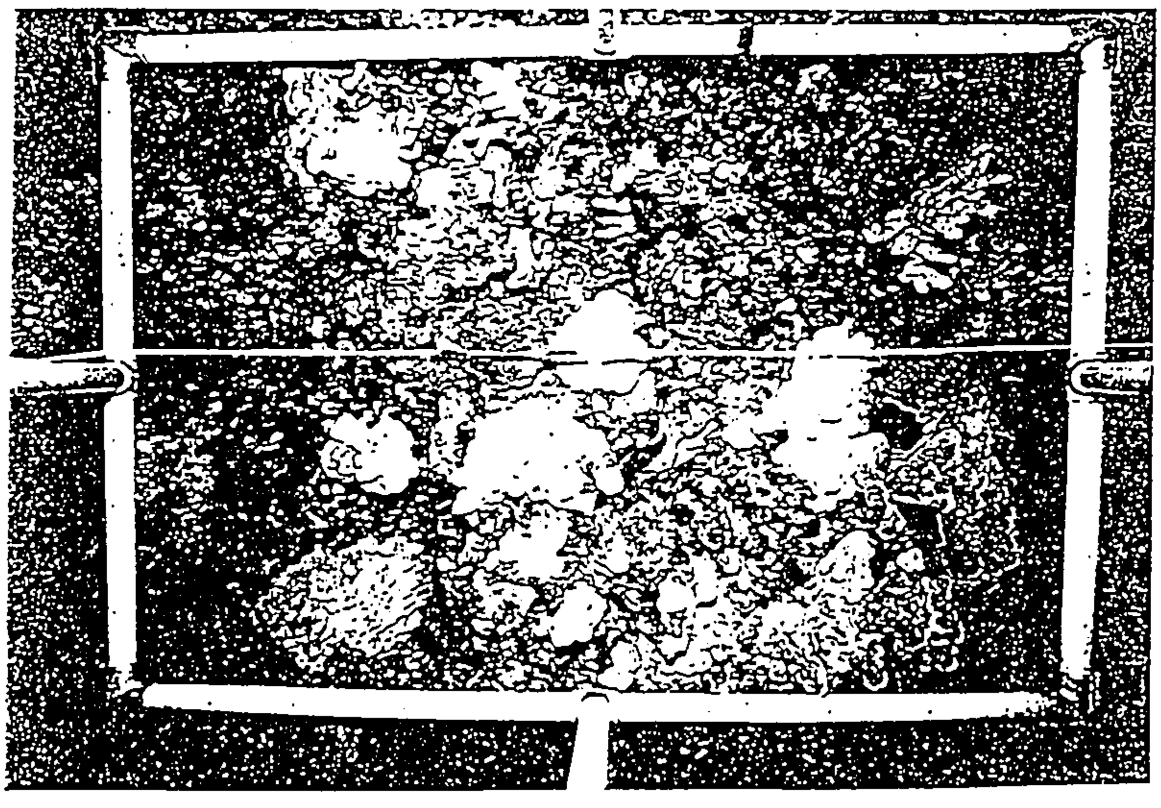

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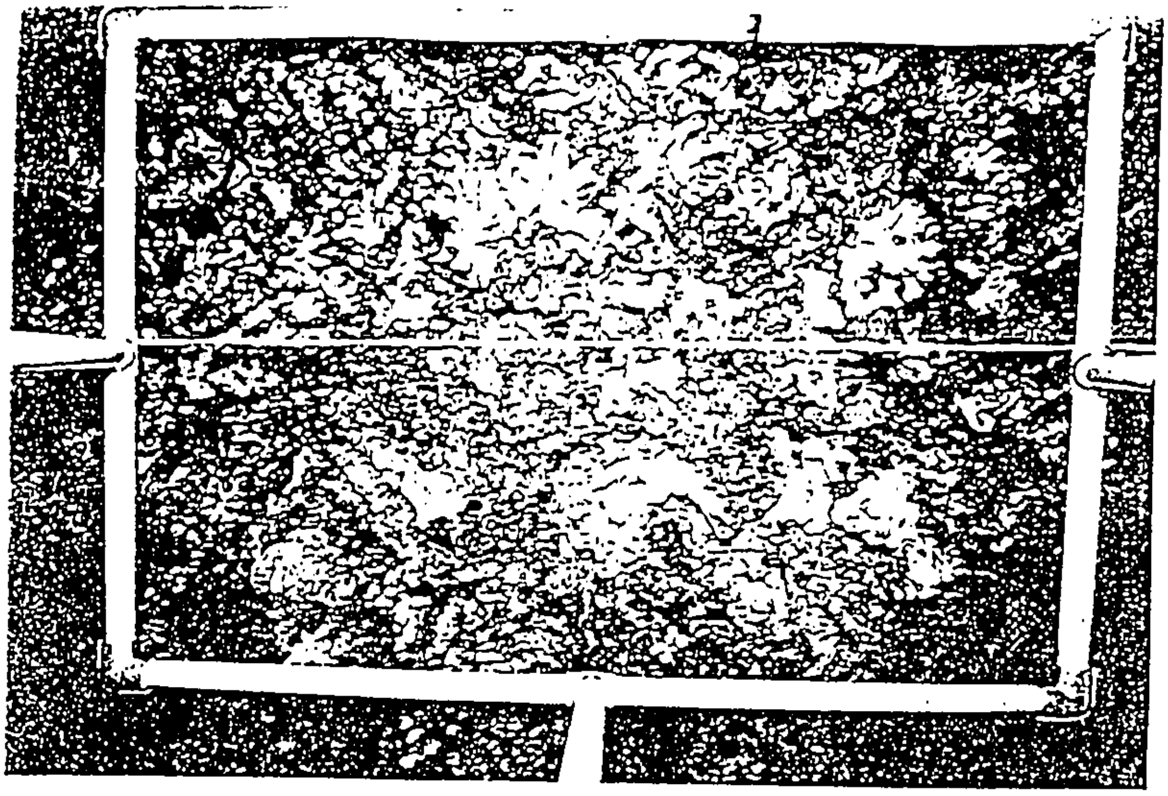

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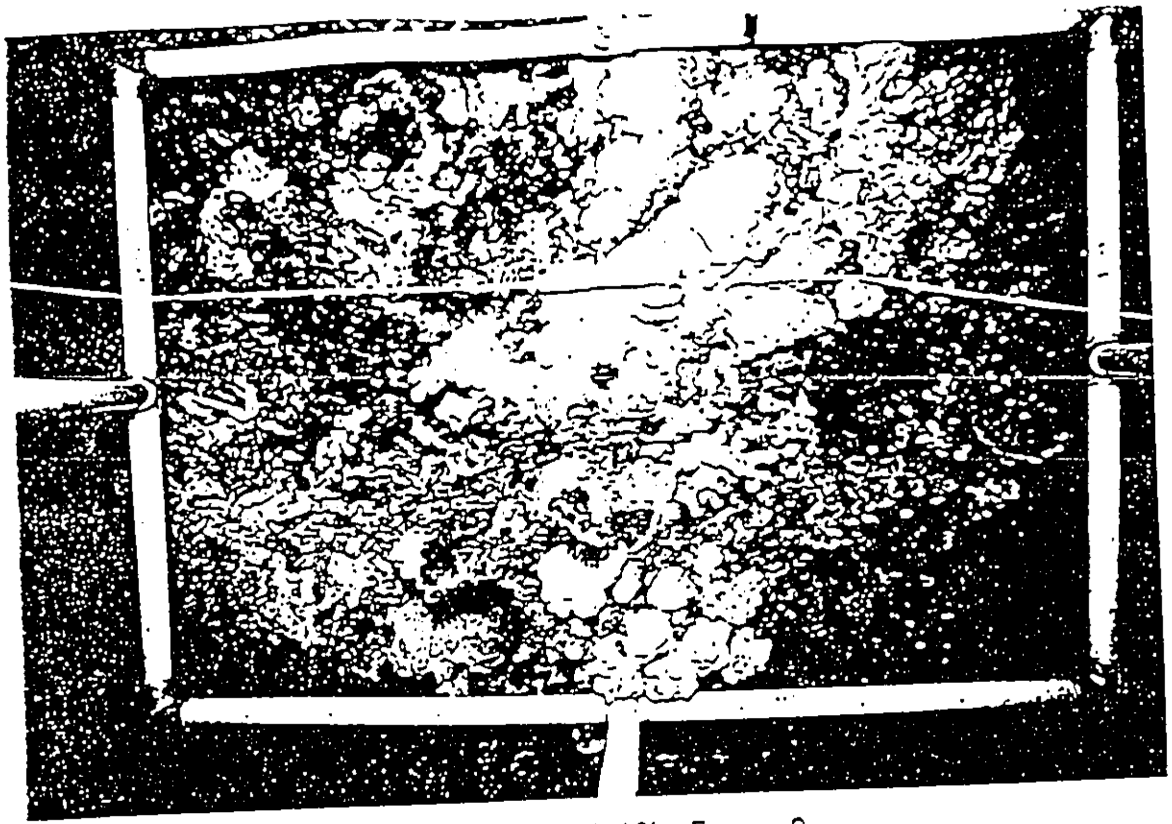
TRANSECT 6-60' - Frame 8



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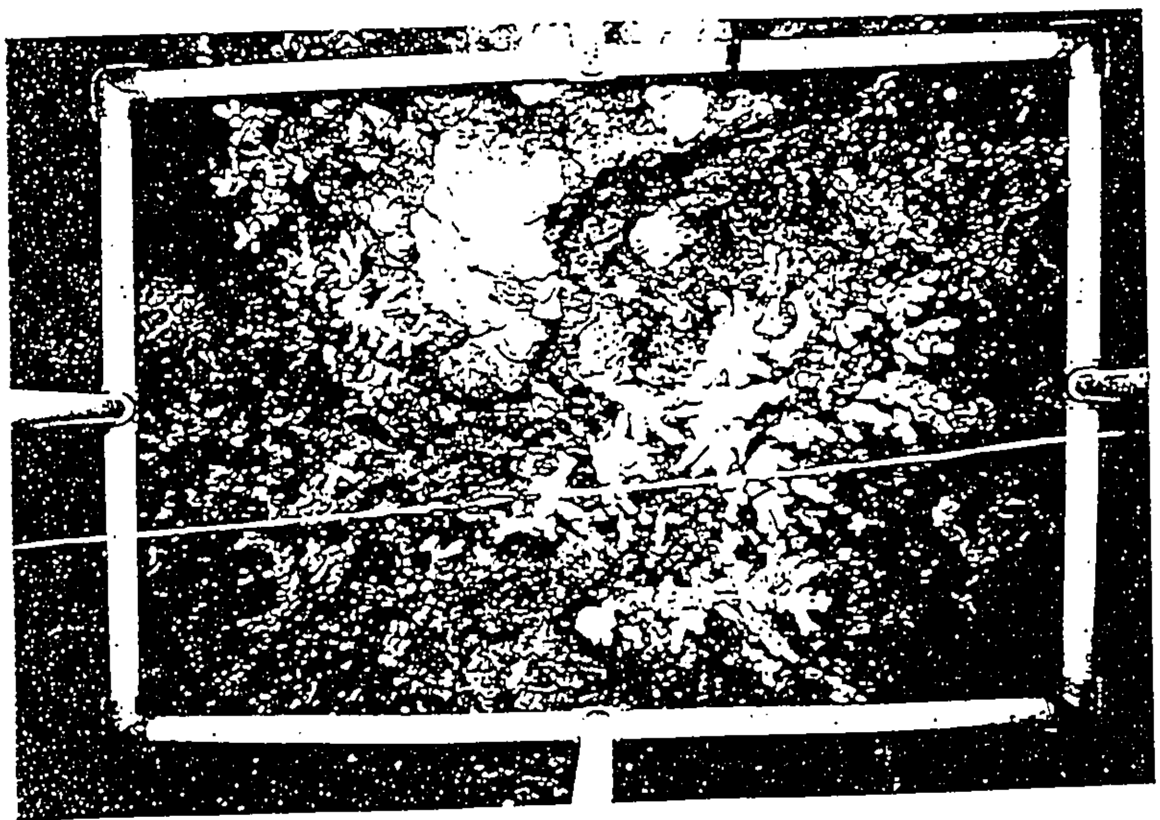

TRANSECT 6-60' - Frame 10

APPENDIX F
Air Quality Impact Report

AIR QUALITY IMPACT REPORT
KEAHOLE AIRPORT
NORTH KONA, HAWAII

March, 1988

Prepared for

R. M. Towill Corporation

and

State of Hawaii
Department of Transportation
Airports Division

Prepared by

J. W. Morrow
Environmental Management Consultant
Kailua, Hawaii

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1.0 INTRODUCTION

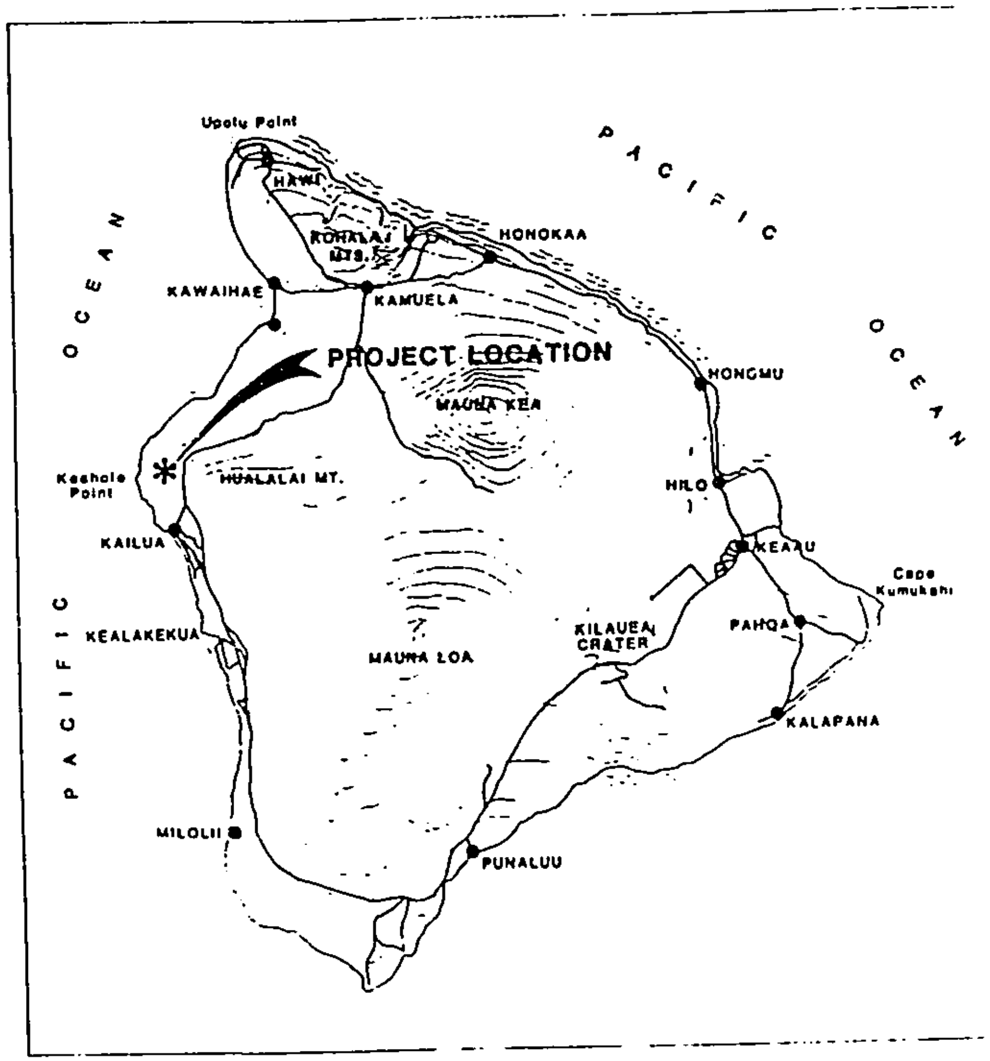
Keahole Airport is located in the the North Kona District on the west side of the Island of Hawaii (Figure 1). It sits on a 4,000 acre parcel of barren "aa" and "pahoehoe" lava created during the eruption of 1801.

In April, 1986, the State of Hawaii, Department of Transportation, Airports Division, initiated a comprehensive planning study for Keahole Airport under the Federal Aviation Administration Airport Improvement Program. The purpose of that study was to determine the type and extent of aviation facilities needed at the airport through the year 2005 and to produce a new Master Plan to accomplish the required development [1,2]. As part of this Master Plan study, an air quality impact analysis has been conducted and the results are reported herein.

A growing commercial airport such as the Keahole Airport is clearly an "indirect" source of air pollution as defined in the federal Clean Air Act [3]. This is because of its very nature of attracting and concentrating mobile sources of pollution, i.e., aircraft and motor vehicles. In addition, the fuel storage and handling associated with these mobile sources is another major source of emissions in an airport area. The airport-related emissions are then affected by local meteorology and terrain and mixed with emissions from other sources in the airport environs to result in ambient levels of pollution. The specific purpose of this analysis is to estimate emissions and ambient impact for actual 1985 aircraft operations as well as projected operations for 1990 and 2005.

FIGURE 1

PROJECT LOCATION
KEAHOLE AIRPORT



2.0 FEDERAL AND STATE REGULATIONS

2.1 Emission Standards

2.1.1 State of Hawaii. The rules governing air pollution control were revised in May, 1986 and are now found under Chapter 60 of the Department of Health's Administrative Rules, Title 11. The State does not regulate aircraft emissions. It regulates motor vehicle emissions only to the extent of prohibiting visible emissions from gasoline-powered vehicles and placing a 5-second time limit on visible smoke from diesel-powered vehicles. The rules also place restrictions on engine idling while parked [4], which, in the case of the airport, would apply primarily to buses vans, and taxis. Another emission control provision applicable to airport operations pertains to fuel storage. Any new storage vessel of more than 250-gallon capacity must be equipped with some type of vapor control system. All storage tanks with a capacity in excess of 40,000 gallons are required to have vapor control systems [5]. These rules apply only to fuels with a vapor pressure equal to or greater than 1.5 pounds per square inch under actual storage conditions, e.g., gasoline.

2.1.2 Federal Government.

2.1.2.1 Aircraft and Aircraft Engines. Since 1980, a number of substantial changes have been made to the federal rules governing aircraft and aircraft engines. In December, 1980, the U.S. Environmental Protection Agency (EPA) delayed compliance with all gaseous standards until January 1, 1983 [6]. In December, 1982, the most extensive amendments were made by EPA [7]. These amendments created new aircraft classes, withdrew all carbon monoxide (CO) and nitrogen dioxide (NO_2) standards, and delayed compliance with hydrocarbon (HC) standards until January, 1984. The newly defined classes of aircraft engines included:

Class TP	all aircraft turboprop engines.
Class TF	all turbofan or turbojet engines except engines of Class T3, T8 and TSS.
Class T3	all aircraft gas turbine engines of the JT3D model family.
Class T8	all aircraft gas turbine engines of the JT8D model family.
Class TSS	all aircraft gas turbine engines employed for propulsion of aircraft designed to operate at supersonic flight speeds.

In August, 1984, EPA rejected an appeal by an aircraft engine manufacturer and removed a stay on the smoke emission standard for small (< 26.7 kilonewton thrust) engines [8]. Finally, in October, 1984, EPA amended the exemption for low production engines and provided clarification of the prohibition of fuel venting [9].

With the aforementioned amendments since 1980, the federal rules are presently composed of the following parts [10]:

Subpart A	provides general provisions including exemptions.
Subpart B	prohibits intentional discharge to the atmosphere of fuel from any new or in-use aircraft gas turbine engines.
Subpart C	establishes particulate (smoke) and hydrocarbon standards for new gas turbine aircraft engines (all classes). Particulate standards are based on visibility effects rather than mass emissions; thus, the standard is expressed in terms of a dimensionless "smoke number."
Subpart D	sets particulate (smoke) standards for in-use gas turbine engines (Classes T8 & TF).

It should be noted that the compliance dates for the aforementioned standards have all passed; thus, the standards should all be currently met by new and in-use aircraft engines subject to regulation.

2.1.2.2 Motor Vehicles. The EPA has also promulgated emission standards for newly manufactured motor vehicles [11,12]. Since 1980 there have been numerous amendments to those rules--too many to enumerate in this report. Suffice it to say that the EPA regulates mass emissions of carbon monoxide, hydrocarbons, and nitrogen oxides from motor vehicles. Standards are generally expressed on a grams per vehicle mile (g/veh-mi) basis and set for specified categories of vehicle, e.g., light duty gasoline-powered vehicles (LDV), light duty diesel vehicles, (LDDV), heavy duty diesel vehicles (HDDV), etc. In the case of diesel vehicles, gaseous emission standards are expressed as grams per brake-horsepower hour. Additionally, diesel vehicles are subject to particulate standards, expressed in terms of percent opacity.

The fuel and fuel additives used in motor vehicles are also regulated. Perhaps the most notable aspect of these regulations is the intent to sharply reduce the use of lead additives in gasoline and thereby reduce lead emissions from motor vehicles.

All newly manufactured gasoline powered vehicles are designed and required to burn only unleaded gasoline, i.e., gasoline with a lead content less than 0.05 gram per gallon [13].

2.1.2.3 Petroleum Storage. The EPA has also promulgated new source performance standards (NSPS) for fuel storage tanks which are similar to the State rules [14,15].

2.2 Ambient Air Quality Standards

2.2.1 Hawaii Ambient Air Quality Standards (HAAQS). The Department of Health is the agency charged with promulgating and enforcing ambient air quality standards throughout the state. The existing standards, as amended in April, 1986, are summarized in Table 1 [16]. The principal differences between the pre-1986 and current standards are:

- relaxation of state particulate matter and sulfur dioxide standards so as to make them equivalent to the federal standards.
- elimination of the 24-hour nitrogen dioxide (NO2) standard
- elimination of the 3-hour non-methane hydrocarbons standard
- adoption of a lead standard

The CO, ozone, and annual NO2 standards remain more stringent than their federal counterparts. Finally, as described in the following section, the federal particulate standards were recently revised; thus, the state standards are at this time not the same as the federal standards.

2.2.2 National Ambient Air Quality Standards (NAAQS). The EPA promulgates and enforces the federal air quality standards which are also presented in Table 1. As noted in the table, the federal primary standards are directly health-related while the secondary standards are intended to prevent adverse effects in a number of public welfare-related areas [17]. Two significant revisions have occurred to the NAAQS since 1980. These are listed below:

- hydrocarbons standard was eliminated [18]
- total suspended particulate (TSP) standard was changed to PM-10 standard [19].

TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS PRIMARY	FEDERAL STANDARDS SECONDARY	STATE STANDARDS
1. Total Suspended Particulate Matter (TSP)	Annual Geometric Mean	75	60	60
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	260	150	150
2. PM-10	Annual	50	50	--
(micrograms per cubic meter	Maximum Average in Any 24 Hours	150	150	--
3. Sulfur Dioxide (SO2)	Annual Arithmetic Mean	80	--	80
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours		1,300	1,300
4. Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	100		70
(micrograms per cubic meter)				
5. Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10,000		5,000
(micrograms per cubic meter)	Maximum Average in Any 1 Hour	40,000		10,000
6. Photochemical Oxidants (as O3)	Maximum Average in Any 1 Hour	240		100
(micrograms per cubic meter)				
7. Lead (Pb)	Maximum Average in Any Calendar Quarter	1.5		1.5
(micrograms per cubic meter)				

This latter change made the annual PM-10 standard an arithmetic average rather than the previously used geometric average and also established a statistical method for determining violations instead of the simple "one allowable exceedance per year" approach.

2.3 State Implementation Plan (SIP). Pursuant to the federal Clean Air Act, the State of Hawaii in 1972 developed a plan for air pollution control called the State Implementation Plan or more commonly SIP [20]. Since, with the previous exception of particulates and sulfur dioxide [21], Hawaii meets all primary and secondary NAAQS, most of its control strategies as originally promulgated were aimed at meeting *State* standards. Although written into the SIP, these strategies are not considered an official part of the federally approved SIP because the NAAQS are already being met [22]. Thus, in the case of carbon monoxide, hydrocarbons, and nitrogen oxides, the principal pollutants from aircraft and motor vehicles, historical control strategies were aimed at meeting state standards which because of their stringency will insure maintenance of NAAQS. In the case of sulfur dioxide and particulate matter, the two previously designated nonattainment areas were re-designated attainment in 1985 [23].

3 0 EXISTING AIR QUALITY

There is no permanent Department of Health air monitoring station located in the Kona area; however, monitoring was conducted for total suspended particulates (TSP) and sulfur dioxide (SO_2) in 1985 - 1986. The results of that sampling are presented in Table 2. They suggest that the air quality in Kona is excellent with both particulate and SO_2 levels well below both state and federal standards (see Table 1).

This is not surprising given the current low level of industrial development in the area. The growth and development that has been occuring and continues to occur is more resort oriented and thus is generating automotive pollutants, i.e., carbon monoxide (CO), hydrocarbons (HC), and nitrogen dioxide (NO_2), none of which are routinely monitored on the Island of Hawaii.

A brief two-day air sampling program was conducted by the State Department of Transportation in Kailua-Kona in June, 1983. The results revealed that 1-hour ambient carbon monoxide levels were all below 500 micrograms per cubic meter (ug/m3)[24].

It should be noted, however, that the worst air pollution episodes experienced in Hawaii County are due to volcanic activity. While volcanic emissions are somewhat variable and have not been fully characterized, it is well known that visibility (especially in Kona) is affected by the presence of fine particulates resulting directly from volcanic activity and forest fires caused by lava flows. In addition, conditions are also ideal for the formation of secondary pollutants as a result of atmospheric chemistry. There can also be substantial increases in the ambient concentrations of sulfur dioxide and mercury.

Measurements of sulfur dioxide taken during the January, 1983 eruptive phase, for example, indicated 24-hour concentrations as high as 982 micrograms per cubic meter (ug/m3) at the Volcano Observatory and 654 ug/m3 in Hilo. Sulfur dioxide and particulate measurements made during January and March, 1983 in Kona and Hilo are presented in Table 3. Despite the volcanic activity, concentrations were relatively low on most of the days that measurements were made. This may be explained by the infrequent (non-continuous) monitoring and variable wind directions.

Analysis of the airborne particulate matter during the eruption revealed some rather interesting results as unusually high concentrations of selenium, arsenic, indium, gold, and sulfur were found along with strikingly high concentrations of iridium [25].

TABLE 2

Summary of Aerometric Data Collected
at Kailua-Kona, Hawaii
1985 - 1986

	Total Suspended Particulates(TSP) 24-Hour Concentrations (ug/m3)				Sulfur Dioxide (SO2) 24-Hour Concentrations (ug/m3)			
MONTH	SAMPLES	MIN.	MAX.	MEAN	SAMPLES	MIN.	MAX.	MEAN
Sep 85	5	7	10	8	5	<5	<5	<5
Oct 85	5	7	20	14	5	<5	<5	<5
Nov 85	5	6	11	9	5	<5	8	5
Dec 85	5	6	18	12	5	<5	<5	<5
Jan 86	5	4	16	13	5	<5	<5	<5
Feb 86	5	6	26	15	5	<5	<5	5
Mar 86	5	9	20	14	5	<5	<5	<5
Apr 86	4	10	15	13	4	<5	<5	<5
May 86	5	12	17	13	5	<5	<5	<5
Jun 86	5	12	20	15	5	<5	5	<5
Jul 86	5	13	25	18	5	<5	12	6
Aug 86	5	18	28	22	5	<5	<5	<5
ANNUAL	59	4	28	14	57	<5	12	<5

SOURCE: Department of Health

TABLE 3

SPECIAL AIR MONITORING DATA
KONA & HILO, HAWAII
1983

	24-Hour Concentrations (ug/m3			
	Kona		Hilo	
Date	SO2	TSP	SO2	TSP
----	---	---	---	---
08 Jan 83	---	---	654.7	22.6
09 Jan 83	---	---	447.7	30.6
12 Jan 83	27.0	23.4	0.6	6.9
14 Jan 83	12.0	22.2	----	----
19 Jan 83	----	----	12.2	17.6
20 Jan 83	18.9	----	----	----
04 Mar 83	4.4	39.1	32.9	53.6
05 Mar 83	0	28.4	----	30.1
07 Mar 83	----	----	0.6	37.0
08 Mar 83	0	11.9	0.6	27.5
10 Mar 83	0	12.8	21.3	38.5
11 Mar 83	----	----	0	28.2

Notes: SO2= sulfur dioxide
TSP= total suspended particulates

SOURCE: Department of Health

4.0 CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The airport site is typical of Hawaii's climate with little seasonal or diurnal temperature variation. Monthly temperature averages vary by only about 6 degrees from the warmest months (July and August) to the coolest (January and February) [26]. These leeward coastal areas have a typically semi-tropical, semi-arid climate. Average annual temperature is 78 degrees Fahrenheit.

As in most locations in Hawaii, rainfall is very much affected by local terrain with a gradient which increases with increasing elevation and distance from the shoreline. A good example of this is the 10 - 15 inches of annual rainfall at the proposed Awake'e development site just north of the airport [27] as compared to the 25 inches per year at Kailua-Kona south of the airport [28]. Awake'e is right on the shoreline and more distant from high terrain while Kailua-Kona is beneath the steeper terrain of Puu Hualalai. Annual average rainfall in the Keahole airport area, which is between those two, is approximately 20 inches.

4.2 Surface Winds. Because of the presence of two 13,000 foot volcanic mountain masses northeast and southeast of it, the Kona area is not as dominated by the northeast trade winds as are most other areas of Hawaii. Winds are generally characterized by a diurnal land-sea breeze regime. Daytime onshore winds arise from the more rapid heating of the land surface while nighttime offshore winds result from the more rapid cooling of the land.

One year (1973) of surface wind observations from the old Kona Airport were obtained and processed to produce various windroses. The annual windrose (Figure 2, Table 4) gives a clear indication of the dominance of onshore winds (SSW to WSW) whereas most other locations in Hawaii show a predominance of ENE trade winds. There also appears to be a seasonal variation with the winter months, typified by January, showing a greater diversity of wind direction and lower speeds (Figure 3, Table 5) as compared to August where wind speeds are higher and there is a greater frequency of onshore SSW to WSW winds (Figure 4, Table 6).

FIGURE 2

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT

KEAHOLE AIRPORT
(ANNUAL 1973)

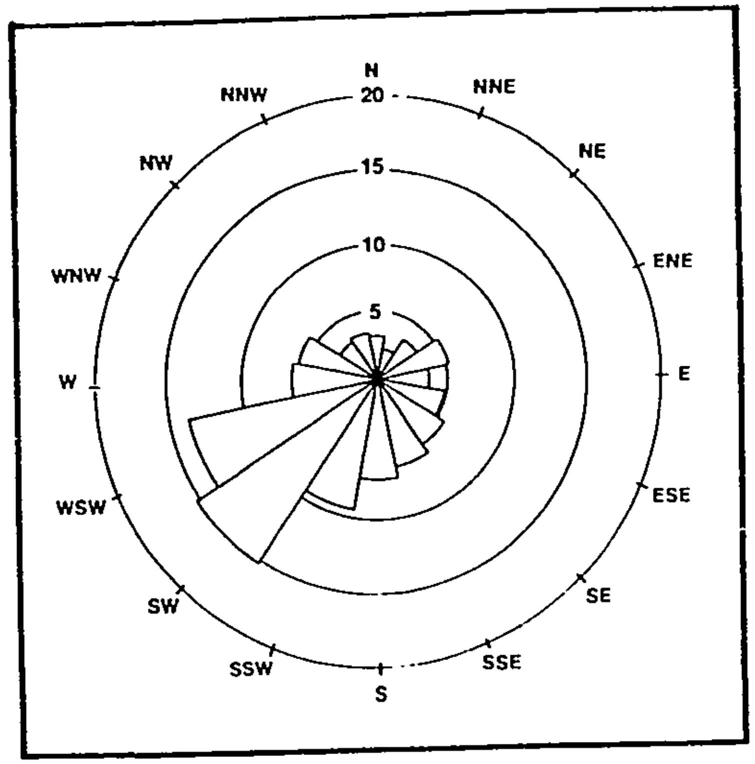


TABLE 4

ANNUAL WIND ROSE*
KEAHOLE AIRPORT

	Wind Speed (Kts)						
Direction	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	.00193	.00935	.01547	.00564	.00081	.00032	.03353
NNE	.00032	.00371	.00838	.00596	.00258	.00081	.02176
NE	.00064	.01015	.01354	.00677	.00258	.00032	.03401
ENE	.00387	.02869	.01015	.00693	.00177	.00016	.05158
E	.00419	.02434	.00725	.00161	.00000	.00000	.03740
ESE	.00387	.02966	.01564	.00064	.00000	.00000	.04981
SE	.00387	.03337	.01902	.00048	.00016	.00000	.05690
SSE	.00387	.02853	.02821	.00403	.00000	.00000	.06464
S	.00097	.01950	.03385	.01821	.00081	.00000	.07334
SSW	.00226	.01547	.05093	.02676	.00097	.00000	.09639
SW	.00193	.02418	.09317	.03643	.00000	.00000	.15571
WSW	.00226	.02708	.08656	.02192	.00000	.00016	.13798
W	.00081	.01596	.03852	.00596	.00000	.00000	.06125
WNW	.00210	.01467	.03852	.00258	.00000	.00000	.05787
NW	.00097	.00838	.02063	.00290	.00000	.00000	.03288
NNW	.00081	.00919	.02160	.00322	.00016	.00000	.03498
TOTAL:	.03466	.30222	.50145	.15006	.00983	.00177	1.00000

* Based on surface observations, 0600 - 2200 HST daily.

SOURCE: National Weather Service

FIGURE 3

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KEAHOLE AIRPORT
(JANUARY 1973)

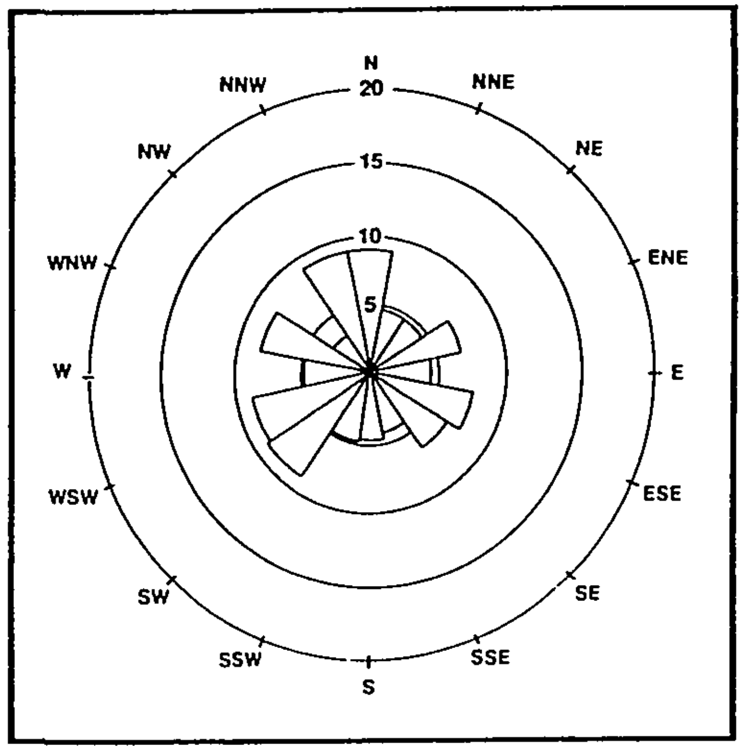


TABLE 5

JANUARY WIND ROSE*
KEAHOLE AIRPORT

Direction	Wind Speed (Kts) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	.00190	.02846	.05313	.00380	.00000	.00000	.08729
NNE	.00000	.01139	.01898	.01518	.00000	.00000	.04554
NE	.00000	.02087	.02467	.00000	.00000	.00000	.04554
ENE	.00759	.05503	.00190	.00190	.00000	.00000	.06641
E	.01328	.02467	.00569	.00000	.00000	.00000	.04364
ESE	.00949	.04744	.01708	.00000	.00000	.00000	.07400
SE	.00949	.04554	.01139	.00000	.00000	.00000	.06641
SSE	.00759	.02846	.00759	.00000	.00000	.00000	.04364
S	.00190	.02846	.01518	.00380	.00000	.00000	.04934
SSW	.00569	.01898	.02467	.00190	.00000	.00000	.05123
SW	.00190	.03416	.04364	.00949	.00000	.00000	.08918
WSW	.00569	.04175	.03605	.00380	.00000	.00000	.08729
W	.00190	.02467	.02277	.00000	.00000	.00000	.04934
WNW	.00380	.03605	.04175	.00000	.00000	.00000	.08159
NW	.00190	.01708	.01328	.00000	.00000	.00000	.03226
NNW	.00000	.02467	.05693	.00569	.00000	.00000	.08729
TOTAL	.07211	.48767	.39469	.04554	.00000	.00000	1.00000

* Based on surface observations, 0600 - 2200 HST daily.

SOURCE: National Weather Service

FIGURE 4

FREQUENCY DISTRIBUTION OF WIND DIRECTION IN PERCENT
KEAHOLE AIRPORT
(AUGUST 1973)

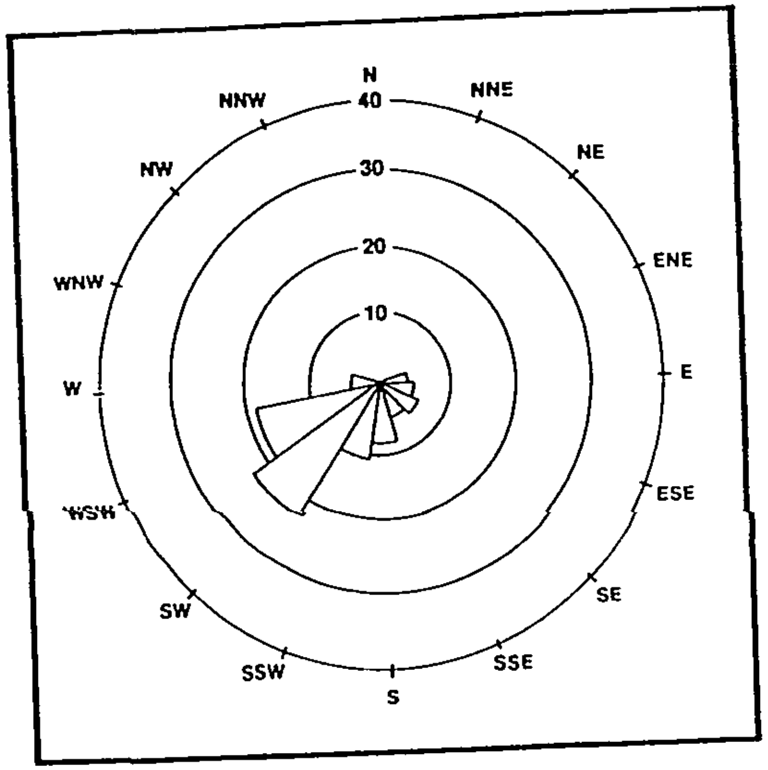


TABLE 6

AUGUST WIND ROSE*
KEAHOLE AIRPORT

Direction	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	.00196	.00784	.00588	.00000	.00000	.00000	.01569
NNE	.00000	.00000	.00196	.00000	.00000	.00000	.00196
NE	.00000	.01373	.01373	.00196	.00000	.00000	.02941
ENE	.00196	.00980	.01373	.00196	.00000	.00000	.02745
E	.00000	.02549	.01176	.00000	.00000	.00000	.03725
ESE	.00784	.01961	.01961	.00000	.00000	.00000	.04706
SE	.00392	.03725	.01765	.00196	.00000	.00000	.06078
SSE	.00196	.02157	.02941	.00000	.00000	.00000	.05294
S	.00588	.01176	.04510	.02549	.00000	.00000	.08824
SSW	.00196	.02353	.04510	.04118	.00000	.00000	.11176
SW	.00000	.02157	.12549	.07843	.00000	.00000	.22549
WSW	.00000	.01961	.13333	.03137	.00000	.00000	.18431
W	.00000	.00392	.03922	.00196	.00000	.00000	.04510
WNW	.00000	.00392	.03137	.00196	.00000	.00000	.03725
NW	.00196	.00784	.01176	.00000	.00000	.00000	.02157
NNW	.00000	.00588	.00784	.00000	.00000	.00000	.01373
TOTAL	.02745	.23333	.55294	.18627	.00000	.00000	1.00000

Wind Speed (Kts)

* Based on surface observations, 0600 - 2200 HST daily.

SOURCE: National Weather Service

5.0 IMPACT ANALYSIS

5.1 Source Activity. Hourly aircraft activity and mix were obtained for the analysis years 1985, 1990, and 2005 [1,29]. Airport access vehicle traffic data were derived from two previous studies [30, 31]. Ground service vehicle (GSV) data were obtained from the major air carriers serving Keahole. GSV fuel use was estimated based on number of air carrier arrivals and experience at Honolulu International Airport. Ground vehicle mix was based on the actual GSV data or, in the case of environs roadways, based on the City & County of Honolulu vehicle registrations [32].

5.2 Emission Factors. Aircraft landing-takeoff (LTO) emission factors were derived from time-in-mode (TIM) and engine emission factors taken from two U.S. Environmental Protection Agency (EPA) publications [33,34]. Motor vehicle emission factors for carbon monoxide, nitrogen oxides, and non-methane hydrocarbons were computed for each of the three study years using EPA's mobile source emissions model MOBILE-3 [35]. These emission factors were localized by use of the 1986 age distribution of registered vehicles in the City & County of Honolulu [32]. Fraction of vehicle miles travelled (VMT) was assumed to be directly proportional to the registration distribution. Emission factors for ground service vehicles (GSV) and aircraft fueling operations were taken from another EPA publication [36].

5.3 Annual Emissions. Estimates of annual emissions of the five major pollutants carbon monoxide (CO), nitrogen oxides (NOx), hydrocarbons (HC), sulfur dioxide (SO2), and particulate matter (PM), were derived using the aforementioned source activity data and emission factors. The results are depicted in Figure 5. It is quite clear that on a tonnage basis alone, carbon monoxide is the most abundant pollutant with NOx and HC about one fifth as much. Sulfur dioxide and PM are only about 3% of the CO values. All pollutants show increases over the 1985 - 2005 period.

For comparative purposes, the State Department of Health's 1980 emissions inventory for the County of Hawaii is presented in Table 7. The airport's 2005 emissions appear to represent from 0.7 to 6.7% of the county inventory for specific pollutants with SO2 being at the low end and NOx at the top. A more detailed breakdown of the major source categories contributing to annual emissions is presented in Table 8. Table 9 simply shows the same data on a percent contribution basis. It is clear from both tables that aircraft are the principal source of all five pollutants in the airport area. Note also the decline in CO and HC emissions from roads and parking over the 1985 - 2005 period. This is due to the federal motor vehicle emission control program [11,12] which because it mandates tighter emission standards for new vehicles appears to offset the projected increase in traffic

TABLE 7

1980 EMISSIONS INVENTORY

COUNTY OF HAWAII

SOURCE CATEGORY	EMISSIONS (Tons/Year)				
	PM	SOx	NOx	CO	HC
Steam Electric Power Plants	263	3,233	1,309	66	22
Gas Utilities	0	0	11	0	0
Fuel Combustion in Agricultural Industry	2,252	996	798	0	7
Refinery Industry	0	0	0	0	0
Petroleum Storage	0	0	0	0	392
Metallurgical Industries	0	0	0	0	0
Mineral Products Industry	1,080	14	11	0	0
Municipal Incineration	0	0	0	0	0
Motor Vehicles	263	177	3,048	42,177	4,035
Construction, Farm and Industrial Vehicles	40	32	454	1,516	152
Aircraft	6	5	46	1,450	174
Vessels	11	91	63	66	29
Agricultural Field Burning	1,800	0	0	20,627	2,446
TOTAL:	5,715	4,547	5,741	65,902	7,258

SOURCE: State Department of Health

FIGURE 5: ANNUAL EMISSIONS, 1985–2005

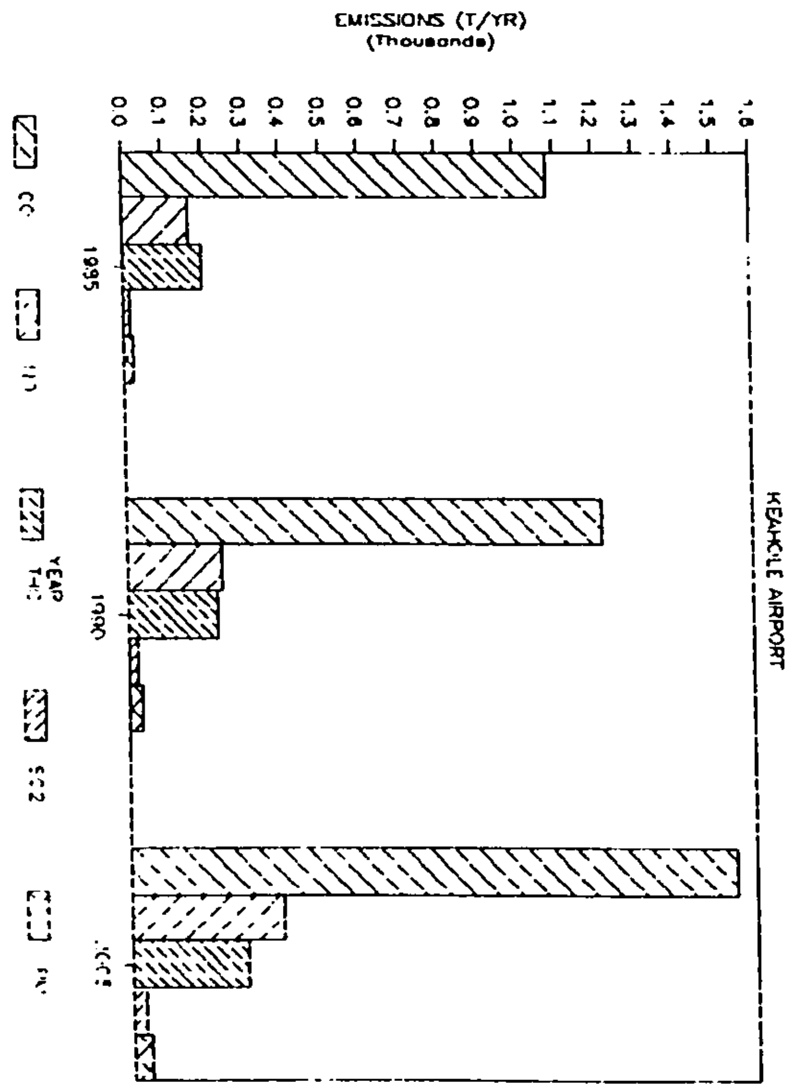


TABLE 8

ANNUAL EMISSIONS BY SOURCE CATEGORY
KEAHOLE AIRPORT
1985 - 2005

Source	CO	NOx	HC	SO2	PM
	Emissions (T/yr)				
1985					
Roads	269	30	43	2	5
Parking	8	<1	1	<1	<1
Ground Serv. Vehicles	91	11	14	1	1
Fuel Storage/Handling	0	0	4	0	0
Aircraft	716	128	140	14	21
TOTAL:	1,085	169	202	17	26
1990					
Roads	274	39	37	3	7
Parking	9	1	1	<1	<1
Ground Serv. Vehicles	95	12	15	1	1
Fuel Storage/Handling	0	0	6	0	0
Aircraft	839	192	170	19	26
TOTAL:	1,217	243	228	23	34
2005					
Roads	233	53	27	6	13
Parking	5	<1	<1	<1	<1
Ground Serv. Vehicles	121	15	19	1	1
Fuel Storage/Handling	0	0	10	0	0
Aircraft	1,192	320	239	27	34
TOTAL:	1,551	388	295	34	48

Notes: CO - carbon monoxide
NOx - nitrogen oxides
THC - total hydrocarbons
SO2 - sulfur dioxide
PM - particulate matter

TABLE 9

PERCENT CONTRIBUTION OF SOURCES TO ANNUAL EMISSIONS
KEAHOLE AIRPORT
1985 - 2005

Source	CO	NOx	HC	SO2	PM
	% Contribution				
1985					
Roads	24.8	17.6	21.3	12.5	17.5
Parking	0.8	0.1	0.3	0.1	0.0
Ground Serv. Vehicles	8.4	6.7	7.0	3.0	3.0
Fuel Storage/Handling	0.0	0.0	1.9	0.0	0.0
Aircraft	66.0	75.6	69.5	84.3	79.4
TOTAL:	100.0	100.0	100.0	100.0	100.0
1990					
Roads	22.5	15.9	16.3	13.7	20.6
Parking	0.7	0.4	0.4	0.2	0.1
Ground Serv. Vehicles	7.8	4.8	6.4	2.6	2.4
Fuel Storage/Handling	0.0	0.0	2.4	0.0	0.0
Aircraft	69.0	78.9	74.5	83.4	77.0
TOTAL:	100.0	100.0	100.0	100.0	100.0
2005					
Roads	15.0	13.6	9.0	17.4	27.0
Parking	0.3	0.1	0.2	0.2	0.1
Ground Serv. Vehicles	7.8	3.8	6.3	2.1	2.1
Fuel Storage/Handling	0.0	0.0	3.5	0.0	0.0
Aircraft	76.9	82.5	81.0	80.3	70.8
TOTAL:	100.0	100.0	100.0	100.0	100.0

Notes: CO - carbon monoxide
NOx - nitrogen oxides
THC - total hydrocarbons
SO2 - sulfur dioxide
PM - particulate matter

volume. NOx, PM, and SO2 emissions, on the other hand, show increases due to increasing source activity, less stringent NOx emission standards, and no standards for PM and SO2.

5.3 Ambient Modeling. While emissions estimates can be informative and helpful in predicting air pollution trends, they are rather crude indicators of ambient air quality. It is air quality or specifically air pollutant concentrations that are more meaningful in terms of predicting health or materiel effects as well as compliance with air quality standards.

In this particular case, an airport vicinity air pollution model (AVAP) developed at the Argonne National Laboratory [37] was employed in order to generate estimates of ambient pollutant levels in the airport area. Normally, hourly concentrations of CO, NO2, HC, TSP, and SO2 would be computed for a 24-hour period in each of the study years using the AVAP model. In this particular case, due to the limited daytime operation of the airport and the lack of 24-hour meteorological data, the model was run for a 14-hour period (6:00 am to 8:00 pm).

Emission factors and source activity as discussed above were input to the model along with even more detailed data regarding source-receptor geometry, runway use, and local meteorology. In order to estimate maximum landside pollutant concentrations under prevailing southwesterly wind conditions, 40 receptor locations were selected on the northeast (mauka) side of the airport. See Figure 6 for all receptor locations.

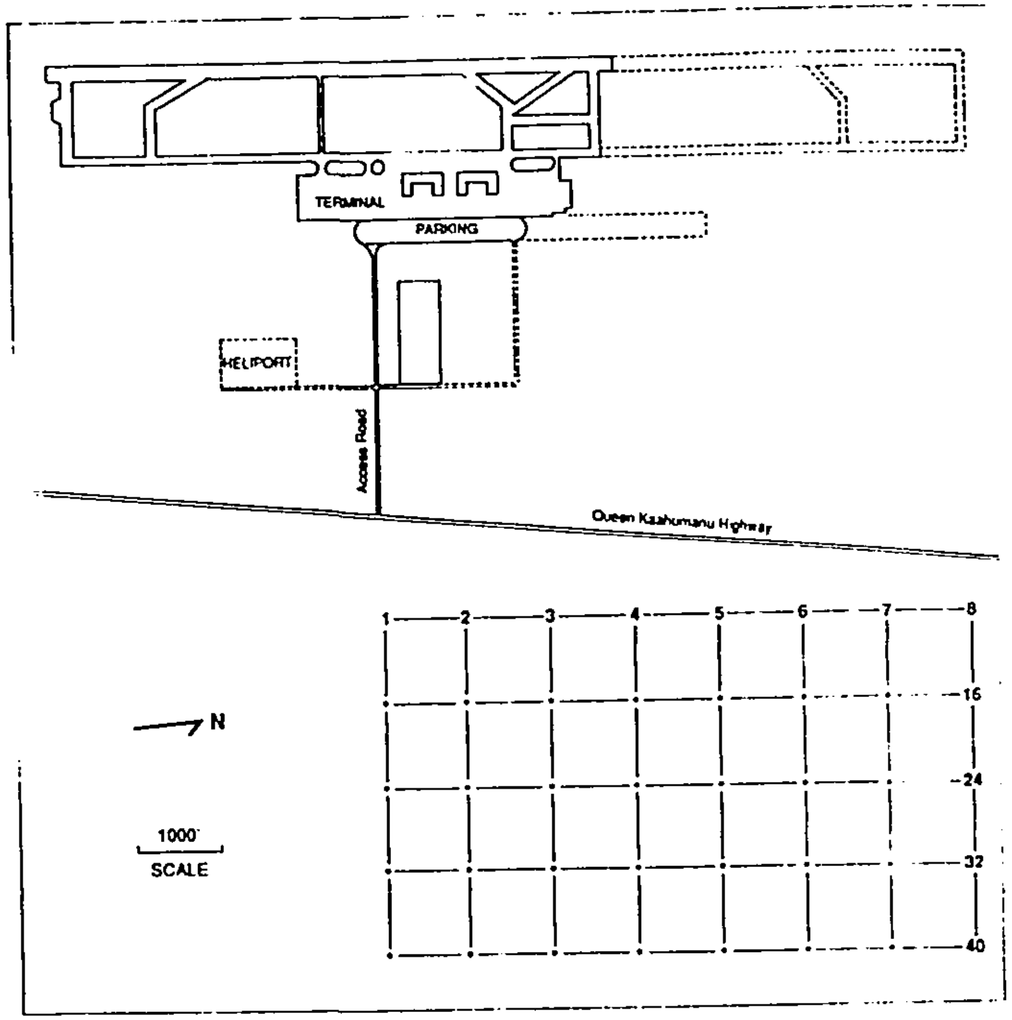
One year (1973) of airport meteorological data were then screened in order to identify the 24-hour period with the greatest number of hours of southwesterly winds and lowest average wind speed. The persistency of direction and low wind speed would insure maximum impact on the selected receptors.

A summary of this modeling is presented in Table 10. Note that for each pollutant a background level has been added to the modeled concentration. CO levels appear to be well below both state and federal 1-hour and 8-hour standards (see Table 1). It should be noted, however, that the receptor grid was not set up to identify CO "hotspots"; therefore, CO levels at such locations, e.g., curbside loading/unloading near the terminal, will be higher than the modeling indicates. The modeling results simply indicate the more general impact of airport activities on the surrounding environs. Onsite air sampling would be the best method of determining CO levels in the "hotspot" areas.

As noted in Section 2, there are currently no ambient hydrocarbon standards. The ambient concentrations of total hydrocarbons (THC) listed in Table 10 include an estimated background level of methane of 1648 ug/m3 based on the 1979-80 measurement data at the Honolulu International Airport. By subtracting this baseline methane concentration from the values in Table 10, one can see that the 3-hour non-methane concentrations would not exceed the

FIGURE 6

AVAP* MODELING RECEPTOR GRID
KEAHOLE AIRPORT
1985 - 2005



LEGEND

*AVAP = Airport Vicinity Air Pollution Model
.... = 1900 - 2005 Expansion

TABLE 10

RESULTS OF AVAP* MODELING
KEAHOLE AIRPORT
1985 - 2005

Pollutant	Year	Averaging Period	Range of Maximum Concentrations (ug/m3)	Ending Hour of Maximum	Location of Maximum
Carbon Monoxide	1985	1-hr	119 - 448	11:00 am	03
	1990		131 - 505	11:00 am	03
	2005		134 - 472	12:00 n	01
	1985	8-hr	182 - 234	6:00 pm	03
	1990		218 - 272	6:00 pm	02
	2005		262 - 346	7:00 pm	02
Total Hydrocarbons (THC) (as methane)	1985	3-hr	1,649 - 1,658	5:00 pm	04
	1990		1,650 - 1,662	1:00 pm	02
	2005		1,651 - 1,662	2:00 pm	02
Nitrogen Dioxide (NO2)	1985	24-hr	29 - 32	12:00 mn	03
	1990		30 - 35	12:00 mn	02
	2005		31 - 37	12:00 mn	02
Sulfur Dioxide (SO2)	1985	24-hr	12 - 12	12:00 mn	all
	1990		12 - 14	12:00 mn	02
	2005		12 - 14	12:00 mn	02
Total Suspended Particulate Matter (TSP)	1985	24-hr	28 - 29	12:00 mn	02
	1990		28 - 30	12:00 mn	02
	2005		28 - 30	12:00 mn	02

NOTES:
1. AVAP = Airport Vicinity Air Pollution Model
2. ug/m3 = micrograms per cubic meter
3. Background levels:
   CO - 100 ug/m3 (= 0.1 mg/m3)
   TSP - 28 ug/m3 (based on 1985-86 DOH monitoring at Kona)
   NO2 - 29 ug/m3 (based on 1975 DOH monitoring at Hilo)
   SO2 - 12 ug/m3 (based on 1985-86 DOH monitoring at Kona)
   THC - 1,648 ug/m3 methane (based on 1979-80 monitoring at the Honolulu International Airport)
4. See Figure 6 for locations of maximum concentrations.

now defunct state standard of 100 ug/m3. Thus, while the airpor will continue to contribute to downwind oxidant formation as result of its emissions of precursors, i.e., non-methan hydrocarbons, exceedances of photochemical (ozone) standards ar not presently predicted.

Since the estimated twenty-four hour NO2 concentrations are lowe than the annual NO2 standards, it is likely that the airport are will continue to be in compliance with both the state and les stringent federal NO2 standards.

Sulfur dioxide concentrations were very low due to the lack o significant SO2 sources in the airport area. One-hour maxima ar well below 3-hour, 24-hour and annual standards; thus, al standards should continue to be met. Since gasoline, diese fuel, and aviation fuels are all low in sulfur content, SO concentrations should continue to be low in the future as well.

Total suspended particulates (TSP) were well within the State' 24-hour standard of 150 ug/m3. The highest 24-hour concentratio estimates did not even exceed the State's annual standard; thus one can infer that that standard also will be met. Since th newly promulgated federal standard for PM-10 is also set at 15 ug/m3, one can conclude that it also will be met.

The percentage contributions of aircraft, other airport source (such as parking lots, ground service vehicles, etc.), an environs sources (roads), are presented in Table 11. In contras to more densely populated areas such as Honolulu where heavil travelled roads and freeways can be most significant, th principal contributor in the Keahole area appears to be aircraf and airport activities.

Finally, Figure 7 depicts the predicted typical hourly variatio in CO concentration at two receptor locations (Nos. 1 and 3 across the Queen Kaahumanu Highway under prevailing daytim southwesterly winds. The hourly variation is similar to th other pollutants and corresponds with peak source activity at th airport and along the highway.

FIGURE 7: CARBON MONOXIDE - 1990

TYPICAL HOURLY VARIATION (SW WINDS)

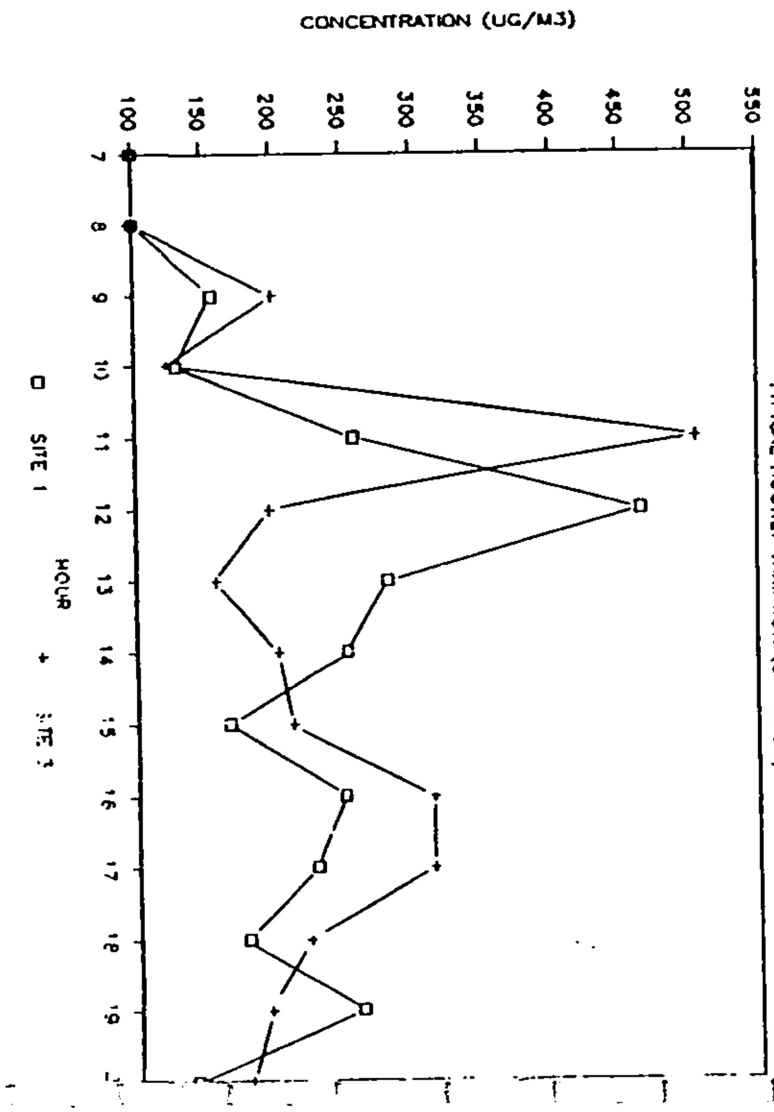


TABLE 11

PERCENT CONTRIBUTION OF SOURCES
TO MAXIMUM ESTIMATED 24-HOUR AMBIENT CONCENTRATIONS
KEAHOLE AIRPORT
1985 - 2005

Source Category	% Contribution CO	NOx	THC	SO2	TSP
1985					
Aircraft	67.1	50.0	88.5	0.0	75.5
Airport Sources	20.7	25.0	6.6	0.0	13.3
Environs Sources	12.2	25.0	4.9	0.0	11.2
TOTAL:	100.0	100.0	100.0	0.0	100.0
Receptor Location:	03	03	03	n/a	02
1990					
Aircraft	64.2	50.0	90.1	100.0	69.3
Airport Sources	26.4	25.0	6.2	0.0	16.4
Environs Sources	9.4	25.0	3.7	0.0	14.2
TOTAL:	100.0	100.0	100.0	100.0	100.0
Receptor Location:	02	03	03	02	02
2005					
Aircraft	60.5	37.5	89.6	100.0	58.7
Airport Sources	33.8	37.5	7.5	0.0	21.7
Environs Sources	5.7	25.0	2.8	0.0	19.5
TOTAL	100.0	100.0	100.0	100.0	100.0
Receptor Location:	02	03	02	02	02

6.0 CONCLUSIONS

Based on the foregoing analysis, the following conclusions may be drawn:

- The airport and its environs are a significant source of carbon monoxide, nitrogen oxides, hydrocarbons, and to a much lesser extent, particulate matter and sulfur dioxide. Emissions of these pollutants are projected to increase over the 1985 - 2005 period as a result of increases in aircraft operations and the ground vehicle activity that is generated by those operations.

- Despite the significant emissions, ambient concentrations of these pollutants are projected to remain in compliance with federal and state air quality standards.

- Because of its unique terrain and meteorological characteristics, Kona is more susceptible to buildup of pollutant concentrations and will have to be monitored closely and periodically reevaluated as industrial, commercial, and residential/resort development proceeds in the future.

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APPENDIX G

PM 10 Monitoring Report

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GOVERNOR

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DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION
400 RODGERS BOULEVARD, SUITE 700
HONOLULU, HAWAII 96819-1880

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
AIR-ETS
97.1588

Mr. Wilfred K. Nagamine
Manager, Clean Air Branch
State of Hawaii
Department of Health
P. O. Box 2278
Honolulu, Hawaii 96801

Dear Mr. Nagamine:

Subject: PM-10 Quarterly Report
Ambient Air Monitoring Program
Special Management Area (SMA)
Use Permit No. 325
Kona International Airport at Keahole
State Project No. AH2072-15

As previously agreed, the enclosed fourth and final quarterly PM-10 report for the period May 1997 - July 1997 is submitted. All measured concentrations of PM-10 at Kona International Airport at Keahole were well within the standard during this period. This concludes the one (1) year sampling period and the monitor has been removed.

Please contact Guy Ichinotsubo, Project Manager at 838-8866 to clarify any questions you may have.

Very truly yours,

Ernest T. Kurosawa
Engineering Program Manager

Enclosure: Quarterly Report

c: V. Goldstein, County of Hawaii Planning Department

Hana Like No Ke Alu Aloha
Working Together to Provide Gateways of Aloha

KEAHOLE INTERNATIONAL AIRPORT

PM10 MONITORING REPORT

FOR MAY - JULY 1997

Prepared for:

State of Hawaii
Department of Transportation
Airports Division

August 1997

B. D. NEAL & ASSOCIATES
Applied Meteorology • Air Quality • Computer Science
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CONTENTS

Section 1

INTRODUCTION

The Hawaii State Department of Health (DOH) has requested the Hawaii State Department of Transportation, Airports Division (DOTA), to monitor concentrations of airborne particulate matter at the Keahole International Airport (KIA) on the island of Hawaii. DOH has requested that the measurements be made in terms of particulate matter with an aerodynamic diameter of less than 10 microns (PM10).

Keahole Associates, Inc. arranged for B.D. Neal & Associates to install and calibrate a Wedding PM10 monitor at KIA on July 26, 1996. In accordance with the statewide schedule set by DOH, the initial PM10 sample at KIA was collected on August 1, 1996 and sampling continued every sixth day thereafter. An audit of the monitor was performed on August 20, 1996. The monitor motor was replaced on October 31, 1996 and again on February 4, 1997 and April 29, 1997. Calibrations and audits were also performed on those dates. The final sample was collected on July 27, 1997 and a final calibration and audit were performed on July 29, 1997.

This report includes data for the months of May through July 1997. It summarizes monitoring results for that period and includes calibration, audit and sampler data.

Section 2

PM10 DATA SUMMARY

PM10 MONITORING SUMMARY

LOCATION: Island of Hawaii

Date	24-Hour Average PM10 Concentration ($\mu g/m^3$) Keahole International Airport
5/04/97	11.0
5/10/97	10.2
5/16/97	13.2
5/22/97	11.7
5/28/97	10.5
6/03/97	10.9
6/09/97	11.6
6/15/97	11.7
6/21/97	12.8
6/27/97	12.1
7/03/97	NA
7/09/97	13.7
7/15/97	10.7
7/21/97	17.3
7/27/97	13.5

Notes: Sampling period was 12 AM to 12 AM.
National and State of Hawaii AAQS: 150 $\mu g/m^3$

Section 3

CALIBRATION DATA

B. D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

VFC PM10 CALIBRATION DATA SHEET

Station Location KEAHOLE AIRPORT Date 7-29-97 Time 1005

Sampler Model WEDDING PM10 S/N 0440890798U Operator R. MATT

Pa 757.7 mm Hg, Ta 28 °C 301 °K, Unusual conditions: NONE

Orifice S/N 578 Orifice Calibration Date 3-5-96

Orifice calibration relationship: m = 1.22 b = .019648 r = .999914

Plate Number	Orifice ΔH_2O (in.)	Sampler ΔH_2O (in.)	Sampler ΔP_{stg} (mm Hg)[a]	$P1=Pa-\Delta P_{stg}$ (mm Hg)	P1/Pa (mm Hg)	Qa (orifice) flow rate[b] (m^3/min)	Qa (orifice) / $(Ta)^{1/2}$
18	5.6	10.4	19.4	738.3	.9744	1.21	
13	5.4	15.3	28.6	729.1	.9623	1.18	
10	5.1	22.1	41.3	716.4	.9455	1.15	

[a] mm Hg = 25.4(in. ΔH_2O/13.6)

[b] Qa (orifice) = $\{[(\Delta H_2O)(Ta/Pa)]^{1/2} - b\}$ (1/m)

[c] % difference = $\frac{100\ [Qa\ (sampler) - Qa\ (orifice)]}{Qa\ (orifice)}$

Lookup Table Validation

Qa (orifice)	Qa (sampler) (Lookup Table)	% Difference[c]
1.21	1.24	2.5
1.18	1.21	2.5
1.15	1.17	1.7

Sampler Calibration Relationship:

☑ Lookup Table Validated (i.e., % difference ≤ 4)

☐ New Calibration relationship:

$X = \frac{Qa(orifice)}{(Ta)^{1/2}}$, $Y = (P1/Pa)$

m = ________ b = ________ r = ________

For subsequent calculation of sampler flow rate:

$Qa = \{[P1/Pa - b](Ta)^{1/2}\}$ (1/m)

Operational Flow Rate __________ m^3/min

Rev. 960726

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Section 4

AUDIT DATA

B. D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

VFC PM10 AUDIT DATA SHEET (PART 1)

Station Location KEAHOLE AIRPORT Date 7-29-97 Time 1025

Sampler Model WEDDING PM10 S/N 0440890798U Operator ALLAN FUJII

Pa 759.7 mm Hg, Ta 30.1 °C 303.1 °K, Unusual conditions: NONE

Orifice S/N 5125 Orifice Calibration Date 5-23-96

Orifice calibration relationship: m = 0.98 b = -0.021573 r = 0.99990

Sampler calibration relationship: m = LOOK b = UP r = TABLE

Orifice pressure drop (ΔH_2O) 2.9 in. H_2O Qa(audit)[a] 1.1196 m^3/min

	With Orifice Installed	Without Orifice Installed
Stagnation pressure (ΔPstg)[b]	45.38 mm Hg	37.54 mm Hg
Absolute stagnation pressure (P1)[c]	714.32 mm Hg	722.16 mm Hg
Stagnation pressure ratio (P1/Pa)	0.9403 (See note)	.9506 (See note)
Qa(sampler)[d]	1.16 m^3/min	1.18 m^3/min

Audit flow rate percentage difference[e] 3.61 % (See note)

Qa(corrected sampler)[f] 1.137 m^3/min

Design flow rate percentage difference[g] 0.66 %

Note: If P1/Pa is less than the values that are listed in the manufacturer's lookup table or if audit flow rate percentage difference is greater than ±6 percent, proceed to Part 2 of the VFC Sampler Audit Data Sheet. Otherwise, complete this part.

[a] Qa (orifice) = $\{[(\Delta H_2O)(Ta/Pa)]^{1/2} - b\}\ (1/m)$

[b] mm Hg = 25.4(in. ΔH_2O/13.6)

[c] P1 = Pa - ΔPstg

[d] Determine Qa(sampler) from manufacturer's lookup table (or from alternate calibration relationship).

[e] Audit % difference = $\dfrac{100\ [Qa\ (sampler) - Qa\ (audit)]}{Qa\ (audit)}$, where Qa(sampler) is measured with the orifice installed.

[f] Qa(corrected sampler) = Qa(sampler) [100 - audit % difference] / 100 , where Qa(sampler) is measured without the orifice installed.

[g] Design flow rate % difference = {(Qa(corrected sampler) - 1.13) / 1.13} 100

Auditor B.D. NEAL Observer R. MATT

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Section 5

FIELD DATA

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 5-4-97 SAROAD # ____________

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11464 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings		Absolute Stagnation Pressure
Initial ΔPstg	36.2 mm Hg	$\overline{P1}$ = 725.8 mm Hg
Final ΔPstg	36.4 mm Hg	$\overline{P1}$ = Pav - Average ΔPstg
Average ΔPstg	36.3 mm Hg	

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9524

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1458.3 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____________

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min	Gross Weight (Wg) 4.2924 g
$\overline{Qstd}$ = Qa (Pav/760)(298/Tav)	Tare Weight (Wt) 4.2735 g
Vstd 1725.2 Std m³	Net Weight (Wn) 0.0189 g
Vstd = ($\overline{Qstd}$)(Elapsed Time)	PM10 Concentration 11.0 µg/m³
	PM10 Concentration = (Wn)(10^6)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 5-10-97 SAROAD # ____________

Sampler Model WEDDING PM10 S/N 04408907 98U

Filter ID No. E11465 Pav 762.1 mm Hg, TAV 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 36.6 mm Hg

Final ΔPstg 36.8 mm Hg

Average ΔPstg 36.7 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 725.4 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9518

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1442.6 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____________

Laboratory Calculations:

$\overline{Qstd}$ 1.185 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760) (298/Tav)

Vstd 1709.5 Std m³

Vstd = (Qstd) (Elapsed Time)

Gross Weight (Wg) 4.3155 g

Tare Weight (Wt) 4.2980 g

Net Weight (Wn) 0.0175 g

PM10 Concentration 10.2 μg/m³

PM10 Concentration = (Wn) (10^6) /Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 5-16-97 SAROAD # ________

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11466 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings	Absolute Stagnation Pressure
Initial ΔPstg 37.0 mm Hg	$\overline{P1}$ = 725.3 mm Hg
Final ΔPstg 36.6 mm Hg	$\overline{P1}$ = Pav - Average ΔPstg
Average ΔPstg 36.8 mm Hg	

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9517

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1439.5 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ________

Laboratory Calculations:

$\overline{Qstd}$ 1.185 Std m³/min	Gross Weight (Wg) 4.3222 g
$\overline{Qstd}$ = Qa (Pav/760)(298/Tav)	Tare Weight (Wt) 4.2996 g
Vstd 1705.8 Std m³	Net Weight (Wn) 0.0226 g
Vstd = (Qstd)(Elapsed Time)	PM10 Concentration 13.2 µg/m³
	PM10 Concentration = (Wn)(10⁶)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 5-22-97 SAROAD # ____________

Sampler Model WEDDING PM10 S/N 04408907988U

Filter ID No. E11467 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 36.2 mm Hg

Final ΔPstg 36.4 mm Hg

Average ΔPstg 36.3 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 725.8 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9524

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1408.0 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____________

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760)(298/Tav)

Vstd 1665.7 Std m³

Vstd = (Qstd)(Elapsed Time)

Gross Weight (Wg) 4.2967 g

Tare Weight (Wt) 4.2772 g

Net Weight (Wn) 0.0195 g

PM10 Concentration 11.7 µg/m³

PM10 Concentration = (Wn)(10^6)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 5-28-97 SAROAD # ________

Sampler Model WEDDING PM 10 S/N 04408907 98U

Filter ID No. E11468 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 36.6 mm Hg

Final ΔPstg 37.2 mm Hg

Average ΔPstg 36.9 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 725.2 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9516

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1410.4 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ________

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760) (298/Tav)

Vstd 1668.5 Std m³

Vstd = (Qstd) (Elapsed Time)

Gross Weight (Wg) 4.3233 g

Tare Weight (Wt) 4.3057 g

Net Weight (Wn) 0.0176 g

PM10 Concentration 10.5 µg/m³

PM10 Concentration = (Wn) (10⁶) /Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 6-3-97 SAROAD # ______

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11469 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 37.2 mm Hg

Final ΔPstg 37.4 mm Hg

Average ΔPstg 37.3 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 724.8 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9511

Average Flowrate ($\overline{Qa}$)* 1.173 m³/min Elapsed Time 1418.5 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ______

Laboratory Calculations:

$\overline{Qstd}$ 1.180 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760) (298/Tav)

Vstd 1673.8 Std m³

Vstd = (Qstd) (Elapsed Time)

Gross Weight (Wg) 4.3101 g

Tare Weight (Wt) 4.2919 g

Net Weight (Wn) 0.0182 g

PM10 Concentration 10.9 µg/m³

PM10 Concentration = (Wn) (10^6) /Vstd

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Station Location KEAHOLE AIRPORT Date 6-9-97 SAROAD # ____________

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11470 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 36.2 mm Hg

Final ΔPstg 37.0 mm Hg

Average ΔPstg 36.6 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 725.5 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9520

Average Flowrate ($\overline{Qa}$)* 1.176 m^3/min Elapsed Time 1444.5 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____________

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m^3/min

$\overline{Qstd}$ = Qa (Pav/760) (298/Tav)

Vstd 1708.8 Std m^3

Vstd = (Qstd) (Elapsed Time)

Gross Weight (Wg) 4.2784 g

Tare Weight (Wt) 4.2585 g

Net Weight (Wn) 0.0199 g

PM10 Concentration 11.6 µg/m^3

PM10 Concentration = (Wn) (10^6) /Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 6-15-97 SAROAD # ________

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11471 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 35.9 mm Hg

Final ΔPstg 36.2 mm Hg

Average ΔPstg 36.05 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 726.05 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9527

Average Flowrate ($\overline{Qa}$)* 1.178 m³/min Elapsed Time 1455.9 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ________

Laboratory Calculations:

$\overline{Qstd}$ 1.185 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760) (298/Tav)

Vstd 1725.2 Std m³

Vstd = (Qstd) (Elapsed Time)

Gross Weight (Wg) 4.2898 g

Tare Weight (Wt) 4.2697 g

Net Weight (Wn) 0.0201 g

PM10 Concentration 11.7 μg/m³

PM10 Concentration = (Wn) (10^6) /Vstd

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Station Location KEAHOLE AIRPORT Date 6-21-97 SAROAD # ____

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11472 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 36.8 mm Hg

Final ΔPstg 37.0 mm Hg

Average ΔPstg 36.9 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 725.2 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9516

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1468.8 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760)(298/Tav)

Vstd 1737.6 Std m³

Vstd = (Qstd)(Elapsed Time)

Gross Weight (Wg) 4.3100 g

Tare Weight (Wt) 4.2877 g

Net Weight (Wn) 0.0223 g

PM10 Concentration 12.8 µg/m³

PM10 Concentration = (Wn)(10⁶)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 6-27-97 SAROAD # ____________

Sampler Model WEDDING PM10 S/N 04408907980

Filter ID No. E11498 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 35.9 mm Hg

Final ΔPstg 36.2 mm Hg

Average ΔPstg 36.05 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 726.05 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9527

Average Flowrate ($\overline{Qa}$)* 1.178 m^3/min Elapsed Time 1446.5 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____________

Laboratory Calculations:

$\overline{Qstd}$ 1.185 Std m^3/min

$\overline{Qstd}$ = Qa (Pav/760)(298/Tav)

Vstd 1714.1 Std m^3

Vstd = (Qstd)(Elapsed Time)

Gross Weight (Wg) 4.3065 g

Tare Weight (Wt) 4.2857 g

Net Weight (Wn) 0.0208 g

PM10 Concentration 12.1 µg/m^3

PM10 Concentration = (Wn)(10^6)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 7-9-97 SAROAD # ______

Sampler Model WEDDING PM10 S/N 04408907980

Filter ID No. E11499 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 35.5 mm Hg

Final ΔPstg 35.9 mm Hg

Average ΔPstg 35.7 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 726.4 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9532

Average Flowrate ($\overline{Qa}$)* 1.178 m³/min Elapsed Time 1476.5 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ______

Laboratory Calculations:

$\overline{Qstd}$ 1.185 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760)(298/Tav)

Vstd 1749.7 Std m³

Vstd = (Qstd)(Elapsed Time)

Gross Weight (Wg) 4.2874 g

Tare Weight (Wt) 4.2635 g

Net Weight (Wn) 0.0239 g

PM10 Concentration 13.7 μg/m³

PM10 Concentration = (Wn)(10^6)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 7-15-97 SAROAD # ______

Sampler Model WEDDING PM10 S/N 04408907798U

Filter ID No. E11500 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings | Absolute Stagnation Pressure

Initial ΔPstg 36.6 mm Hg | $\overline{P1}$ = 725.5 mm Hg

Final ΔPstg 36.6 mm Hg | $\overline{P1}$ = Pav - Average ΔPstg

Average ΔPstg 36.6 mm Hg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9520

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min Elapsed Time 1408.6 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ______

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min | Gross Weight (Wg) 4.2911 g

$\overline{Qstd}$ = Qa (Pav/760)(298/Tav) | Tare Weight (Wt) 4.2733 g

Vstd 1666.4 Std m³ | Net Weight (Wn) 0.0178 g

Vstd = (Qstd)(Elapsed Time) | PM10 Concentration 10.7 μg/m³

PM10 Concentration = (Wn)(10⁶)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 7-21-97 SAROAD # ________

Sampler Model WEDDING PM10 S/N 0440890798U

Filter ID No. E11501 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings — Absolute Stagnation Pressure

Initial ΔPstg 35.7 mm Hg — $\overline{P1}$ = 725.65 mm Hg

Final ΔPstg 37.2 mm Hg — $\overline{P1}$ = Pav - Average ΔPstg

Average ΔPstg 36.45 mm Hg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9522

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min — Elapsed Time 1461.5 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ________

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min — Gross Weight (Wg) 4.3202 g

$\overline{Qstd}$ = Qa (Pav/760)(298/Tav) — Tare Weight (Wt) 4.2903 g

Vstd 1729.0 Std m³ — Net Weight (Wn) 0.0299 g

Vstd = (Qstd)(Elapsed Time) — PM10 Concentration 17.3 µg/m³

PM10 Concentration = (Wn)(10⁶)/Vstd

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VFC SAMPLER FIELD DATA SHEET

Station Location KEAHOLE AIRPORT Date 7-27-97 SAROAD # ____________

Sampler Model WEDDING PM10 S/N 04408907 98U

Filter ID No. E11502 Pav 762.1 mm Hg, Tav 24 °C 297 °K

Relative Stagnation Pressure Readings

Initial ΔPstg 36.6 mm Hg

Final ΔPstg 36.4 mm Hg

Average ΔPstg 36.5 mm Hg

Absolute Stagnation Pressure

$\overline{P1}$ = 725.6 mm Hg

$\overline{P1}$ = Pav - Average ΔPstg

Average Stagnation Pressure Ratio ($\overline{P1}$/Pav) 0.9521

Average Flowrate ($\overline{Qa}$)* 1.176 m³/min

Elapsed Time 1441.3 min

*Obtained from manufacturer's lookup table (or from alternate calibration relationship)

Operator ALLAN FUJII

Comments ____________

Laboratory Calculations:

$\overline{Qstd}$ 1.183 Std m³/min

$\overline{Qstd}$ = Qa (Pav/760) (298/Tav)

Vstd 1705.1 Std m³

Vstd = (Qstd) (Elapsed Time)

Gross Weight (Wg) 4.2984 g

Tare Weight (Wt) 4.2753 g

Net Weight (Wn) 0.0231 g

PM10 Concentration 13.5 µg/m³

PM10 Concentration = (Wn) (10⁶) /Vstd

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APPENDIX H
Archaeological Survey

ARCHAEOLOGICAL UPDATE AND PASH RIGHTS INTERVIEWS FOR KONA INTERNATIONAL AIRPORT AT KEĀHOLE

by
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April 2000

EXECUTIVE SUMMARY

At the request of Edward K. Noda and Associates, Inc., International Archaeological Research Institute, Inc. has updated archaeological information and conducted interviews concerning Public Access Shoreline Hawaii (PASH) rights at the Kona International Airport at Keāhole. This work is part of a Master Plan update for the airport. The primary tasks of this project are to 1) review previous archaeological work using the library, correspondence files, and geographic information system (GIS) at the State Historic Preservation Division (SHPD) and make recommendations for future work based on the review, 2) carry out fieldwork to update archaeological information for parcels identified in Phases I and II of the Master Plan, and 3) collect information on traditional Hawaiian use of and access to the airport property through a series of interviews to assess the nature and extent of PASH rights.

A review of previous archaeological work and archaeological site information at the SHPD reveals that there is no comprehensive inventory of historic sites on airport lands. The SHPD GIS, which serves as an index to the archaeological reports in its library, has only preliminary site location information for the airport. The reasons for this include an early, large-scale archaeological survey that was only reported preliminarily, and later, small-scale surveys that don't provide site locations on standard base maps.

Fieldwork at the Phase I and II parcels relocated six previously recorded sites at the Phase II heliport parcel and established their locations on airport facilities and USGS quad maps with a global positioning system (GPS), and computer-aided drafting (AutoCAD) and GIS software. Inventory survey of the Phase II flight kitchen site preparation and postal facility site preparation parcels identified three small sites consisting of near-circular one- and two-course cobble and boulder alignments. These sites were described and photographed, and their locations were established with GPS. The sites are evaluated as significant solely for the information on Hawaiian history and prehistory that they have yielded. This project collected sufficient information to make these sites "no longer significant."

Recommendations for future work include 1) locate collections made during data recovery at airport sites and ensure they are held in a State approved repository, 2) bring the SHPD's GIS up-to-date, 3) use the updated GIS to develop a list of tasks required to complete the inventory of archaeological sites on airport property, and 4) develop a plan to implement the complete archaeological site inventory.

Assessment of PASH rights based on eight interviews identified seven issues believed by members of the community to apply to the Kona International Airport at Keāhole. These issues include limited access to the shoreline in the vicinity of the airport, impacts to archaeological and historical sites, access to prime fishing grounds, loss of native plants with traditional uses, observation of traditional boundaries (need to treat an *ahupua'a* as one unit), possible impacts to aquifers and seabeds, and activities of Natural Energy Laboratories Hawaii (NELH), whose property is believed by some community members to be inseparable from the airport property.

ACKNOWLEDGMENTS

The authors wish to acknowledge several individuals who assisted in the successful completion of this project. At DOT Air, Lynette Kawaoka coordinated the fieldwork with Airports Division staff in Kona, and Casey Jones provided a converted MicroStation file of airport facilities for our use in AutoCAD. Robert K. Kawamoto facilitated access to sites at Kona International Airport. At IARII, Eugenia Lebsack produced the AutoCAD facilities map. Joan Clarke assisted in the field. Ross Cordy, Muffet Jourdane, and Eric Komori at the State Historic Preservation Division provided information on archaeological site distribution.

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INTRODUCTION

At the request of Edward K. Noda and Associates, Inc., International Archaeological Research Institute, Inc. (IRAII) has updated archaeological information and conducted interviews concerning Public Access Shoreline Hawaii (PASH) rights at the Kona International Airport at Keāhole. This work is part of a Master Plan update for the airport. It resulted in a series of recommendations for management of historic sites and identified seven issues that community members associate with PASH rights at the airport.

The project area consists of the urban areas of the airport, which cover approximately 548 acres, and are identified by boundary lines drawn on 1:24,000 scale USGS topographic maps. The airport lies primarily in Kalaoa *ahupua'a*, but extends north into Hamanana, Haleohiu, Maka'ula, and Kau *ahupua'a*.[1] The urban area boundaries delimited the scope of the review of previous archaeological research and the assessment of PASH rights. Archaeological fieldwork, however, was confined to nine Master Plan Phase I areas and eight Master Plan Phase II areas east of the runways and taxiways (Fig. 1). The Master Plan Phase I areas include Itinerant Aircraft Parking, Ramp "K," Air Cargo Building III, GA Fuel Storage Site Preparation, Overseas Apron, Parking Phase II, Postal Facility Site Preparation, Fuel Farm Site Preparation, and Wastewater Treatment Plant. The Master Plan Phase II areas include Ramp "L," Heliport, Air Taxi Terminal Area, General Aviation Site, Ground Transportation Lease Lots, Overseas Terminal Development, Emergency Generator, Flight Kitchen Site Preparation..

PROJECT SCOPE-OF-WORK

The investigations conducted by IARII were specified in a scope of work prepared by IARII on September 22, 1999 in response to a request for proposal from Edward K. Noda and Associates, Inc. dated September 14, 1999. The project tasks include:

1. Review previous archaeological research at Kona International Airport using the library, correspondence files, and GIS at the State Historic Preservation Division. Make recommendations for future archaeological work based on the review.

2. Conduct archaeological fieldwork to confirm a previous finding of no sites at the Phase I Overseas Apron, Parking Phase II, Postal Facility Site Preparation, GA Fuel Storage Site Preparation, Itinerant Aircraft Parking, Air Cargo Building III, and Phase II Overseas Terminal, Ground Transportation Lease Lots, and General Aviation Site.

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1 Place names follow the spellings in Pukui et al. (1974) where possible. Otherwise, they are spelled as they appear on the USGS quad maps.

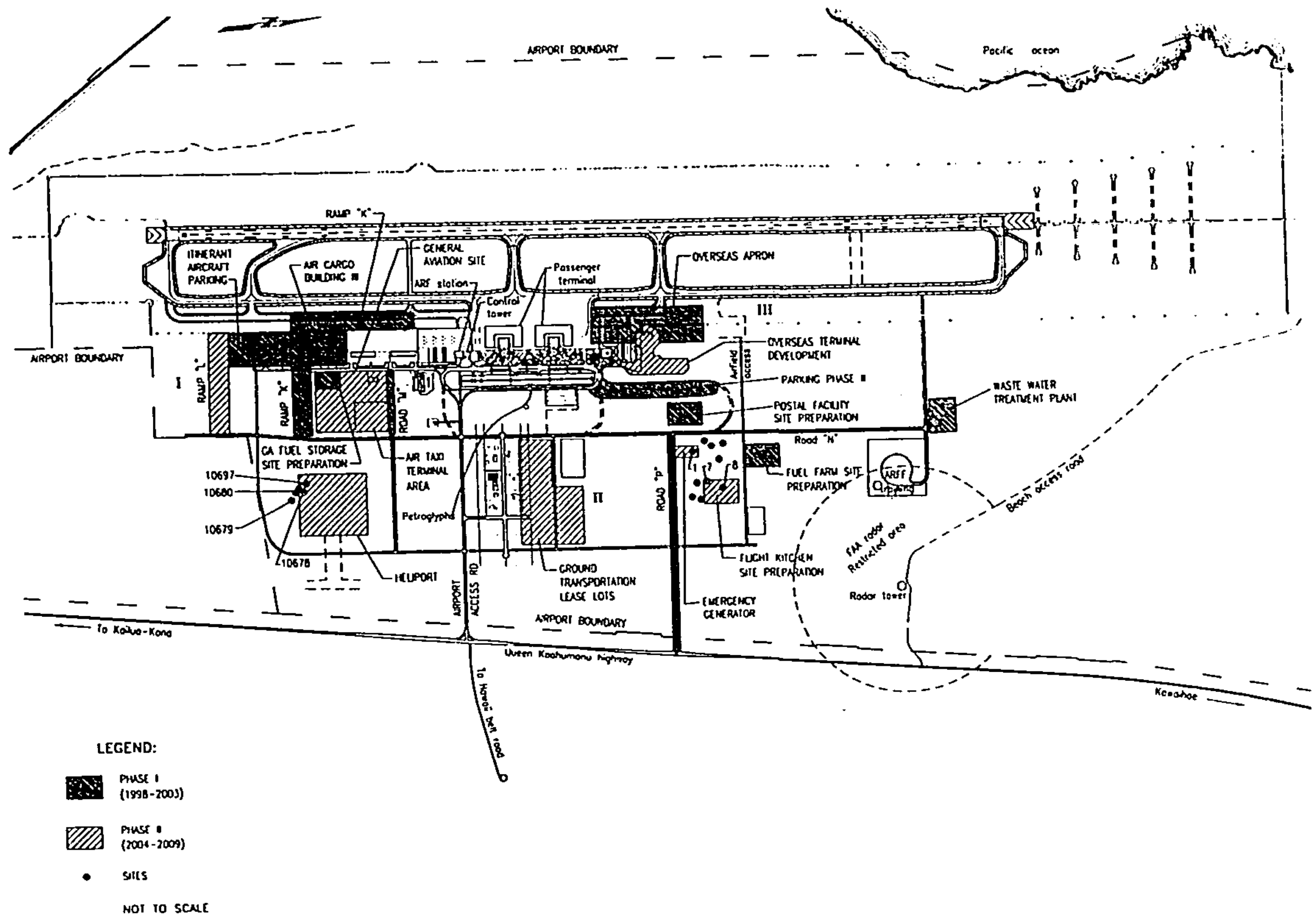

Figure 1. Locations of archaeological sites in relation to airport facilities and Master Plan Phase I and II areas.

3. Conduct archaeological inventory survey of Phase I fuel farm site and wastewater treatment plant and Phase II flight kitchen site preparation area and emergency generator.

4. Relocate, establish GPS locations, and re-determine the significance of sites previously recorded in Phase II heliport, and the vicinity of Phase I Ramp "K" and Phase II Ramp "L."

5. Assess PASH rights on the basis of ethnographic interviews with approximately eight to 10 informants.

6. Document the findings in a technical report.

PROJECT METHODS

Background research for the archaeological update was carried out primarily at the State Historic Preservation Division's Kapolei offices, and with five reports (Barrera 1987a, 1987b, 1990, 1993; Cordy 1985) provided by Edward K. Noda and Associates, Inc. Three sources of information were reviewed at SHPD—a GIS database, the archaeological report library, and correspondence files. The SHPD GIS database of site locations was reviewed as a computer map with site locations in the vicinity of the airport plotted over black-and-white satellite imagery. The review indicated that the GIS database for this portion of the Kona coast is in incomplete draft form. Site location information is not yet linked to site numbers, descriptions, or bibliographic citations. Thus, the GIS could provide only a very general guide to locations in which archaeological information was available, but could not serve as a source of detailed information. The library is organized by tax map key. Reports were systematically reviewed for references to site descriptions in the vicinity of the airport. The correspondence files are also generally organized by tax map key, but with separate file folders for particular facilities or for areas that cross-cut tax map boundaries. The file folders for Keāhole Airport belong to this latter category and are separately labeled. The Keāhole Airport folders were systematically reviewed.

Fieldwork was carried out by the author with the assistance of Joan Clarke on December 10-11, 1999. Survey areas were not marked on the ground and their boundaries were estimated in the field by dead reckoning, using a map of airport facilities (Fig. 1) and a map of black-and-white satellite imagery over which roads shown on the USGS topographic map were overlaid. The satellite imagery was useful for identifying the boundaries of lava flows of different ages; younger flows with little vegetation are dark in the image and older flows vegetated with fountain grass are shades of light gray. Because dead reckoning with these sources of information yielded relatively imprecise estimates of location, surveys extended to locations that could be confidently identified as outside of survey area boundaries. This tactic ensured that survey areas were covered completely, but resulted in quite a bit of survey outside of areas specified in the scope of work.

Survey techniques varied according to the area surveyed and goals of the survey. In those areas where the goal was to confirm previous findings of no sites, several of which had been completely altered, a brief walk-through was generally sufficient to confirm that no sites could be present. These areas generally lack vegetation and visibility is excellent. The small portions of a few of these areas that had not been altered were surveyed in sufficient detail to find all historic sites by walking irregular, closely-spaced transects guided by local topography. In those areas where the goal was to identify previously recorded sites, a prominent site that could be unambiguously identified by its recorded description was located first. Other sites were found by searching in directions and distances indicated by the schematic site maps presented by Barrera (1987a, 1987b, 1990, 1993). In those areas where the goal was to perform inventory-level survey a reconnaissance was first performed to determine the degree of land alteration. If the survey area had not been altered sufficiently to destroy historic sites, then it was surveyed by walking irregular, closely-spaced transects guided by local topography such that the archaeologists reasonably believed that all historic sites had been found.

Once historic sites were found, their locations were determined with differentially-corrected GPS to a precision of 1.9 ± 0.7 m. The differentially-corrected GPS positions were then projected to coordinate systems that enabled them to be plotted on a base map of airport facilities (see Fig. 1) and a USGS topographic map (Fig. 2). The condition and integrity of previously recorded sites were evaluated in comparison to their condition and integrity when first recorded. Newly identified sites were described in sufficient detail to support evaluation of significance according to draft state rules. No materials were collected.

ORGANIZATION OF THE REPORT

The report is organized in five sections, followed by two appendices. The project area background includes information on the environment, traditional Hawaiian settlement patterns, and previous archaeological research. It is followed by archaeological survey results including confirmations of no site determinations, relocation of previously identified sites and inventory survey of previously unsurveyed lands. This is followed by recommendations for future archaeological work in support of historic preservation and historic sites management at the airport. PASH issues identified in oral interviews by Usha Prasad of Social Research Pacific, Inc. make up the fourth section. The report ends with a summary and conclusions. Appendix A lists individuals who were contacted and interviewed for the project. Appendix B lists individuals who are identified/recommended as potential sources/informants.

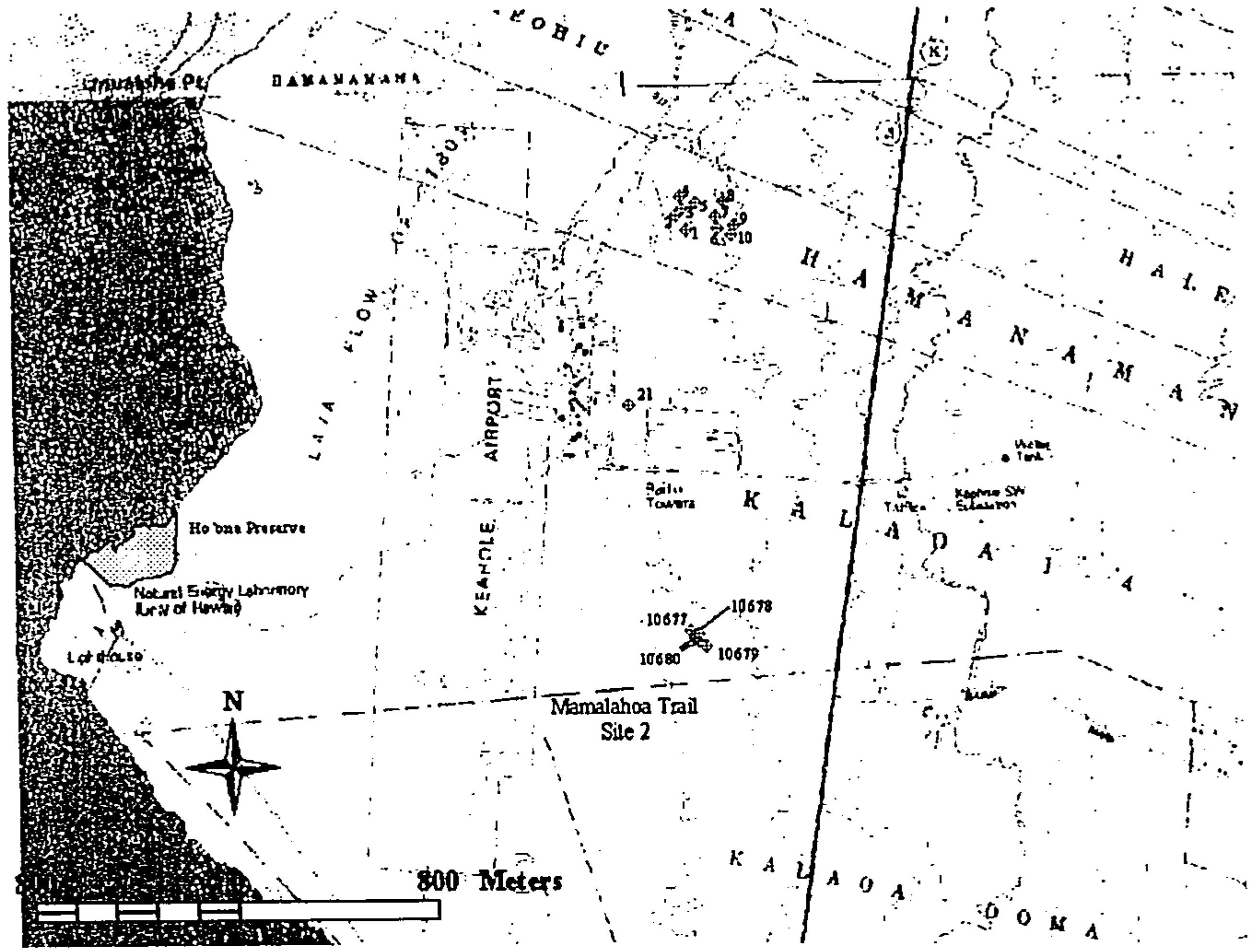

Figure 2. Archaeological site locations plotted on United States Department of the Interior Geological Survey Topographic Map (Keahole quadrangle).

PROJECT AREA BACKGROUND

This section describes the environment of Kona International Airport, surveys information on traditional Hawaiian settlement patterns, and reviews previous archaeological work.

ENVIRONMENT

Kona International Airport at Keāhole is located in the dry, "barren" zone of North Kona, Hawaii Island which stretches from back of the coastline to about 2.4 km inland (Cordy 1985:7). Low annual rainfall of less than 20 in. a year (Armstrong 1983: 63) is a prime limiting factor in the environment, augmented by the extreme youth of much of the volcanic substrate. The northern half of the airport property is covered by the 1801 Hualalai lava flow, which stretches along the coast from Mahai'ula in the north to Keāhole Point. This historic-era flow supports very sparse vegetation. The southern half of the airport is built on Hualalai lavas between 1,000 and 3,000 years old (Moore et al. 1987:574). The younger flows in this series are also sparsely vegetated, but the older flows, present mostly as *kīpuka* surrounded by younger flows, are thickly vegetated primarily with fountain grass (Photo 1).

Photo 1. *Kīpuka* of old pahoehoe lava in the vicinity of the Phase II Emergency Generator and Flight Kitchen Site Preparation vegetated primarily with fountain grass, looking *mauka*.

TRADITIONAL HAWAIIAN SETTLEMENT PATTERN

Cordy (1985) provides a settlement pattern interpretation of archaeological remains in O'oma and Kalaoa *ahupua'a*, the latter of which contains the southern half of the airport. Settlement here was concentrated in favorable areas at the coast, where permanent habitations are found along the shore with a variety of smaller, probably temporarily used structures and caves immediately inland. These smaller structures are also found along less favorable stretches of coastline. Site density drops off markedly inland from the coast in the area known as the "barren zone," and remains extremely low to the 200 ft. contour, which is located *mauka* of Ka'ahumanu Highway near the airport. At elevations from 200-400 ft. caves with habitation features are found associated with trails running *mauka/makai*. Beyond this, in the upland forest zone, site density increases again with a variety of habitation features associated with an agricultural system likely based on sweet potato cultivation. The airport falls completely within the portion of the barren zone with the lowest site density.

Cordy (1985:38 ff.) argues that this section of coast was permanently settled relatively late in time, in the 16th and 17th centuries, and that population was relatively small.

PREVIOUS ARCHAEOLOGICAL RESEARCH

Ching and Rosendahl (1968) surveyed a portion of the Queen Kaahumanu Highway alignment and Kona International Airport at Keāhole, an area of approximately 2,708 acres. They found three sites in the vicinity of the Phase II Heliport, which they numbered Kalaoa T2, T3, and T4. Kalaoa T2 is a lava tube cave with three small chambers. A "short series of well built steps" (Ching and Rosendahl 1968:12) leads from the surface into the cave. Within the cave were found "the few remains of a very disturbed burial ... very small glass beads, a possible konane game stone ... two bone picks or awls... a wana file ... a human tooth ...two possible coral rubbing stones and a possible pitching [g]ame stone (quoit)" (Ching and Rosendahl 1968:12). Kalaoa T3 is a possible refuge in an extremely large lava tube roughly 25 ft. wide, 30 ft. high, and about 800 ft. long. The entrance to the tube contains a wall approximately 8 ft. high, upon which two coconut half shells (possible drinking cups) were found. An *ahu* about 600 feet from the entrance marks a small pool formed by water dripping from the cave roof. Another coconut half shell, similar to the two found near the entrance, was found at the *ahu*. Kalaoa T4 is a large lava tube that was not explored extensively. Two geometric petroglyphs were noted on the pahoehoe surface near the entrance to the lava tube.

Ching et al. (1968-1969) conducted an archaeological survey of the area now occupied by the developed portion of the Kona International Airport at Keāhole. The survey was accomplished with the aid of a helicopter, which enabled the archaeologists to identify site clusters quickly and accurately. A map included with this report indicates locations of seven or eight trails and approximately 200 archaeological sites in the region stretching from Wawahiwaa Point in Kohanaiki ahupua'a south of the airport facilities to Pu'ukala ahupua'a *mauka* of Queen Kaahumanu Highway north of the airport. A final report of this survey was not produced and it is not possible to relate site descriptions to the numbered sites shown on the map. Sites are indicated at or in the vicinity of the Phase II Heliport and Ramp "L," and trails are indicated in the vicinity of Phase II Ground Transportation Lease Lots, and perhaps

Phase I Parking (Phase II), Postal Facility Site Preparation, and Phase II Emergency Generator and Flight Kitchen Site Preparation, although it is difficult to relate the trail locations to these small areas with sufficient precision.

Ching (1971: Map 20) shows the approximate locations of more than four dozen surveyed features and more than a half dozen trails or trail segments at or near the airport property. Most of the features appear to be at the south end of the airport, on either side of the Mamalahoa Trail south of the 1801 lava flow. Most of the features and all of the trails are not labeled, so it is not possible to correlate them confidently with descriptive information.

Bonk (1979) conducted a brief survey of a "borrow area" *mauka* of the airport parking lot and north of the airport access road, and found no sites. The map of the "borrow area" location includes the Phase II Ground Transportation Lease Lots, a portion of Phase I Parking Phase II, and perhaps portions of the Phase II Emergency Generator and Flight Kitchen Site Preparation areas. These latter two areas, however, are situated in *kīpuka* of old pahoehoe where grasses and shrubs are relatively abundant, whereas Bonk describes the area he surveyed as "rough, mostly a'a, lava land with some grass scattered here and there where the natural surface of the lava has not been *disturbed*" (Bonk 1979). Thus, Bonk's survey area might not have extended to these areas, which are located at or near the northern edge of the "borrow area."

Barrera (1979) surveyed access road corridors extending north and south from the airport runway. He found two sites south of the runway, Sites 50-10-27-6961 and -6962, and excavated a small test trench at one feature of the latter site.

Barrera (1987b) surveyed two areas comprising approximately 51 acres and recorded two traditional Hawaiian historic sites, the Mamalahoa Trail, which entered airport property from the southwest, and Site 50-10-27-10306. Survey Area I was located immediately *mauka* of the extant ground transportation lease lots. No sites were found in Survey Area I, which had been mostly bulldozed prior to the archaeological survey. Survey Area II included the Phase I Air Cargo Building III, portions of Ramp "K," and Itinerant Aircraft Parking, and portions of Phase II Ramp "L." The Mamalahoa Trail crossed the western end of Phase II Ramp "L" and Site -10306 was located at or near the Phase I Itinerant Aircraft Parking area. The report was reviewed by the State Historic Preservation Officer (Nagata to Miyamoto, April 22, 1988) who concurred that all the sites had been found, but requested additional site descriptive information and that marine shells be collected. This information was later provided by Barrera in a letter report (Barrera to Miyasato, May 9, 1988), in which the site was determined to be no longer significant.

Barrera (1993) contains detailed documentation of the Mamalahoa Trail and reports two newly discovered traditional Hawaiian sites near the south end of the airport. The two new sites, given State site numbers 50-10-27-15259 and -15260, were located between the airport taxiway and runway. The State determined that field documentation of the trail in the area of the south ramp was successfully executed (Hibbard to Meyers 1993) and accepted the report (Hibbard to Johnson 1994). The SHPD concurred that destruction of the Mamalahoa Trail on a portion of the airport property was permissible (Hibbard to Meyers 1993). The Advisory Council on Historic Preservation objected to the Federal Aviation Administration's participation in destruction of the Mamalahoa Trail because that agency did not consult with Native Hawaiian groups (Bush to Sumida 1993, Nissley to Sumida 1994).

Barrera (1987a) surveyed five areas comprising approximately 355 acres and recorded six traditional Hawaiian sites, which were given State site numbers 50-10-27-10675 through -10680. Survey Area I was located south of the main airport passenger facilities, outside of the airport security fence. It included the Phase I GA Fuel Storage Site Preparation area and portions of Ramp "K." and the Phase II General Aviation Site, Air Taxi Terminal, portions of Ramp "L." and Heliport areas. Site -10675 was located at or near the Phase I Itinerant Aircraft Parking Area, Site -10676 was located at or near the Phase II Ramp "L." and the other four sites were located at or near the Phase II Heliport. Survey Area II was located north of the extant ground transportation lease lots and was largely coterminous with the Phase II Ground Transportation Lease Lots. This area was previously excavated as a borrow pit and yielded no historic sites. Survey Area III was located immediately north of the main airport passenger facilities and included at least portions of the Phase I Overseas Apron and Parking Phase II and Phase II Overseas Terminal Development. This area was also previously excavated as a borrow pit and yielded no historic sites. Survey Area IV was located immediately north of the runways in 1987, an area on the 1801 lava flow that is today occupied by runways and taxiways. No historic sites were found here. Survey Area V extended north from Survey Area 3 on the 1801 lava flow, where no historic sites were found. The State Parks Administrator, who at that time was responsible for the historic preservation program, found that the survey was sufficient to locate all historic sites and agreed that all six of the sites were significant for their information content (Nagata to Evans 1988). Sufficient information was collected from three of the sites—10675, -10676, and -10680—making them "no longer significant." He further agreed that archaeological data recovery was an appropriate mitigation plan for the treatment of these three sites.

Barrera (1990) reports on data recovery investigations at sites 50-10-27-10675, -10676, and -10680. The State determined that the fieldwork for the data recovery had been successfully executed (Nagata to Evans 1989) and later accepted the report (Hibbard to Koga 1990).

In the early 1990s, the Ho'ona Preserve was established *makai* of Kona International Airport at Keāhole at the Natural Energy Laboratory of Hawaii (Fig. 2). The 16.5 acre preserve contains a range of well-preserved traditional Hawaiian habitation structures typical of coastal hamlets in Kona dating to the 1800s and early 1900s. Descendants of the families last resident at the sites live in Kona today and have identified burial structures in the preserve. The Natural Energy Laboratory of Hawaii is responsible for maintaining Ho'ona Preserve.

ARCHAEOLOGICAL SURVEY RESULTS

This section presents the results of the archaeological survey organized by survey goal. Areas in which the goal was confirmation of previous findings of no sites are presented first, followed by areas in which previously recorded sites were to be relocated. Finally, the results of inventory survey in previously unsurveyed areas are presented.

CONFIRMATIONS OF NO SITES

Nine areas were surveyed with the goal of confirming earlier findings of no sites. In each of these areas no sites were found.

PHASE I OVERSEAS APRON AND PARKING PHASE II, AND PHASE II OVERSEAS TERMINAL

These three areas are located north of the airport passenger facilities (see Fig. 1). Barrera described this area, which he called Survey Area III, as having been previously excavated as a borrow pit (1987a:1). His survey recorded no sites. Today these areas are graded and used primarily for construction lay-down, although the portion of the Overseas Apron inside the airport security fence is paved with asphalt and the northern end of the Overseas Apron might include a bit of the 1801 lava flow.

The 1801 lava flow at the northern end of this area was surveyed for sites as part of the current project. Precise boundaries of the area could not be determined in the field, so the survey extended north to a point definitely outside of the area. The 1801 lava flow supports very little vegetation and surface visibility during the survey was excellent. The archaeologists traversed the lava flow on irregular transects, paying special attention to possible caves and overhangs. The level of survey was sufficient to find any historic sites that might be present, but no sites were found. This finding of no sites is consistent with previous work elsewhere on the 1801 lava flow.

Development of the Overseas Apron, Parking Phase II, and the Overseas Terminal will have "no effect" on historic sites because no historic sites are present.

PHASE I POSTAL FACILITY SITE PREPARATION

The Postal Facility Site Preparation area is located immediately *mauka* of the Parking Phase II area (see Fig. 1). The area is today mostly graded and was probably part of the borrow pit reported by Barrera in his Survey Area III (Barrera 1987a:1). A small area of old pahoehoe with fountain grass, part of an extensive *kīpuka* located mostly *mauka* of Road "N"

(Photo 1), is found in the vicinity. This small area was surveyed at a level sufficient to find any historic sites that might be present, but no sites were found.

Development of the Postal Facility Site Preparation Area will have "no effect" on historic sites because no historic sites are present.

PHASE II GROUND TRANSPORTATION LEASE LOTS

The Ground Transportation Lease Lots are located immediately north of the extant car rental facilities (see Fig. 1). Barrera (1987a:1) described this area, which he called Survey Area II, as having been excavated as a borrow pit. His survey located no sites. The area is today graded and filled. Survey outside the *mauka* end of the disturbed area yielded no sites.

Development of the Ground Transportation Lease Lots will have "no effect" on historic sites because no historic sites are present.

PHASE I AIR CARGO BUILDING III AND GA FUEL STORAGE SITE PREPARATION, AND PHASE II GENERAL AVIATION SITE AND AIR TAXI TERMINAL

GA fuel storage, general aviation site, and air taxi terminal area are partially graded, but have expanses of undisturbed pahoehoe lava. Barrera (1987a) found no sites here and our survey confirmed these negative findings.

Development of the Phase I Air Cargo Building III and GA Fuel Storage Site Preparation and Phase II General Aviation Site and Air Taxi Terminal will have "no effect" on historic sites because no historic sites are present.

PREVIOUSLY IDENTIFIED SITES

Four areas were surveyed with the goal of relocating previously identified sites, establishing their locations with GPS, and re-assessing significance. In one of these areas previously described sites remains largely intact. In the other three, however, recent landscape modifications have destroyed previously recorded sites that were evaluated as "no longer significant."

PHASE I RAMP "K" AND ITINERANT AIRCRAFT PARKING, AND PHASE II RAMP "L"

Ramp "K," Itinerant Aircraft Parking and Ramp "L" are located at the southern end of the airport (see Fig. 1). This area was partially surveyed by Barrera (1993), who made a photographic record of a portion of Mamalahoa Trail (State Site 50-10-27-2), which either passed over or very near the west end of Ramp "L." Barrera (1987b) surveyed the Itinerant Aircraft Parking, Air Cargo Building III, and the *makai* ends of Ramps "K" and "L" outside the security fence, finding one site, 50-10-27-10306, consisting of 11 features interpreted as habitation shelters and associated functions. Site -10306 was located in the vicinity of Ramp "K" according to the schematic site location map (Barrera 1987b: Fig. 3). Barrera (1987a) surveyed the *mauka* ends of Ramps "K" and "L," finding two sites in the vicinity of Ramp "L." Site 50-10-27-10675 was described as "a hole excavated into the pahoehoe bedrock" (Barrera 1987a:2). Site 50-10-27-10676 was a "rock mound" (Barrera 1987a:2). These sites were evaluated as containing information important for Hawaiian prehistory. They were determined to be "no longer significant" after they were recorded (Barrera 1990:1).

Today the portion of this area outside the airport security fence is completely graded (Photo 2), and the portion of Ramp "K" inside the security fence is paved with asphalt. The historic sites once located there, including Sites -10306, -10675, and -10676 are now destroyed, as is a portion the Mamalahoa Trail. Development of Ramp "K," Itinerant Aircraft Parking, and Ramp "L" will have "no effect" on historic sites because no historic sites are present.

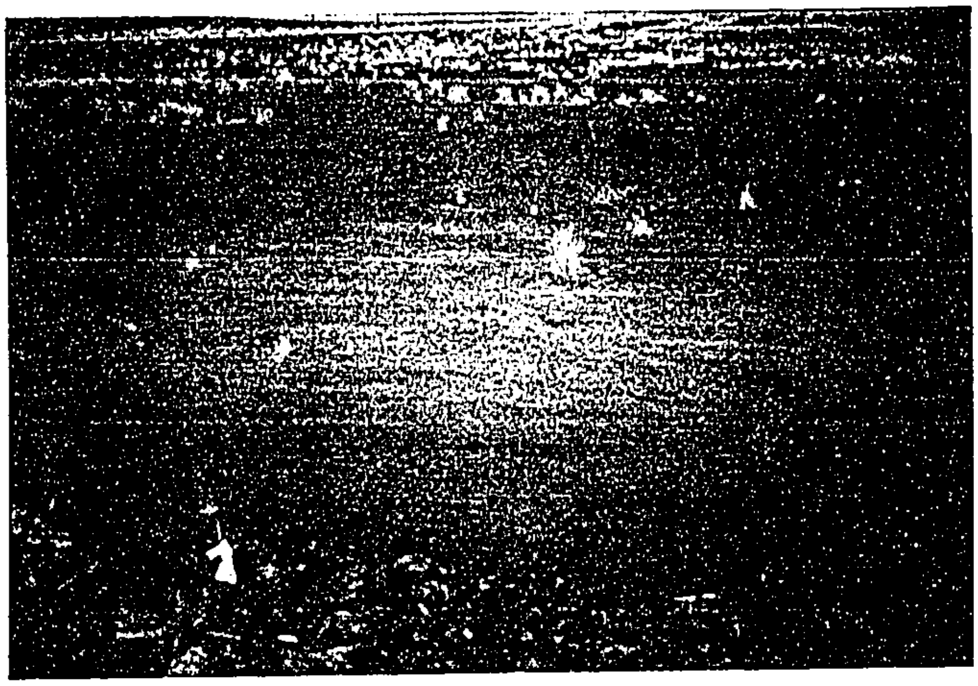

Photo 2. Graded area south of Ramp "K," including the vicinity of Mamalahoa Trail (upper left), Site 50-10-27-10306 (upper right), and Sites 50-10-27-10675 and -10676 (mid left). The airport security fence runs along the top of the photograph.

PHASE II HELIPORT

Barrera (1987a:6 ff.) recorded four sites in the vicinity of the Phase II Heliport. They include: Site 50-10-27-10677, a habitation cave; Site 50-10-27-10678, a cave; Site 50-10-27-

10679, a lava tube; and Site 50-10-27-10680, two excavations into the pahoehoe bedrock. Barrera appears to have been unaware that Site 10677 was previously recorded by Ching and Rosendahl (1968) as Site Kalaoa T2, and that Site 10679 was recorded by them as Sites Kalaoa T3 and T4. All four of the sites were evaluated as significant for the information on Hawaiian prehistory and history that they have yielded and are likely to yield (Barrera 1987a:11) and later underwent data recovery (Barrera 1990). The data recovery excavations were successfully completed (Hibbard to Koga 1990) according to an approved data recovery plan (Nagata to Miyamoto 1989). The sites were then technically "no longer significant."

Barrera (1990:7) described Site 10677 as

> a low broad lava bubble the roof of which has collapsed so as to form two living areas, one open to the sky and the other a cave. The open area consists of the original lava flow surface, a block of which has collapsed much like a miniature graben to form a living space enclosed by lava walls. This open section measures 5.7 by 6.9 meters [34.4 square meters] and contains Features A, B and C. The other living area consists of the bubble interior where the roof did not collapse, with a main living area that measures 5.0 by 5.5 meters [18.4 square meters] and a maximum ceiling height of 1.4 meters.... A piled arrangement of stones forms a stairway providing access via the 1.15-meter drop into the cave. Features D and E were found in this section.

Features A, C, and D are described as "stone mounds" (Barrera 1990:7) with heights of 45-60 cm. Feature B is "an alignment of basalt rocks" (Barrera 1990:7), and Feature E is a "crude hearth" (Barrera 1990:8).

Data recovery investigations, reported briefly by Barrera (1990), involved dismantling stone mound Features A and D, collecting all of the material in hearth Feature E, and collecting materials from "midden remains" described as "scarce and discontinuous, with no real concentrations that might properly be described as deposits" (Barrera 1990:10). The site yielded 12 traditional Hawaiian artifacts, including fishhooks, abraders of coral and echinoid spine, a basaltic glass core, and a flake from a basalt adze, along with 15 pieces of coral that were brought to and deposited at the site. Food remains included common marine shells dominated by cowrie, medium bird bone, bone of dog, pig, and fishes, primarily parrotfish. Also recovered were human and rat bones. Botanical remains included *kukui* shell, pandanus, and possible gourd fragments, along with unidentified charcoal (Barrera 1990: Tables 1-5). A ^{14}C date on unidentified wood charcoal yielded a conventional radiocarbon age of 360 ± 60 B.P., which calibrates to A.D. 1430-1650 at 2σ.

Barrera excavated nearly the entire deposit at this site. The site has yielded the information on Hawaiian history and prehistory that it contains. The determination that the site is "no longer significant" is valid. The collections from this site contain materials that are potentially important for the information they contain about Hawaiian prehistory and history.

Barrera described Site 10678 as a cave with "a human-excavated hole in the pahoehoe bedrock" (Barrera 1990:11) as an entrance. The cave lacked artifacts, midden or other living debris.

This site appears today almost exactly as Barrera described it. The site contains no information on Hawaiian history and prehistory that is not recorded in its location. Thus, the site's designation as "no longer significant" is correct.

Barrera (1990:11, 23) described Site 10679 as

> a lava tube, the utilized portion of which extends for a distance of approximately 210 meters .... It measures between six and 15 meters in width and has a maximum ceiling height of about four meters. At the lowest point, for a distance of 20 meters... the cave is only 40 centimeters high. Water constantly drips through the roof of the cave, primarily as a result of condensation.... Access is gained through two sections where the roof has collapsed. At the east end this roof collapse has formed a chamber measuring 7.0 by 18.9 meters. ... Access to the west end of the tube is gained through a large hole in the roof.

Barrera described 10 features at Site 10679: a platform and four stone mounds or cairns near the eastern entrance and five sets of petroglyphs near the western entrance. Barrera made surface collections of materials at 26 locations, mostly east of the low portion of the tube, but also near the western entrance, excavated 2 m^2 in the "only true midden deposit ... found on the south side of the [east] chamber just inside the drip line" (Barrera 1990:23), and placed a trench through the platform at the eastern entrance. Materials collected include abraders, unfinished fishhooks, fragments of bonito lures, an adze preform, a fireplow, unidentified charcoal from 10 torches, several "plank fragments," pieces of coral and non-local basalt, naturally deposited bird bones (Hawaiian crow, Bulwer's and dark-rumped petrel, and Malay turtle dove), common marine shell species, primarily large *'opihi* interpreted as artifacts used "as ladles or scoops for the collection of water" (Barrera 1990:25), a small amount of human, rat, pig, medium mammal, and fish bone, *kukui* nutshells, unidentified wood, coconut, and gourd. Two ^{14}C dates on unidentified charcoal collected midway along the length of the tube and the eastern entrance returned conventional radiocarbon ages of 1000 ± 200 and 910 ± 140 B.P., which calibrate to 2σ ranges of A.D. 640-1390 and A.D. 781-1385.

Barrera described Site 10680 as "two excavations into the pahoehoe bedrock, situated at a distance of 13 meters from each other" (Barrera 1987a:10). These two features appear not to have been altered since Barrera described them. They have been adequately recorded and remain "no longer significant."

Barrera made extensive collections of artifacts and other materials, primarily from Sites 10677 and 10679. These collections were stored by Barrera's firm, Chiniago, Inc. (Hibbard to Koga 1990), which is now defunct. A review of records at Airports Division DOT and SHPD was made to determine the status of these collections without success.

INVENTORY SURVEY

Four previously unsurveyed areas were surveyed at an intensity sufficient to support the reasonable belief that all sites were found. Historic sites were found in two of the areas located at least partially in a *kīpuka* of relatively old lava. The other two areas were completely altered and do not contain historic sites.

PHASE I FUEL FARM SITE PREPARATION AND WASTEWATER TREATMENT PLANT

The Fuel Farm Site Preparation area and Wastewater Treatment Plant are located at the northern end of the airport (see Fig. 1). Both of these areas are completely disturbed. The Fuel Farm Site Preparation area is on a portion of an a'a lava flow that is today completely graded. There are no historic sites present at the Fuel Farm Site Preparation area. The Wastewater Treatment Plant is located on a former quarry, and is today a massive hole in the ground (Photo 3). Survey around the *mauka* edge of the quarry revealed evidence of heavy machinery activity and no trace of historic sites.

Photo 3. Former quarry at the site of the Wastewater Treatment Plant.

Development of the Fuel Farm Site Preparation area and Wastewater Treatment Plant will have "no effect" on historic sites because no historic sites are present.

PHASE II EMERGENCY GENERATOR AND FLIGHT KITCHEN SITE PREPARATION

The Emergency Generator and Flight Kitchen Site Preparation area are located in a *kīpuka* area of old pahoehoe lava with common fountain grass and small shrubs (see Photo 1). *mauka* of Road "N" (see Fig. 1). The pahoehoe lava surface here is irregular and broken. with large up-thrust sections. Fountain grass growth obscured the ground surface in many areas, especially low spots in the topography. In some places, where fountain grass growth was especially thick, it was not possible to gain a clear view of the ground surface. Two archaeologists spent approximately 8 person hours surveying for sites in the vicinity of the Emergency Generator and Flight Kitchen Site Preparation area. Because it wasn't possible to determine the precise boundaries of these areas in the field, an effort was made to survey a larger area that included them both. The archaeologists walked eight irregular north-south transects through the area, at approximately 25 m intervals, varying their paths according to the topography to include all likely site locations. Sites were described and photographed and their locations were later established with differentially-corrected GPS.

Ten sites were recorded in the general area (see Fig. 2) and assigned consecutive field numbers from 1 to 10. The site locations were plotted on a map of airport facilities. which shows that most of the sites fall outside of the two project areas (see Fig. 1). However. Sites 7 and 8 are found within the boundaries of the Flight Kitchen Site Preparation area and Site 1 falls within the boundaries of the Emergency Generator.

Sites 1-9 can be described as circular or near-circular plan alignments of angular pahoehoe cobbles and boulders, generally a single course high but in places two or exceptionally three courses high, with outside diameters between 1.2 and 2 m. In some of the sites, one or more pahoehoe slabs are set on end, giving a portion of the alignment a height of ca. 20 cm, but in the usual situation the cobbles and boulders rest on their larger surfaces and rise only ca. 10 cm above the surrounding ground surface. In all cases the alignments are constructed on an expanse of unbroken pahoehoe that is level or gently sloping. No cultural materials were found associated with any of these sites.

Site 10 is a C-shape structure of pahoehoe cobbles and boulders up to two courses high that augments a natural depression in the pahoehoe, creating a barrier approximately 50 cm high (Photo 4). The structure is open at its *makai* end, where it is 2.5 m wide. No cultural materials were observed at this site. It is located south of the Flight Kitchen Site Preparation area (see Fig. 1).

Site 1 is a circular alignment of angular pahoehoe cobbles and boulders with an outside diameter of 1.9 m (Photo 5). No cultural materials are associated with the site.

Site 7 is a circular alignment of angular pahoehoe cobbles and boulders with an outside diameter of 1.7 m (Photo 6). Several of the pahoehoe slabs at the *mauka* end of the site are standing on edge. No cultural materials are associated with the site.

Site 8 is a circular alignment of angular pahoehoe and a'a cobbles and boulders with an outside diameter of 1.5 m (Photo 7). The site is located at the edge of a massive a'a lava flow, from which several cobbles and small boulders were taken as construction materials. No cultural materials are associated with the site.

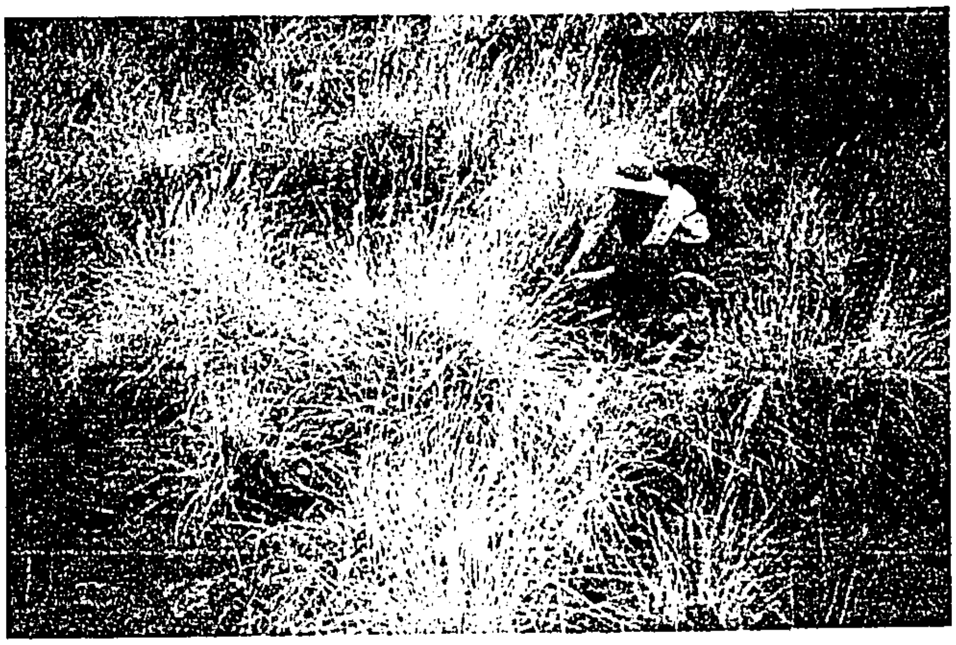

Photo 4. C-shape structure, Site 10.

Photo 5. Site 1 at Emergency Generator (see Fig. 1).

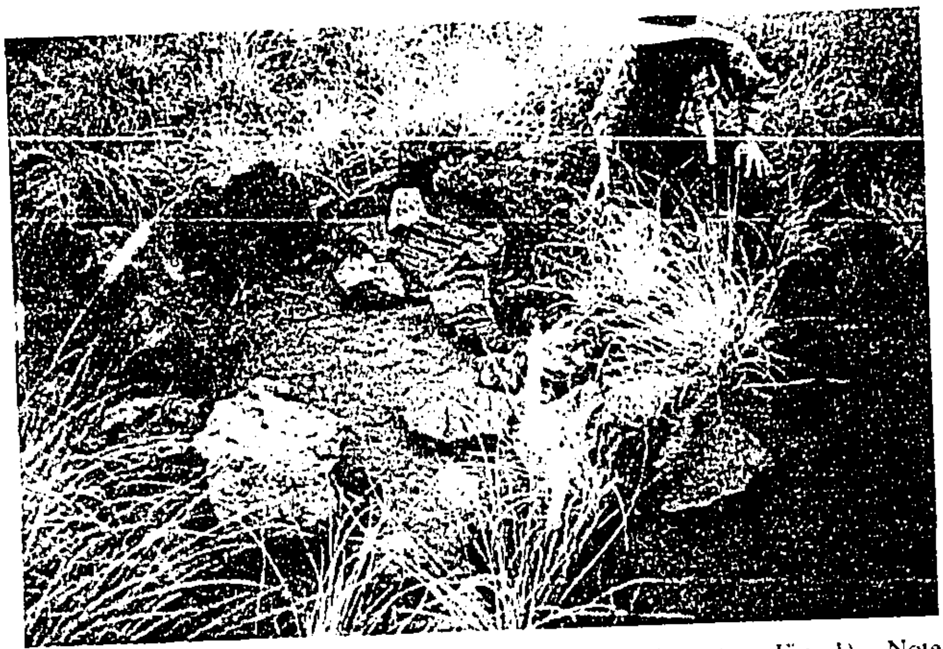

Photo 6. Site 7 at Flight Kitchen Site Preparation Area (see Fig. 1). Note pahoehoe slabs standing on edge.

Photo 7. Site 8 at Flight Kitchen Site Preparation Area (see Fig. 1). Note the a'a flow adjacent to the site.

Sites 1, 7, and 8 are significant for the information on Hawaiian prehistory that they have yielded. All three of the sites represent minimal labor investments, are constructed on bare pahoehoe lava, and have no associated cultural materials. Their locations have been accurately recorded and they have been described in appropriate detail. Therefore, these three sites are "no longer significant" because they have yielded the information that made them significant.

RECOMMENDATIONS FOR ARCHAEOLOGICAL WORK

Most of the archaeological projects at Kona International Airport at Keāhole have been relatively small-scale surveys carried out in the vicinity of the main airport facilities. These facilities are located in an ecological "barren zone" in which are found a low density of traditional Hawaiian archaeological sites, primarily temporary habitation sites and refuges. The foci of traditional Hawaiian settlement in this part of Kona were the coast and *mauka* areas where rainfall was more plentiful. An early large-scale survey carried out in the late 1960s located and recorded 343 sites in the general vicinity of the airport, with concentrations along the coast and *mauka* of Queen Kaahumanu Highway, which was constructed subsequent to the survey. Many, if not most, of these sites are located outside of the current airport boundaries. A final report of this large-scale survey was not completed and site records once held at the State Parks Division have apparently been lost. Subsequent small-scale surveys conducted in conjunction with proposed improvements to the airport generally show sites on non-standard schematic maps, which make it difficult or impossible to derive real-world coordinates for their locations. These circumstances, among others, have made this part of Kona a "problem area" for the SHPD GIS database, which today contains only preliminary and apparently incomplete site location information for the Kona International Airport at Keāhole. The SHPD GIS is a primary tool used in management of historic sites throughout the state, which serves as the definitive index to historic site information.

It is recommended that the SHPD's GIS be brought up-to-date. This task would involve four steps. The first step would be to enter a location for each site that appears on an archaeological site location map. Next, archaeological reports would be systematically reviewed to develop an index to information on the sites. A third step would be to determine and enter boundaries of areas that have been surveyed for historic sites. Finally, geo-registered aerial photographs or satellite imagery would be used to identify and establish boundaries of developed areas where historic sites are unlikely to be present.

It is further recommended that the updated GIS database be used to develop a list of tasks required to complete the inventory of archaeological sites on airport property. It is anticipated that these tasks will include field survey to verify site locations and to gather information about sites that lack documentation or for which there is contradictory information, and inventory level survey of areas that are likely to contain historic sites but which have not been archaeologically surveyed. This list of tasks would serve as the basis for development of a plan to implement the complete archaeological site inventory. Such a plan would serve primarily as a guide to archaeological work required for future airport projects, so that future archaeological work at Kona International Airport at Keāhole contributes systematically to the growing body of information on Hawaiian history and prehistory.

It is further recommended that an attempt be made to locate collections made during data recovery at airport sites. It is believed that some of the collections held by Chiniago Inc. were taken over by the contract archaeological firm on Hawai'i Island headed by Lloyd

Soehren. This lead should be followed up with a telephone call to Mr. Soehren and possibly a trip to Hawai'i Island to review any Chiniago Inc. collections that he might hold. Once the Kona International Airport at Keāhole collections are identified, arrangements should be made to curate them in a State approved repository.

PUBLIC ACCESS SHORELINE HAWAII (PASH) RIGHTS

INTRODUCTION

This section presents results of oral interviews done to address PASH rights, including traditional and cultural rights issues for Kona International Airport at Keāhole, Hawai'i Island. Social Research Pacific, Inc. (SRP) undertook the project for IARII. Interviews were conducted between December 3, 1999 and February 9, 2000.

PURPOSE OF THIS PROJECT

The purpose of this project was to assess PASH rights, including traditional and cultural rights issues for Kona International Airport. The task was to be accomplished through interviews with approximately eight to 10 informants. The project entailed identifying informants for the interviews, arranging and conducting the interviews, and preparation of this report.

PASH, as it concerns this report, is the resulting court decision based on a series of three cases brought before the Hawaii Supreme Court. These three cases have culminated in what is otherwise known as the PASH decision. The first of these, *Kalipi vs. Hawaiian Trust Company, Ltd.*, was brought before the court system in 1982, and concerned balancing the rights of land owners and native practitioners (Native Hawaiian Bar Association 1997). The *Pele Defense Fund vs. Paty*, was brought before the courts in 1992, and expanded customary and traditional gathering rights of native Hawaiians beyond the boundaries of the *ahupua'a* of residence (Native Hawaiian Bar Association 1997). In the final case, *Public Access Shoreline Hawaii vs. County Hawaii, July 1997* (also known as the *Kohanaiki* ruling), the court's rulings determined the following: 1) the right of each *ahupua'a* tenant to exercise traditional and customary practices remains intact, notwithstanding arguable abandonment of a particular site; 2) continuous exercise is not absolutely required to maintain validity of a custom; 3) the western concept of exclusivity is not universally applicable in Hawai'i; and 4) the state is obligated to protect customary and traditional rights normally associated with residency in an *ahupua'a*, [and] may also apply to the exercise of the rights beyond the physical boundaries of that particular *ahupua'a* (Native Hawaiian Advisory Council 1997).

The results of PASH rulings such as the above help define the criteria and establish the groundwork for addressing issues associated with access to areas used for traditional and customary practices by Hawaiians. Some questions about Hawaiian traditional and customary practices remain unresolved; these are addressed by House Resolution No. 197, HD1 (Office of Planning 1998).

Kona International Airport is located at Keāhole, and spans over several *ahupua'a* boundaries, and as well, borders the shoreline of the Kona coast. Like the *Kohanaiki* ruling

[case], similar concerns may arise as plans proceed with the development/expansion associated with Kona airport. However, as results of the oral interviews indicate, these issues/concerns have already been brought forth and are being discussed among the Hawaiian community. These will be elaborated on in the presentation of the results of the interviews. The following seven PASH-related issues were identified during interviews.

PASH AND TRADITIONAL/CULTURAL ISSUES IDENTIFIED FOR THE PROJECT AREA

The application of PASH rights encompasses issues that relate to the broader concept of *ahupua'a*, which includes the shoreline. The concerns shared by the native Hawaiian community in the Kona area echo these broad issues. The following seven areas have been identified as the major PASH and traditional/cultural issues for the project area:

1. Limited access to shoreline within the vicinity of existing airport properties;
2. Compromising of archaeological and historical sites;
3. Access to prime fishing grounds;
4. Loss of native (traditional) plants;
5. Observation of traditional boundaries (need to treat an *ahupua'a* as one unit);
6. Impacts to aquifers and seabeds; and
7. Boundaries compromised and/or seen as inseparable from Natural Energy Laboratories Hawaii (NELH).

The following section elaborates on these issues, presenting a summary of responses from informants who participated in the interviews.

ORAL INTERVIEWS

THE INTERVIEW PROCESS: IDENTIFYING INFORMANTS AND LEVEL OF EFFORT

At the recommendation of the contractor, informants for this project were to be identified with the help with the District Airport Manager, Mr. Frank Kamahele. This suggestion was followed, and in addition, contact was made with the Office of Hawaiian Affairs (OHA), the State Historic Preservation Division (SHPD), and individuals who were familiar with long-term Hawaiian residents of the Kona area. Appendix A lists the individuals contacted and interviewed for this project.

Two factors need to be noted before further discussion is made of the interviews. First, PASH issues do not appear to have been raised or addressed in relation to Kona International Airport prior to the current project, but such issues have been raised for areas near and/or adjacent to the airport. This matter cannot be avoided, nor can it be treated as a separate concern since it is very likely that the same PASH issues will be echoed in association with additional/further development of the airport. The *Protect Kohanaiki Ohana*, which represents a land area just north of Keāhole, is an organization that has formed largely out of the need to address the protection of traditional and cultural Hawaiian practices.

Secondly, it should be noted that since this project specifically addresses PASH issues, attempts were made to contact members of PASH (a public organization based in Kailua, Hawai'i, that brought the *Kohanaiki* case to court), in particular Mr. Angel Pilago. Mr. Pilago is a central figure in the PASH organization but did not agree to discuss PASH issues as they may relate to the current project. His primary objection was based on the feeling that he could not contribute to this project. He was also concerned about the misuse of any information that he would provide. Time permitting, all others contacted were able to share their knowledge about the area as well as help identify issues with which they are concerned.

RESULTS OF THE INTERVIEWS

Eight formal interviews were completed between December 3, 1999 and February 9, 2000. These were completed primarily on the island of Hawai'i, with one in-person and one telephone interview done on Oahu. In addition to formal interviews, informal discussions were held to gather general background information on the area and identify potential informants (Appendix A).

The interviews indicated seven issues or major areas of concern in relation to PASH and traditional and cultural issues in the project area. The results of these interviews are presented below in summary form.

Issue 1: Limited Access to Shoreline Within the Vicinity of Existing Airport Properties

Limited access to the shoreline is a current concern and source of problem for residents in the Kona area, as well as those who wish to use the shoreline for fishing and recreation. Although access has been limited somewhat by or since construction of the airport, more recently, access has been denied due to the boundaries and restrictions created by NELH (the NELH is discussed further below).

In general, changes in shoreline access brought about by the development of the airport were perceived as a change to which people adapted. Most informants agree that the three major uses of the area, (a) vehicle access, (b) camping, and (c) fishing, were not compromised by construction of the airport. The change in vehicular access as a result of realignment and partial construction of a new road around the airport property was acceptable. Although a little more inconvenient, most individuals wanting to use the shoreline could still do so. Since construction of NELH facilities, however, access to the area has become more restricted. Road access, camping and fishing are seen as either inaccessible or so limited that people can rarely use the shoreline area. Fishing is believed to be more limited as a result of a reduction in the fish supply; this is attributed largely to NELH's near-shore activities. In addition, the existence of beaches along the shoreline is also questioned.

It is generally believed that beaches *makai* of the airport that once connected to one another, no longer exist as a result of the changes brought about by development in the area.

Issue 2: Compromising of Archaeological and Historical Sites

Archaeological and historical sites, both known and unidentified, are believed to exist within and/or adjacent to the current airport boundaries. The first group of such sites is those that carry the greatest degree of cultural significance for the descendants of Keāhole lands. These are human (ancestral) burials in caves within the vicinity of the airport. Although burials have not been identified by previous archaeological surveys in the area (Tom Dye, pers. comm.), nearly every informant stated that ancestral burials exist around the airport. The exact location of these burials is known to some of the *kupuna* (individuals who can help locate them) living in the area. According to Frances Keanaaina, officials from the airport and the adjoining NELH facilities have been made aware of the existence of these burials. (The Keanaaina family members are descendants of these lands; others include the Mahi, Lee and the Kamaka families.)

The second group of archaeological and historical sites includes known features that have very specific boundaries/localities. Val Ako, who was born in 1926, remembers that there were various trails leading from Keāhole to Hualalai. According to Mr. Ako, "there were boulders, stepping stones all the way up Hualalai Mountain...they're all gone...they were all blue rock." Among the known trails are the *Mamalahoa* and the *Kahaka ala Kalakai* trails. According to Kona County Councilman Curtis Tyler, Congress is currently considering setting up the *ala kalakai*, which is just *makai* of the airport, as part of the national trail system. The *Mamalahoa Trail*, which runs parallel to the coastline, is partially dissected by existing airport boundaries. The primary concerns are that these trails be maintained (restored if necessary), and made accessible as footpaths.

Although no detailed or specific information was gathered during the interviews about the existence of a former fishpond in the airport area, a few people recall that this pond was covered during construction of the airport. The fishpond was not raised as an area of concern but it was referenced in discussions emphasizing historical significance of the area. Also, most people referenced the salt ponds in the area. Though rarely used now, these ponds were known to be a valued resource prior to the development of the airport. According to Kaina Keanaaina, there is also a *konane* board (ancient Hawaiian checkerboard), located in fairly deep water off the shoreline. During several interviews, mention was also made of the Kona Field System, which is well outside the airport area but is associated with/demonstrates the overall significance of the Kona area.

Issue 3: Access to Prime Fishing Grounds

People recall the abundant fishing grounds that lie along the shoreline of Kona airport. The area extends south towards Kailua, and north towards Kawaihae but access was perhaps best from the beaches and rocky shorelines in the Keāhole area. Among the types of fish resources known were: *akule*, *ōpelu*, *maini*, *ha'uke'uke*, *limu*, *'opihi* and *wana*. In recent years, not necessarily corresponding with development of the airport, the fish supply has declined. Access to fishing grounds has two levels of concern: 1) the actual supply [reduction] of resources, and; 2) physical access to shoreline areas known previously as prime fishing grounds.

The reduction in the supply of fish resources is most closely associated with the activities of NELH. Although it may be related to other events, in general, people see that NELH's use of the area has seriously changed the availability of resources. According to Mr. Ako, a black sand beach beyond Keāhole lighthouse (northern part of Kona airport, towards an area referred to as Ho'ona) that was a very good fishing ground, was completely destroyed during NELH's attempts to raise algae. Also, there was easier and greater access to salt ponds in the area; some of these have completely disappeared or are no longer good areas for collecting salt.

Physical access to the shoreline along airport boundaries has been restricted more since the development of NELH. Vehicle access is important and was available through a detour around airport properties. This road access, which at one time allowed further pedestrian access along the shoreline, is now limited. According to informants who use the area, these restrictions include chain fences/gates with padlocks on the NELH side (southern edge of airport), and boulders along the northern edge of the shoreline adjoining the airport.

Along with fish supply, there are related concerns of noise, lights and exhaust (jet fuel) traveling from the airport to the ocean. These factors are believed to adversely impact fishing in the area.

Issue 4: Loss of Native (Traditional) Plants

There are plants along the shoreline that are used to make leis. Hannah Springer, OHA trustee, notes that "there is an absence of vegetation in general [in the airport area]...*ohia* and *naio* are there and native to Hawaii." She believes both plants are of biological interest and the *'ōhi'a* should be looked at for its affinities to other varieties that survive in such water-stressed areas. *'Ōhi'a* plants can be found on the current airport property.

According to Ruby McDonald, the area was very likely used for the gathering of traditional plants since this was a practice of most areas settled by Hawaiians. Some of these plants however, are no longer available because they have been pulled out by development of the airport area. K. Keanaaina also emphasized the importance and use of the shoreline by hula *hālau* for ritual and gathering purposes. Going to the shoreline to gather plants, spiritual cleansing, etc., are activities performed by his *hālau*.

Issue 5: Observation of Traditional Boundaries
(Need to Treat an *Ahupua'a* as One Unit)

In addressing PASH issues, it is clear that application of physical boundaries [as in the current project area] needs to be clarified. At question is how to take into consideration the notion of an *ahupua'a*, while also working within designated, site-specific boundaries. Traditional and cultural customs and practices involve addressing the entire *ahupua'a*. The airport spans over several *ahupua'a*. Therefore, the area on which the airport is located cannot be restricted to only its designated boundaries. A clarification of traditional Hawaiian land divisions, which consist of *ahupua'a*, is needed if traditional land use and issues are being addressed.

According to Councilman Tyler, the more appropriate question that needs to be addressed by this project is, "Is anything happening here that is going to preclude the exercise of one's *kuleana*." As he describes, *kuleana* means responsibility, and it is the responsibility of every generation of Hawaiian to care for, as much as to live in and off the land. *Kuleana* also allows the individual to request that they be allowed to exercise their rights to the land. (It should be noted that PASH rights in general, and the issues identified in this report, are a questioning of the ability to properly or fully exercise one's *kuleana*).

Issue 6: Impacts to Aquifers and Seabeds

According to Hannah Springer, the two main concerns with reference to PASH issues in the Kona airport area are: 1) impacts to aquifers; and 2) impacts to seabeds. She would like to see research evaluating impacts to the freshwater lens, including the quality of salt and the extent of pollutants mixing in deep water. Hannah feels there needs to be a clearer understanding of the aquifers in the land area. Also, salt collections that are sometimes owned [regularly used] by families should be evaluated for their quality. Salt collection is seasonal but may be impacted by activities associated with nearby developments. With reference to deep water, she knows that offshore from the airport, are rich fishing grounds.

Issue 7: Boundaries Compromised and/or Seen as Inseparable from NELH

PASH rights to the area, as they concern Kona International Airport, are nearly inseparable from concerns associated with NELH. The present location of NELH, at the southeastern edge of the airport boundary, is within the same *ahupua'a* as Kona airport. With the exception of the Airport District Manager and public officials, most informants and area residents do not separate the two facilities, or the lands on which they are located. There are several areas of contention with NELH, including it (a) being a private enterprise using ceded lands, (b) possibly polluting the nearby shoreline, and (c) not being community oriented or cooperating with the community. Although these issues are beyond the scope and purpose of the current project, they are related to the Kona airport in the minds of the informants.

DOCUMENTARY INFORMATION

In addition to the oral interviews, a review was made of *A Social History of Kona: Vols. I and II* (Ethnic Studies Program 1981). This report presents results of an oral history project done with residents from the Kona area, by the Ethnic Studies Program at University of Hawaii. A review of this report helped gain background information on individual's recollections of the history of this area. While little information was provided on issues relating to shoreline access or historical sites, individuals of Hawaiian ancestry in particular, elaborated on land use in the area in the earlier part of the 20th century. Fishing was a "chief livelihood" at the turn of the century, and "the shores were lined with coconut which the Hawaiians used for food and a variety of other means" (Ethnic Studies Program 1981:A6). Also, ethnic breakdowns indicate changes that were taking place in the Hawaiian community, that numbered only 20 by 1932. In comparing this figure with informants' (from the current study) recollections about settlement in the area, the numbers do not appear to adequately represent the rather large Hawaiian community in the Kona area. Otherwise, the 1981 interviews do indicate the abundance of foodstuffs and the importance of fishing for Kona area residents.

SUMMARY AND CONCLUSIONS

Based on information gathered from the interviews, seven issues concerning PASH and traditional and cultural rights to the Kona International Airport area have been identified. Although it is difficult to ascertain at this time which of these seven will be viable PASH rights issues, it is foreseeable that (#1) limited access to the shoreline within the vicinity of existing airport properties, (#3) access to prime fishing grounds, (#6) impacts to aquifers and seabeds, and (#7) boundaries compromised and/or seen as inseparable from NELH, will be among the major concerns raised by the community.

Some of these issues are remnants of past concerns but some are in need of more immediate action, particularly if further development is planned for the airport area. People who provided the interviews (Appendix A) range from public officials, to descendants of the land, to those who have recently settled the Kona area. Their knowledge as well as opinions demonstrates a great deal of consistency, and as well, a desire to work cooperatively in order to achieve continuation of cultural practices along with development of the airport.

Cooperation with groups such as PASH, the *Kohanaiki Ohana*, etc., will help identify issues and concerns for future use of the area, as well direct development goals in a mutually acceptable manner. It is unfortunate when individuals representing some of these concerns do not wish to participate in the planning process, however, there are Kona residents in official and non-official categories, who would be willing to address such matters.

In addition to the individual with whom interviews were completed, the study also identified sources, primarily through recommendations, with whom interviews and/or discussions were not done. Appendix B lists the names of all actual and potential informants. Due to the time constraints of the project, these individuals were not contacted or could not be located. However, it is recommended that future studies addressing PASH and traditional and cultural rights issues for the Keāhole area, attempt to contact and interview these potential informants.

A major issue that needs to be reiterated is that a clear separation between land use and access by the airport and NELH, will be unlikely in any future developments in the area. Residents, not necessarily public officials, perceive these two facilities as occupying one area. Likewise, any limitations or lack of access to the shoreline and adjoining areas created by one will likely be attributed to both.

SUMMARY AND CONCLUSIONS

A review of previous archaeological work at Kona International Airport at Keāhole using the library, correspondence files, and GIS at the SHPD revealed probable gaps in the inventory of historic sites. These gaps are due, in part, to a large-scale survey in the late 1960s that wasn't fully reported and to the use of non-standard base maps for plotting sites located during a series of small-scale surveys. On the basis of this review, it is not possible to estimate accurately the amount of fieldwork that would be required to bring the inventory of historic sites to completion. Accordingly, it is recommended that available archaeological survey and site location information be entered into the State GIS where it can be used in conjunction with geo-registered aerial photography to derive a list of tasks needed to complete the inventory. It is anticipated that these tasks will include a mix of "ground-truthing" uncertain information, attempts to relocate previously identified but incompletely recorded sites, and survey of unsurveyed lands.

Fieldwork at the Phase I and II parcels relocated six previously recorded sites at the Phase II heliport parcel and established their locations on airport facilities and USGS quad maps with a GPS. Inventory survey of the Phase II flight kitchen site preparation and postal facility site preparation parcels identified three small sites consisting of near-circular one- and two-course cobble and boulder alignments. These sites were described and photographed, and their locations were established with GPS. The sites are evaluated as significant solely for the information on Hawaiian history and prehistory that they have yielded. This project collected sufficient information to make these sites "no longer significant."

Collections of archaeological materials from sites at the airport could not be located. The collections were originally stored by a now defunct archaeological firm, Chiniago, Inc. The collections are an important record of traditional Hawaiian use of the lands now occupied by the airport and it is recommended that leads on the present status of the collections be followed up. Once the collections are recovered they should be stored in a State approved repository.

An assessment of PASH rights is based on a series of eight interviews conducted on Hawai'i and O'ahu Islands. During the interviews seven issues related to PASH by members of the community were identified. These issues include limitations on access to the shoreline and to prime fishing grounds in the vicinity of the airport, possible impacts to archaeological and historical sites (including human burials), loss of native plants used traditionally by Hawaiians, considerations of traditional *ahupua'a* boundaries, possible impacts to aquifers and seabeds, and activities of NELH, whose property is believed by some community members to be inseparable from the airport property.

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1987 Hualalai Volcano: A Preliminary Summary of Geologic, Petrologic, and Geophysical Data. Chapter 20 in *Volcanism in Hawaii*, Vol. 1, edited by R. W. Decker, T. L. Wright, and P. H. Stauffer, pp. 571-586. U.S. Geological Survey Professional Paper 1350. U.S. Government Printing Office, Washington, D.C.

Nagata, Ralston
1988 April 22 memorandum to Owen Miyamoto, Airports Administrator re: National Historic Preservation Act & Chapter 6E, H.R.S. Historic Preservation Review—Keahole Airport South Ramp & Ground Transportation Lease Lots Addition, Kalaoa, North Kona, Hawaii, TMK: 7-3-43. On file, State Historic Preservation Division, Kapolei.

1988 July 26 memorandum to Roger Evans, OCEA re: Draft EIS--Keahole Airport Master Plan, Kalaoa area, North Kona, Hawaii (88-560), TMK:7-4-3: part 3. On file State Historic Preservation Division, Kapolei.

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1989 June 21 memorandum to Roger Evans, OCEA re: State LUC Petition (A89-641)--548 Acres from Conservation to Urban for Expansion of Keahole Airport Facilities (DOT) (89-675, 89-653), Kalaoa area, North Kona, Hawaii, TMK:7-3-43: parts of 1, 2, 3. LOG NO: 1158. On file, State Historic Preservation Division, Kapolei.

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1997 Summary of the Kohanaiki Decision (Public Access Shoreline Hawaii vs. Hawaii County Planning Commission). Kailua, Hawaii. July.

Native Hawaiian Bar Association
1997 "Life with PASH." Results of the 1997 Native Hawaiian Bar Association Convention held at Sheraton Waikiki Hotel, Honolulu.

Nissley, Claudia
1994 September 23 letter to Henry A. Sumida, Federal Aviation Administration re: Keahole Airport, Kailua-Kona, Runway Relocation; Destruction of the Mamalahoa Trail. On file State Historic Preservation Division, Kapolei.

Office of Planning
1998 "PASH/Kohanaiki Study Group Report." Prepared by the Department of Business, Economic Development and Tourism, Office of Planning, January 20.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther Mookini
1974 *Place Names of Hawaii*, 2nd edition. University Press of Hawaii, Honolulu.

APPENDIX A.
INDIVIDUALS CONTACTED AND INTERVIEWED FOR PROJECT

NAME	POSITION/TITLE	DATE INTERVIEWED/LOCATION
Fanny Ahoy*	Kona resident	325-5202; Kona
Valentine Ako	Kupuna; previous landowner	1/21/00; 822-5606 Kauai
Papa (Henry) Auwai*	Kahuna/Kupuna	Hilo
Amalu McClure Brink	Kona resident	1/28/00; Kona
George Kahananui*	Kupuna (Val's brother)	Kona
Frank Kamahele	Airport District Manager	12/3/99; Kona Intnl. Airport
Anna Keanaaina	Kupuna	1/28/00; Kona
Frances Keanaaina	Kupuna	1/28/00; Kona
Keana Keanaaina	Kumu of halau in Kona	1/28/00; Kona
Reggie Lee*	Kona resident	323-3141; DOCRE (Kona)
Kepa Maly	Oral Historian	12/12/99; Hilo
Ruby McDonald	Resource Specialist, OHA	1/28/00; 329-7368 Kona
Holly McEldowney	State Archaeologist, SHPD	1/09/00; 692-8208 Oahu
Angel Pilago**	PASH	1/24/00; 327-4770 Kona
Mark Smith	Hawaii State archaeologist	1/25/00; 933-0482 Hilo
Hannah Springer	OHA Trustee	12/8/99; 593-1888 Oahu
Curtis Tyler	Kona County Councilman	1/28/00; 326-5684/325-6600

* Attempts to contact and interview these individuals were not successful.
** Declined to be interviewed for this project.

APPENDIX B.
INDIVIDUALS IDENTIFIED/RECOMMENDED AS POTENTIAL SOURCES/INFORMANTS

NAME

Fanny Ahoy
Valentine Ako*
Papa (Henry) Auwai
Rick Gaffney
George Kahananui
Mauka S. Kalua
Frank Kamahele*
Frances Keanaaina*
Haole Keanaaina
Norman Keanaaina
Elizabeth Lee (Reggie's mother)
Reggie Lee
Arthur Mahi
Kepa Maly*
Ruby McDonald*
Holly McEldowney*
Gerard Nihous
Angel Pilago*
Hannah Springer*
Alan Sousa (also known as Alena Kekaikoa)
Curtis Tyler*
Bill Walsh

* Indicate individuals with whom interviews and/or discussions were held.

GOVERNOR
BENJAMIN A. CAYETANO

2001-01-08-HI-FEA-

FINAL ENVIRONMENTAL ASSESSMENT

Kona International Airport at Keahole Master Plan Update

KEAHOLE, NORTH KONA, HAWAII

Proposing Agency:
Department of Transportation, Airports Division
State of Hawaii

November 2000

Keahole Associates, Inc.
420 Waiakamilo Road, Suite 411 • Honolulu, Hawaii 96817-4941 • (808) 841-2228 • fax (808) 841-3285

FINAL ENVIRONMENTAL ASSESSMENT

KONA INTERNATIONAL AIRPORT AT KEAHOLE MASTER PLAN UPDATE

NORTH KONA, HAWAII

TMKs: 7-2-05: 07 and
7-3-43: 03, 06 through 35, 37 through 40 and
43 through 47

This document has been prepared pursuant to Chapter 343,
Hawaii Revised Statutes and the National Environmental Policy Act

NOVEMBER 2000

PROPOSING AGENCY

State of Hawaii
Department of Transportation
Airports Division
Honolulu International Airport
Honolulu, Hawaii

PREPARED BY

Keahole Associates, Inc.
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

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SECTION 1
EXECUTIVE SUMMARY

1.1 PURPOSE AND BACKGROUND

This Environmental Assessment (EA) is prepared pursuant to the Kona International Airport at Keahole (KOA) Master Plan update which provides a land use guide for the location, design and construction of airport related facility improvements through the year 2015. The Master Plan update builds on the previous 1987 Keahole Airport Master Plan to ensure that proposed updates and improvements are commensurate with forecasted growth, aviation standards, and safety requirements.

A separate Federal Aviation Regulations (FAR) Part 150 Noise Compatibility Program (NCP) document was concurrently prepared to address existing and future potential noise impacts on the airport environment. The Noise Compatibility Program recommends noise impact mitigation measures for adoption by local units of government in conjunction with their overall planning programs. The Final NCP report was completed in December 1997.

The State Department of Transportation, Airports Division, has prepared this EA to meet the following requirements: Chapter 343, Hawaii Revised Statutes and the rules and regulations of the Office of Environmental Quality Control; Chapter 200, Title 11, Hawaii Administrative Rules; National Environmental Policy Act (40 CFR Part 6); and the Airport Environmental Handbook (FAA, Order 5050.4A, October 8, 1985).

As noted in the prior 1987 Keahole Airport Master Plan, the purpose of constructing expanded airport facilities is to meet projected aviation demands, provide unrestricted operations of all aircraft types, and site major facilities for operational safety and efficiency. The current KOA Master Plan update provides for continued airport improvements to help meet these goals to the year 2015.

1.2 PROJECT LOCATION

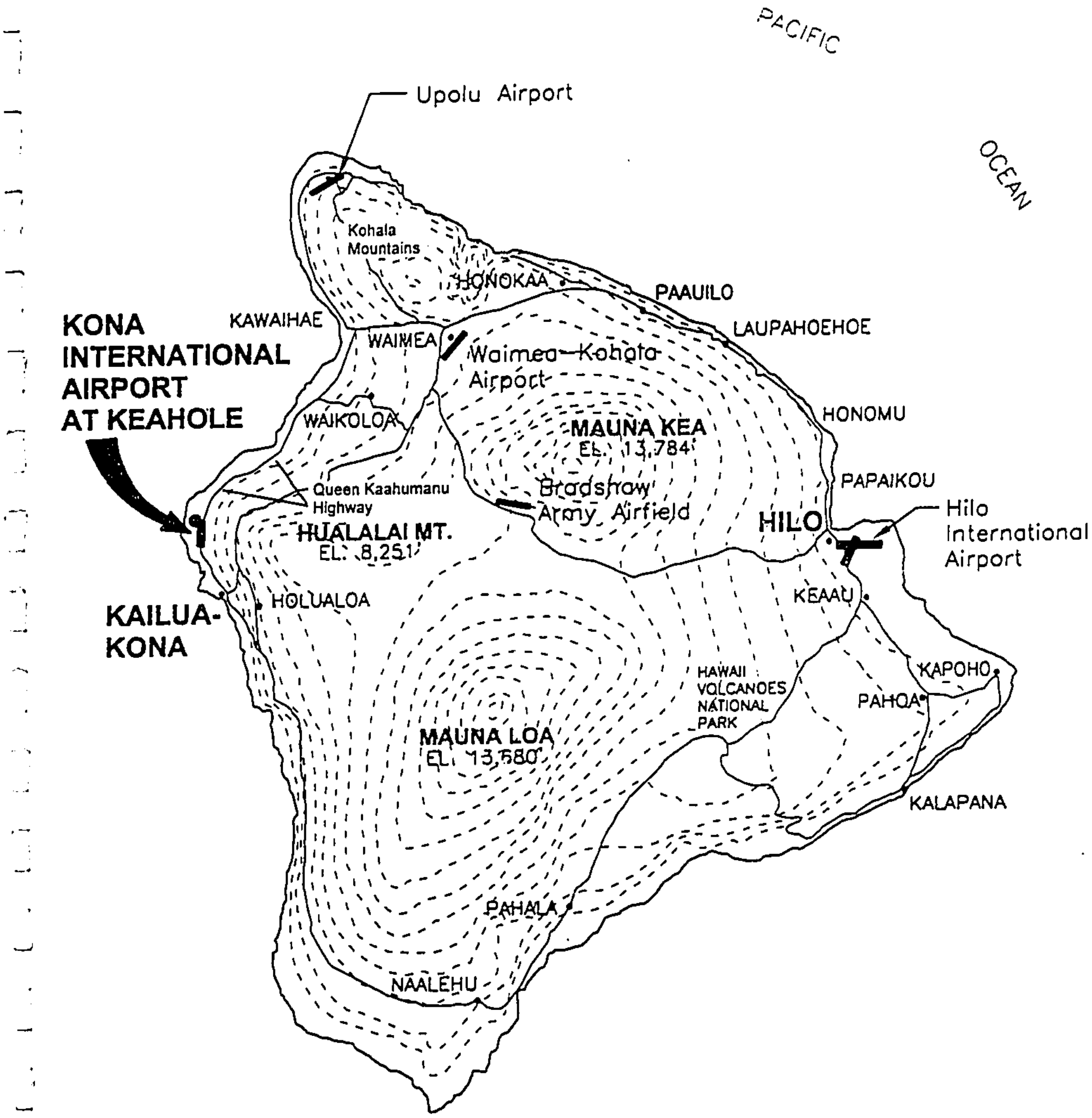
KOA is located on the west side of the Island of Hawaii in the North Kona district (**Figure 1-1**). The airport is located west of the Queen Kaahumanu Highway and is approximately seven miles north of Kailua-Kona, Hawaii. KOA is served by scheduled interisland, domestic, and overseas carriers. KOA is the primary entry and departure port on the west side of the island, and Hilo International Airport is the primary entry and departure port on the east side of the island. KOA is approximately 56 nautical miles west of Hilo International Airport.

The gross area of airport land is 4,244.1 acres (less an exclusion area of 40 acres equals 4,204.1 acres, Survey of Keahole Airport, April 30, 1985). The total net area available for airport use is 3,407.18 acres (**Figure 1-2**): approximately 421.12 acres to the south have been leased to the Hawaii Ocean Science and Technology (HOST) Park; 321.80 acres to the west have been leased to the Natural Energy Laboratory of Hawaii (NELH); 50 acres have been set aside to Department of Land and Natural Resources (DLNR) by a 1984 Triparty Agreement between the State Department of Transportation (DOT), DLNR, and Department of Hawaiian Home Lands (DHHL); and 4 acres have been set aside for a U.S. Postal Service facility.

1.3 PUBLIC PARTICIPATION PROGRAM

Public participation is an integral part of the Master Plan update. A public participation program has been developed consisting of two elements: (1) Public informational meetings and, (2) Technical Advisory Committee (TAC).

Public participation meetings inform interested parties in the community on the progress of the Master Plan update. The TAC was organized to review and provide comments on detailed aspects of the Master Plan update and Noise Compatibility Program. The TAC is composed of community leaders, business leaders, airport users, and governmental agencies. Members and affiliations of TAC are listed in **Table 1-1**.



AIRPORTS DIVISION
Department of Transportation
State of Hawaii
State Project No. AH 2011-03

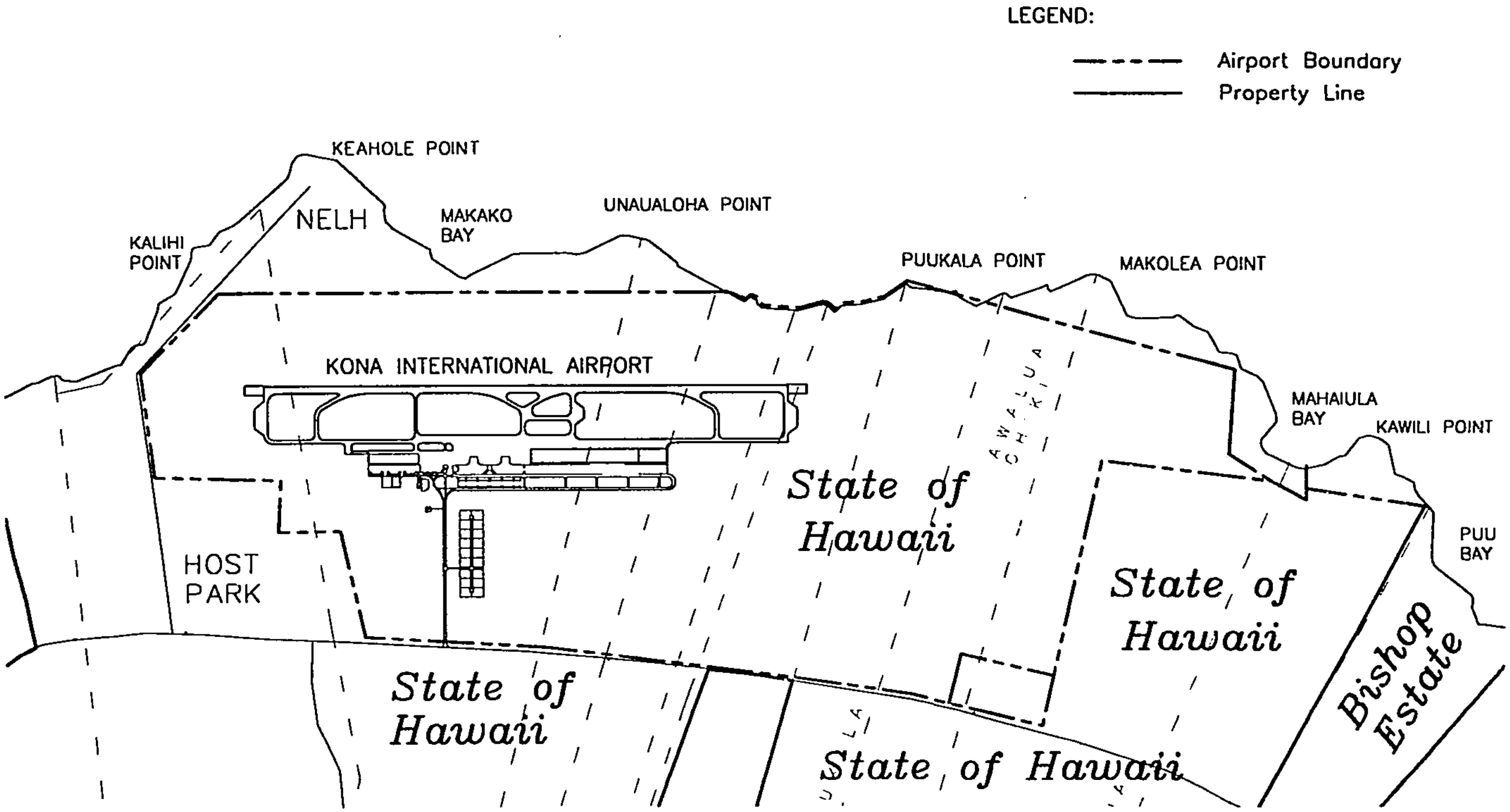
0 13 26
MILES

FIGURE 1-1
LOCATION MAP
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

R. M. Towill Corporation

JAN 1999



AIRPORTS DIVISION
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State of Hawaii
State Project No. AH 2011- 03

FIGURE 1-2
EXISTING LAND OWNERSHIP
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

R. M. Towill Corporation

JAN 1999

TABLE 1-1

TECHNICAL ADVISORY COMMITTEE MEMBERSHIP

FEDERAL AVIATION ADMINISTRATION

Mr. Dean Edmonds, Air Traffic Manager

Mr. David Welhouse, Airport Planner

STATE AGENCIES

Mr. Frank Kamahele, Airport District Manager, Airport District Office

Mr. Hugh Ono, Highways Administrator, DOT Highways Division

Mr. Michael Wilson, Director, State Board of Land and Natural Resources

Dr. Thomas Daniel, PhD, Scientific Director, Natural Energy Laboratory of Hawaii Authority

COUNTY AGENCIES

Ms. Virginia Goldstein, Planning Director, County of Hawaii Planning Department

Ms. Donna Kiyosaki, Chief Engineer, County of Hawaii Public Works Department

Mr. Milton Pavao, Manager, County of Hawaii Water Supply Department

Ms. Diane S. Quitiquit, Director, County of Hawaii Department of Research and Development

LOCAL AGENCIES

Mr. Pete L'Orange, President, Hawaii Leeward Planning Conference

Ms. Noelani Whittington, Executive Director, Kohala Coast Resort Association

Ms. Mami Herkes, President, Kona Chamber of Commerce

AVIATION INDUSTRY

Mr. Tim Flournoy, Hawaii Regional Safety Chairman, Airline Pilot Association

Mr. John Thatcher, Executive Director, Airlines Committee of Hawaii, and Hawaii Fueling Facility Corporation

Mr. Lou Salomon, Director - Technical Services, Airport Aviation Professionals, Inc.

UTILITY COMPANIES

Mr. Clyde H. Nagata, P.E., Manager of Engineering, Hawaii Electric Light Company

Mr. Gordon Yadao, Supervising Engineer, GTE Hawaiian Tel

1.4 FORECAST AND PROJECTIONS

1.4.1 AVIATION DEMAND FORECASTS

Table 1-2 presents forecasts of aviation demand at KOA for 1992 through 2020. The annual forecasts were prepared as part of an update for the State Airport System Plan (SASP), and are from a report entitled Update of Hawaii Aviation Demand Forecasts, by Aries Consultants, Ltd. October 1994. Aviation demand is expected to continue to grow to 2020, generated by an increase in visitor arrivals, but at a slower rate of increase than what has been recognized in the past. The total enplaned plus deplaned passenger volume at KOA is forecasted to increase approximately 33 percent from the actual 1997 Airport Activity Statistics of 2,628,157, to 3,489,000 in 2015.

The volume of cargo and mail is forecast to increase from 26,838 tons in 1997 to 35,000 tons in 2015. This is an increase of approximately 30 percent.

Total aircraft operations are forecast to increase from 87,358 in 1997 to 88,700 in 2015. Of this increase, air carrier and commuter/air taxi operations are expected to increase operations from 42,416 in 1997 to 53,000 in 2015. Approximately 10 percent of the air carrier operations during this period are expected to be air cargo.

General aviation, although forecast to rise only modestly from 2000 to 2015, has recently seen a marked increase of 78%, from 21,066 in 1992, to 37,549 in 1997. Given this recent trend, usage of general aviation facilities should be carefully monitored with commensurate facility upgrades provided as needed.

1.4.2 HOURLY RUNWAY CAPACITY

The hourly runway capacity of KOA was estimated using the FAA Runway Capacity Model and interviews with KOA Aircraft Controllers. The runway capacity is 60 operations per hour under Visual Flight Rules (VFR) conditions, and approximately 20 operations per hour under Instrument Flight Rules (IFR) conditions.

FAA has identified KOA as a candidate for the ASR-11 (Air Surveillance Radar-11) program which may increase the IFR capacity in the future. This program is planned to be implemented in 2005, at the earliest. Current programs to update existing VFR/IFR capabilities include installation of the

Kona ATCBI-4 (Air Traffic Control Beacon Interrogator-4) radar which is approximately 50% completed. Funding to complete this project will be sought in the coming fiscal year budget.

The existing peak runway demand is 38 operations per hour. Operations in the year 2015 are projected at 28 operations per hour which will result from use of higher passenger carrying capacity aircraft.

TABLE 1-2
AVIATION DEMAND FORECASTS
KONA INTERNATIONAL AIRPORT AT KEAHOLE (KOA)

ANNUAL	ACTUAL		FORECAST				
FORECASTS	1992	1997	2000	2005	2010	2015	2020
Passengers (Enplaned and Deplaned)							
Overseas							
Mainland	278,995	310,681	445,000	619,000	816,000	1,034,000	1,270,000
International	0	60,258	131,000	182,000	246,000	334,000	429,000
Interisland	1,882,941	2,257,218	2,078,000	2,122,000	2,139,000	2,121,000	2,081,000
TOTAL	2,161,936	2,628,157	2,654,000	2,923,000	3,201,000	3,489,000	3,780,000
Cargo and Mail (Enplaned and Deplaned)							
Cargo (Tons)	19,766	24,616	22,900	25,500	28,100	30,800	32,600
Mail (Tons)	2,579	2,222	3,100	3,500	3,900	4,200	4,400
TOTAL	22,345	26,838	26,000	29,000	32,000	35,000	37,000
Aircraft Operations							
Air Carrier	29,477	27,462	32,100	33,200	34,300	36,000	37,000
Commuter/Air Taxi	9,200	14,954	13,400	14,600	15,800	17,000	18,200
General Aviation	21,066	37,549	20,000	21,000	22,000	23,000	24,000
Military	4,196	7,393	12,900	12,700	12,700	12,700	12,700
TOTAL	63,939	87,358	78,400	81,500	84,800	88,700	91,900
Based Aircraft*	32	40	43	46	49	52	55

SOURCE: "Update of Hawaii Aviation Demand Forecasts," Aries Consultants, Ltd., October 1994.
*DOT-A, August 10, 1998

1.5 PROPOSED ACTION

1.5.1 AIRFIELD FACILITIES

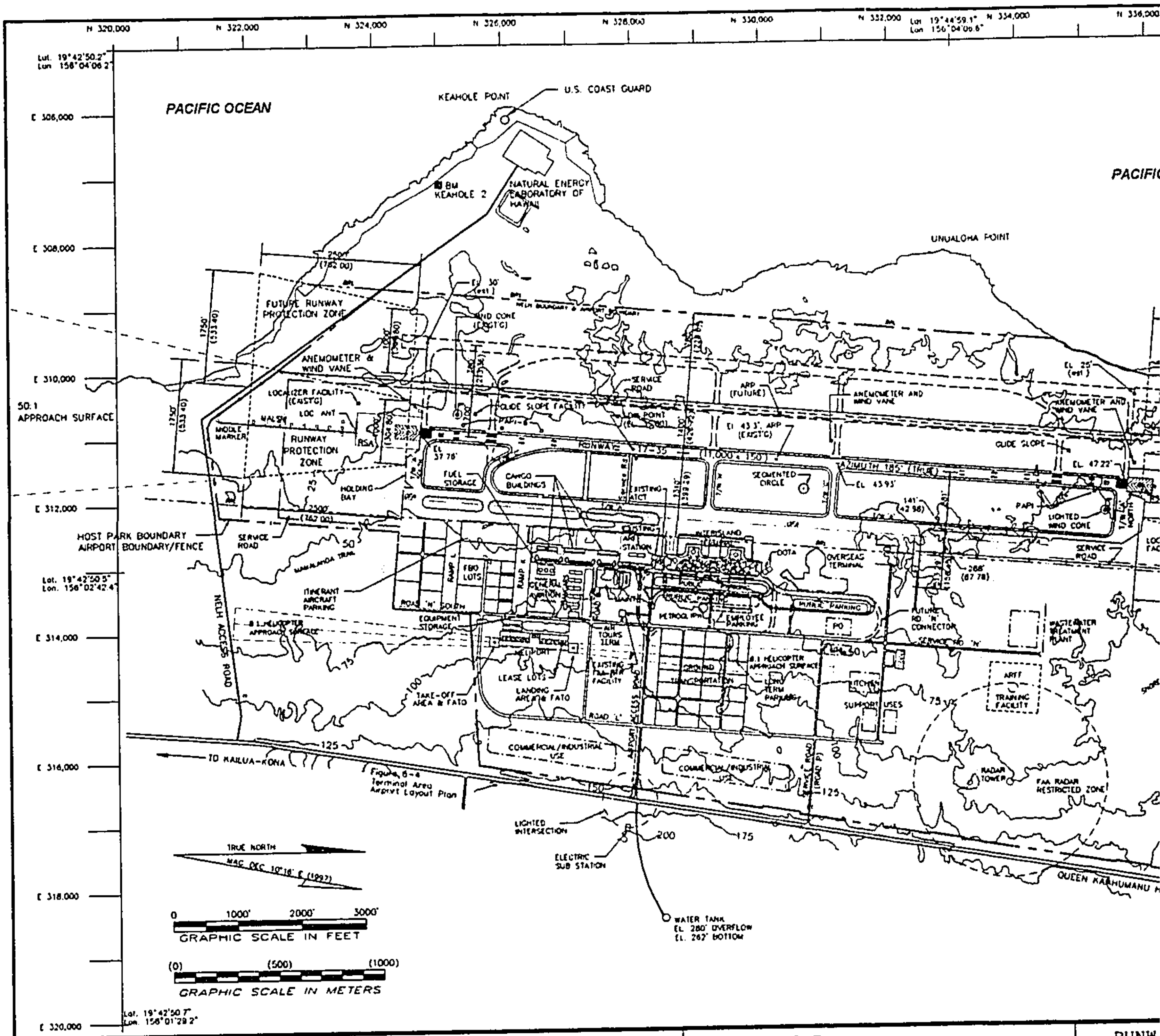
The size and configuration of the existing single runway is expected to provide sufficient capacity for the future to the year 2015. This is based on an existing capacity of 60 aircraft per hour and projected demand for 28 aircraft per hour in 2015. Airfield improvements that will ensure the continued safety of the runway will include Itinerant Aircraft Parking and construction of a new aircraft Ramp "K" to support General Aviation (GA) needs (**Figure 1-3**).

1.5.2 TERMINAL AND AIRPORT SUPPORT FACILITIES

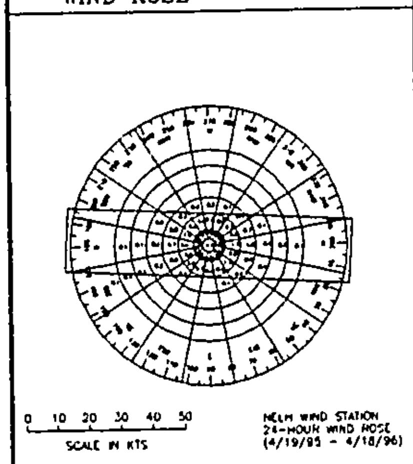
The proposed terminal complex is based on the existing linear arrangement of major facilities. Expansion will provide for a new overseas terminal, airport and infrastructure upgrades, and support facilities to permit increased commercial activities. Relocation of some facilities are necessary to maintain efficiency of airport operations.

Major terminal facilities proposed include the following:

- New overseas terminal with support facilities including flight kitchen, overseas apron and loading bridges, parking, general aviation fuel storage site preparation, and utility and electrical distribution upgrades. This facility is proposed north of the existing interisland terminal. Improvements to serve interim overseas needs are in progress and are located at the interisland terminal area.
- Telecommunications System
- Wastewater Treatment Plant
- Air Traffic Control Tower
- GA Site Preparation
- Heliport
- Air Tour Terminal
- Department of Transportation/Drug Enforcement Agency Administration Building
- Airfield Improvements
- Access Road and Utility Improvements
- Fuel Farm Site Preparation
- Postal Facility Site
- Miscellaneous Projects (including but not limited to: Ground Transportation Service and Ready Area; various parking projects; Telecommunications System upgrades; Air Cargo Facilities; etc.)



WIND ROSE



LEGEND

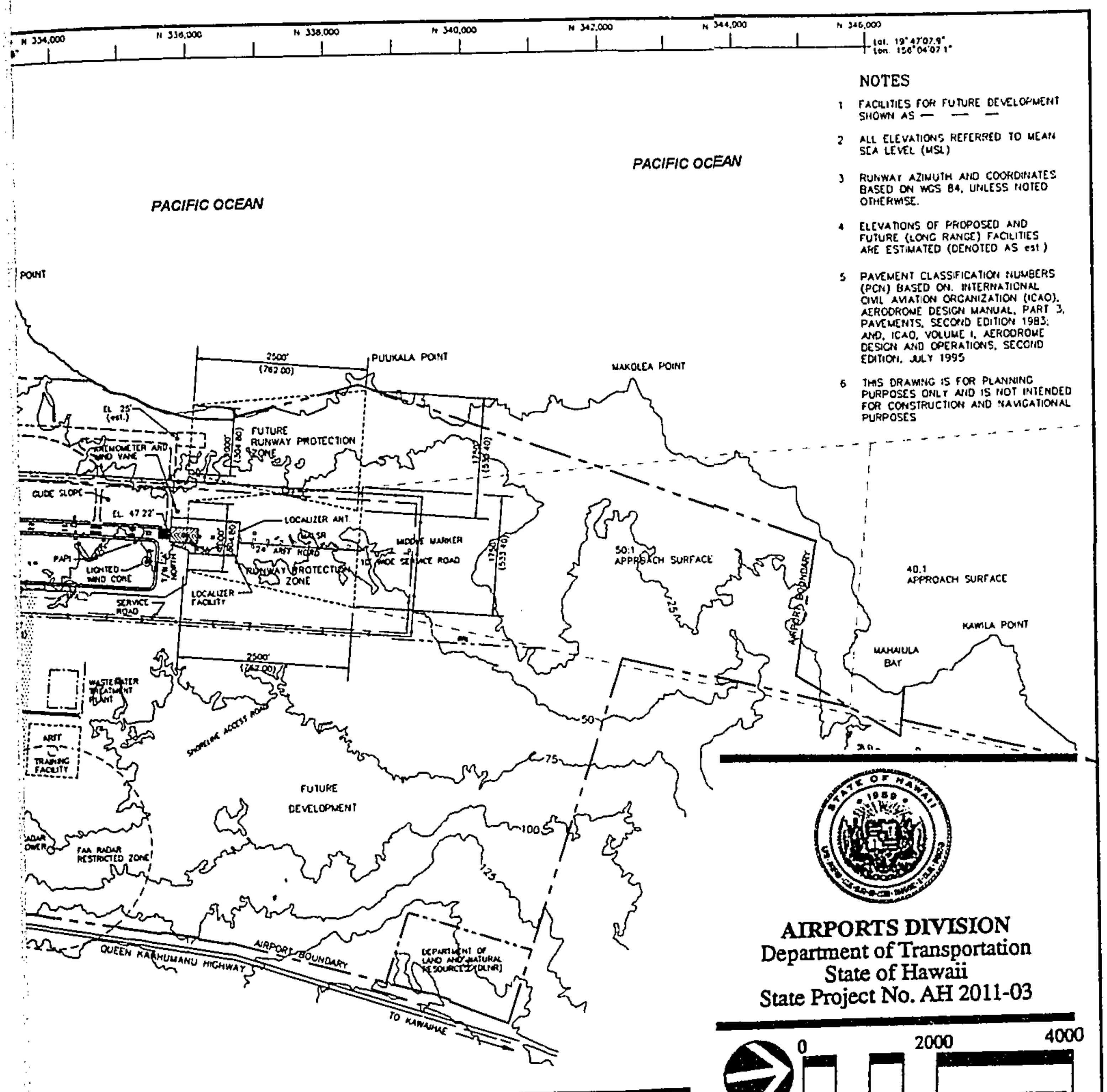
DESCRIPTION	EXISTING	PROPOSED	FUTURE
AIRFIELD FACILITIES			
TERMINAL FACILITIES			
AIRPORT BOUNDARY			
APPROACH SURFACE			
RUNWAY PROTECTIVE ZONE			
BUILDING / STRUCTURE			
BUILDING RESTRICTION LINE	BRL	BRL	
FENCE LINE			
GROUND CONTOUR	50		
ROADS:			
PAVED			
UNPAVED			
PATH/TRAIL			
OBJECT FREE AREA	OFA	OFA	
SITE DEVELOPMENT			

AIRPORT DATA

DESCRIPTION	EXISTING	PROPOSED
AIRPORT REFERENCE POINT		
(ARP) COORDINATES:		
LATITUDE	19°44'32.0"(WGS 84) / *19°44'30.8"(NAD 27)*	
LONGITUDE	156°02'59.5"(WGS 84)/ *156°02'54.4"(NAD 27)*	
AIRPORT ELEVATION	47.22 FT.(14.40 M.)	47.22 FT. (14.40 M.)
MEAN MAXIMUM DAILY	85.4°	85.4°
TEMP. (HOTTEST MONTH)		
WEATHER FACILITIES	AWOS	ASOS
AIRPORT AND TERMINAL NAVIGATIONAL AIDS	ILS (LOC/DME,GS,MM, MALSR),PAPI-6,HIRL, MTL,RTR,BEACON, VORTAC	ILS (LOC/DME,GS,MM, MALSR),PAPI-6,HIRL, MTL,RTR,BEACON, VORTAC
PAVEMENT:		
RUNWAY	ASPHALT	ASPHALT
TAXIWAYS	ASPHALT	ASPHALT
AIR CARRIER / AIR CARGO APRONS	CONCRETE/ ASPHALT	CONCRETE

RUNW

DESCRIPTION
RUNWAY IDENTIF
INSTRUMENT RU
APPROACH SUR
APPROACH LIGH
NAVIGATIONAL A
RUNWAY LIGHTIN
RUNWAY MARKIN
RUNWAY SAFETY
SAFETY AREA W
EFFECTIVE GRAD
PAVEMENT STRE
SINGLE
DUAL
DUAL TANDEM
DOUBLE DUAL
WIND COVERAGE
PAVEMENT CLAS NUMBER (PCN)
RUNWAY COORD
Longitude
Latitude



NOTES

1. FACILITIES FOR FUTURE DEVELOPMENT SHOWN AS — — —
2. ALL ELEVATIONS REFERRED TO MEAN SEA LEVEL (MSL)
3. RUNWAY AZIMUTH AND COORDINATES BASED ON WGS 84, UNLESS NOTED OTHERWISE.
4. ELEVATIONS OF PROPOSED AND FUTURE (LONG RANGE) FACILITIES ARE ESTIMATED (DENOTED AS est)
5. PAVEMENT CLASSIFICATION NUMBERS (PCN) BASED ON: INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO), AERODROME DESIGN MANUAL, PART 3, PAVEMENTS, SECOND EDITION 1983; AND, ICAO, VOLUME I, AERODROME DESIGN AND OPERATIONS, SECOND EDITION, JULY 1995
6. THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND IS NOT INTENDED FOR CONSTRUCTION AND NAVIGATIONAL PURPOSES

...POSED	RUNWAY DATA				
	DESCRIPTION	EXISTING		PROPOSED	
	RUNWAY IDENTIFICATION	17	35	17	35
	INSTRUMENT RUNWAY	YES	YES	YES	YES
...'30.8"(NAD 27)	APPROACH SURFACES	50 : 1	50 : 1	50 : 1	50 : 1
...2'54.4"(NAD 27)	APPROACH LIGHTING	MALSR, PAPI-6	MALSR, PAPI-6	MALSR, PAPI-6	MALSR, PAPI-6
...2 FT (14.40 M)					
85.4°	NAVIGATIONAL AIDS	ILS	ILS	ILS	ILS
	RUNWAY LIGHTING	HIRL		HIRL	
ASOS	RUNWAY MARKING	PRECISION INSTRUMENT		PRECISION INSTRUMENT	
...LOC/DME,GS,MM, ...SR),PAPI-6,HIRL, ...RTR,BEACON, ...TAC	RUNWAY SAFETY AREA	500'x1000' (152.4x304.8)	500'x1000' (152.4x304.8)	500'x1000' (152.4x304.8)	500'x1000' (152.4x304.8)
	SAFETY AREA WIDTH	500 FT (152.40 M)		500 FT (152.40 M)	
	EFFECTIVE GRADIENT	0.086%		0.086%	
	PAVEMENT STRENGTH				
	SINGLE	75,000 LBS		130,000 LBS	
	DUAL	200,000 LBS		210,000 LBS.	
ASPHALT	DUAL TANDEM	400,000 LBS		572,000 LBS	
ASPHALT	DOUBLE DUAL TANDEM	850,000 LBS		850,000 LBS	
CONCRETE	WIND COVERAGE	99.29%		99.29%	
	PAVEMENT CLASSIFICATION NUMBER (PCN)	56		56	
	RUNWAY COORDINATES (at End)	11,000'x150' (3,352.8x45.7)		11,000'x150' (3,352.8x45.7)	
	Longitude	19°43'26.15", 19°45'14.79"(WGS 84) / 19°43'25.03", 19°45'13.68"(NAD 27)			
	Latitude	156°2'55.19", 156°2'44.97"(WGS 84) / 156°02'50.06", 156°02'39.84"(NAD 27)			

AIRPORTS DIVISION
Department of Transportation
State of Hawaii
State Project No. AH 2011-03

FIGURE 1-3
AIRPORT LAYOUT PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.
R. M. Towill Corporation

JAN 1999

1.5.3 IMPLEMENTATION PLAN

Implementation of the KOA Master Plan is recommended in three phases: Phase I (1998-2003), Phase II (2004-2009), and Phase III (2010 and beyond). The actual construction of facilities within each phase will vary due to funding availability and need. Projects recommended by phase include the following:

1.5.3.1 Phase I (FY1998-2003)

The first development phase addresses access, circulation, infrastructure improvements on the airport's terminal side, and increased aircraft parking and safety on the airfield side. Improvements during this first phase will prepare the airport for the future overseas terminal. Terminal area related improvements include the following:

- Wastewater Treatment Plant
- Fuel Farm Site Preparation
- General Aviation Fuel Storage System Site Preparation
- Air Cargo Building III
- Postal Facility Site Preparation
- Road "P"
- Road "M"
- Telecommunications System
- Parking Phase II

Airside improvements for Phase I include:

- Itinerant Airline Aircraft Parking
- Ramp "K"
- Overseas Terminal (OST) Site Preparation - Overseas Apron and Gates
- Air Traffic Control Tower (ATCT)

The KOA Master Plan and NCP (Noise Compatibility Program) update is anticipated in FY2002. A Design Guide Plan should also be included as part of Phase I. The Design Guide will help to ensure appropriateness and consistency to the future design of facilities at KOA. The scheduling and scope of projects for Phase II and III, may be revised according to updated requirements.

1.5.3.2 Phase II (FY2004 - 2009)

Phase II facilities primarily involve terminal area improvements. The major project during Phase II is the OST. Facilities in Phase II include:

Overseas Terminal (OST)
Air and Water Quality Monitoring
Electrical Distribution and Emergency Generator
Flight Kitchen Site Preparation
Ground Transportation Lease Lots
GA Site Development and Hangars
Air Tour Terminal
Heliport Phase I
Ramp "L"
FBO Sewer System and Lift Station
Road "N" South
Rock Quarry

1.5.3.3 Phase III (FY2010 - 2015+)

Phase III facilities involve long term improvements that will require reassessment in the 2002 Master Plan. Major projects for this phase include:

Connecting Road "L"
Long Term Parking
DOT/DEA Administration Building
Keahole to Kawaihae Fuel Corridor

1.5.4 MASTER PLAN COST ESTIMATE

Master Plan phasing cost estimates are described below. Costs are based on construction bid tabulations of projects completed or in progress at KOA as well as other airports in the State. Cost figures are shown in 1997 dollars and include a contingency amount for construction. Cost estimates do not include taxes, land acquisition costs, and other non-construction costs. Cost estimates also do not include furniture, equipment, interior finishing, or moving expenses:

	(cost in millions) Phase I (FY1998-2003)	Phase II (FY2004-2009)	Phase III (FY2010-2015+)
KOA MASTER PLAN	$46.62	$72.24	$11.92

1.6 RATIONALE FOR ACTION

KOA is evolving to serve an increasingly broad mix of passengers. Aircraft serving these passengers will range from small personal and commuter aircraft to transoceanic capable B-747, B-777/767, and DC-10/L-1011 types. Passenger requirements will similarly involve need for a broader range of facilities and services than are now provided. Air tour operators will require only relatively transient accommodations since air tour passengers are generally self sufficient with little to no need for access to regularly scheduled airline service, baggage claim, or other amenities typically associated with interisland or transoceanic travelers. Consequently, air tour operators are planned to be located away from the main terminal area for convenience and to avoid unnecessary aircraft and passenger congestion.

Conversely, commuter and interisland passengers require relatively convenient access to terminals, gates, and longer term parking. Transoceanic travelers will similarly require amenities and services commensurate with the longer distances traveled. This will include, but not be limited to, greater choices for food, beverage, convenience and gift concessions, terminal facilities that are comfortable and can occasionally be sheltered from the elements, and Federal Inspection Services, necessary for foreign departures and arrivals. Although interisland and domestic/international flights currently share major portions of the existing terminal area, future plans are to further separate these spaces to increase passenger convenience, efficiency of movement, and safety of airport operations.

It is anticipated that the trend for increasing domestic and global travel will continue to place demands on KOA to provide for a mixed customer base. The proposed upgrades identified in this plan are intended to help meet these demands and the passengers visiting the Kona region of Hawaii.

1.7 PHYSICAL ENVIRONMENT - SUMMARY OF IMPACTS AND MITIGATION

1.7.1. LAND USE

The existing airport uses a net area of approximately 3,407.18 acres. The airport roadways, terminal area, and runways encompass 548 acres and are classified in the State Urban District and zoned General Industrial by the County of Hawaii. Lands to the north of the airport and immediately east of the runway are classified in the State Conservation District. Current airport uses are consistent with these land use classifications and the changing role of KOA to serve interisland and overseas mainland and international arrivals and departures.

The need for a second runway is not a concern within the 2015 planning period of the KOA Master Plan update. However, it is recommended that presently available space on the west side of the existing runway be preserved for a possible second runway in the future. Consequently, future development in areas affected by aircraft noise should continue to be limited as stated in the subsection on Noise (Section 5.7).

1.7.2 NATURAL HAZARDS

Risks to life and property caused by natural disasters such as earthquakes and volcanoes are present at KOA. The Island of Hawaii is classified as Seismic Risk Zone 3, based on a scale of 1 to 4, with 4 being higher; therefore, risks to life and property are present at the airport site. Structures are subject to seismic provisions of the Uniform Building Code of the County of Hawaii. Structures shall be designed and constructed to resist stresses produced by lateral seismic forces. This will require that masonry or concrete structures have the principal reinforcement spaced not more than 2 feet on center using frames designed to carry all vertical loads. The frames shall similarly have joints capable of resisting forces by bending.

Volcanic hazards include the potential eruption of Hualalai, an active volcano, which last erupted in 1800-1801. Lava which emerged from the northwest volcanic rift zone created a flow that entered the ocean north of Keahole Point. There have been no recent incidences of volcanic activity from Hualalai.

KOA is located outside of any floodway or flood fringe zone, as described by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). The terminal buildings are also located outside the evacuation zone for tsunami hazards.

1.7.3 GEOLOGY AND SOILS

Soils at KOA consist of a'a and pahoehoe associated lava flows. This soil classification may contain lava tubes which could collapse during excavation or construction. Extensive soil testing and borings should be conducted during the design phase. Grading operations, therefore, should be taken with care in the event lava tubes are discovered.

1.7.4 FLORA

A botanical survey of the undeveloped portions of the Urban designated lands at KOA was undertaken on November 20 and 21, 1999 (Botanical Survey, Kona International Airport at Keahole, North Kona, Hawaii, February 2000).

"A total of 67 plant species were found. Of these, 52 (78%) are introduced; 2 (3%) are originally of Polynesian introduction; and 13 (19%) are native. Ten of the native species are indigenous (native to the Hawaiian Islands and elsewhere), while three are endemic (native only to the Hawaiian Islands). None of the plants is a threatened and endangered species. Two of the endemic plants, the maiapilo or native caper (*Capparis sandwichiana*) and *Fimbristylis hawaiiensis*, are considered species of concern, but these are not high priority species of concern and the populations number in the thousands" (Ibid, February 2000).

Based on results of the botanical survey, an Endangered Species Act, Section 7 consultation was not required.

No further mitigation measures are expected or required, the February 2000 botanical study, however, recommends that native plants specifically adapted to the low rainfall and volcanic substrate conditions be used for landscaping wherever possible.

1.7.5 FAUNA

A faunal survey of the project site was conducted on December 7 and 8, 1999 (Faunal Survey of Avian and Mammalian Species, Kona International Airport at Keahole, February 2000). The study encompassed the area within KOA and within an elevation range between ±6 m to ±43 m relative to mean sea level (MSL).

The results of the survey indicated no threatened, endangered, or rare mammalian species. Hawaii's sole endemic terrestrial mammalian species, the endangered Hawaiian hoary bat, or `Ope'ape'a, was not detected. (Ibid, February 2000).

A total of 14 avian species were detected. The only native species recorded was the Pacific Golden-Plover (*Pluvialis fulva*), a common indigenous migratory species which was seen close to the south ramp area. All of the other 13 species recorded are considered to be alien to the Hawaiian Islands.

All avifauna detected are common species found throughout the leeward lowland areas of the Big Island. No endangered or threatened avian species were detected within the KOA site. It is likely that Hawaiian hoary bats overfly the airport facilities upon occasion (David 1993, Jacobs 1994, R. David unpublished field notes 1975-1999).

There is a small anchialine wetland system located east of the southwest fence corner at the southern end of the runway.

Habitat found on the site and within fountain grass dominated lowland areas in North Kona do not provide the resources necessary for the sustenance or nesting of native avian species. If lawns, parking lots and other open areas are created it is likely that these features will also attract a number of migratory shorebirds. Many of the more than 80 species of migratory and extralimital avian species which have been recorded from Hawaii have been recorded from coastal areas in North Kona (Pyle et al. 1988, David 1991b, Pyle 1992, 1997).

No Federal or State of Hawaii listed threatened or endangered vertebrate species were observed on the KOA property. The anchialine pond located at the south end of the runway fence will remain in an undisturbed condition to ensure no potential for negative adverse impacts associated with development.

Although not detected during this survey, the endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*) has been recorded within the existing airport boundaries. Given that aquaculture operations are continuing to expand within NELH, and Cyanotech Corporation is being required to continue managing habitat to increase the production of stilts, there will continue to be potential for bird air strike hazard (BASH) incidents involving avian species which are being attracted to the NELH/Cyanotech mitigation ponds. The small anchialine pond located outside the existing perimeter fence supports at least one species of Hawaiian anchialine shrimp, (*Halocardina rubra*), or `opae'ula. It is probable that as the population of stilt increase within the aquaculture farms that they will "discover" this food resource, putting more birds in the direct path of aircraft approaching or climbing away from the southern end of the main runway.

It is also possible that the endangered endemic Hawaiian subspecies of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), or Ua'u over-fly the airport facilities between the months of May and October (Banko 1980, Harrison 1990). The primary cause of mortality in Dark-rumped Petrels is thought to be predation by alien mammalian species (Day and Cooper 1998, Cooper and Day 1994). Collision with utility structures is considered to be the second most significant cause of mortality in Hawaii. Nocturnally flying seabirds can become disoriented by exterior lighting on their way to sea. When disoriented, seabirds often collide with manmade structures and, if not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Ainley and Podosky 1993, Ainley et al. 1994, Cooper and Day 1994, Day and Cooper 1997, Cooper and Day 1998, Podolsky et al. 1998). There is no suitable nesting habitat within the project site for this species.

The principal potential impact that further development of airport facilities poses to Dark-rumped Petrels is the increased threat of the downing of birds disoriented by exterior lighting which may be required with further expansion of the airport.

It is anticipated that with increased landscaping of the terminal and surrounding airport area that there will be a commensurate increase in the avifaunal population. While no adverse impacts are anticipated to foreign exotic or introduced species, state and federally listed threatened and endangered species may be affected. Continued use of adjacent facilities including NELH are expected to increase the frequency of visits by such species. Mitigation measures to reduce the potential for adverse impacts include:

- NELH/Cyanotech Corporation should consider relocation of the mitigation pond to an alternative location. The development of new alternatives should involve the U.S. Fish and Wildlife Service (USFWS) and an objective non-agency biologist. As required, DOT-A would assist with this coordination.

- Even with removal of the mitigation ponds, existing commercial ponds are expected to continue to be a source of attraction. DOT-A will coordinate with NELH to encourage the development of hazing protocols to make the existing aquaculture ponds less attractive to passing wetland associated avifauna.

- Because there is the potential for bird/aircraft collisions, mitigation that will continue to be carried out by DOT-A will include use of the FAA, Wildlife Hazard Management Plan for KOA (see Appendix) (Federal Aviation Regulations, Part 139.337).

Unwanted interactions between the airport facility and nocturnal avian species overflying the facility will continue to be addressed through use of shielded exterior lighting. The purpose of shielded lighting will be to reduce unwanted glare which could affect overflights of nocturnal species such as the Dark-rumped Petrel.

1.7.6 NOISE

According to the Federal Aviation Regulation (FAR) Part 150 Noise Compatibility Program Report (NCPR), December 1997, there are no existing incompatible land uses within the 5-year Noise Exposure Map for the Kona International Airport at Keahole, and therefore, corrective noise measures are not required. However, because of potential for increased noise in the airport sideline areas, the NCPR recommends limited minor restrictions on runway use. At this time DOT-A is also considering further emphasis on limiting land development in the airport environs as a means of preventing any voluntary restrictions on aircraft operations. If land in the airport areas can be preserved for airport uses, there will be fewer future opportunities for noise conflicts.

Voluntary measures identified by the NCP include the following:

- Continue monitoring land development proposals in the KOA environs.
- Non-noise sensitive uses, such as commercial and industrial development, should not be discouraged from locating within the 60 DNL noise contour.
- Disclose the Base Year and 5-Year Noise Exposure Maps to the local community by providing overlays of the noise contours on applicable Tax Maps. Also provide information in support of the mandatory airport noise disclosure requirements of State Law in all real estate transfers of lands within the airport noise contours.
- Annually monitor aircraft noise levels and operations at the Kona International Airport at Keahole, and conduct Public Informational Meetings on the progress of the FAR Part 150 Noise Compatibility Program.

1.7.7 HAZARDOUS MATERIALS

An Environmental Compliance Audit (ECA) for KOA was completed in 1994 and 1999. Administration of the ECA is by DOT-A for the purpose of identifying and determining the regulatory status of DOT-A and airport tenant facilities, and to evaluate the potential for contamination due to past, present, and future activities on airport property.

The findings of the 1999 ECA primarily updates current conditions involving storage, use, and disposal of potentially hazardous materials. As required, appropriate operational practices and measures were implemented to ensure no adverse impacts.

No adverse impacts are anticipated from development of the proposed airport improvements. The Environmental Compliance Audit program is intended to provide sufficient information necessary for compliance with existing Federal, state, and local regulations regarding hazardous wastes. Where appropriate, mitigative measures have been proposed and were implemented to ensure no adverse impacts to the environment.

Other projects involving treatment of hazardous materials, such as asbestos or lead abatement, will continue to be provided as required by applicable state and federal regulations.

1.7.8 WATER QUALITY

1.7.8.1 Surface and Groundwater Resources

No impacts to surface or groundwater resources are expected. The results of a prior Water Quality Monitoring Program for the Keahole Airport Expansion, December 1998, have been included in the appendix. The results of the study provides further discussion and includes sampling from ground based monitoring wells and coastal waters offshore of the airport to ascertain potential for adverse impacts to both groundwater quality and coastal/marine benthic biota. According to results from the study, "There are no significant unexpected features of the data. All values fall within expected norms."

1.7.8.2 Shoreline and Nearshore Waters

The coastal nearshore waters are classified "AA" according to the Water Quality Standards Map of the Island of Hawaii, October 1987, by the Office of Environmental Planning and State Department of Health (DOH). The proposed KOA Master Plan update is not expected to result in adverse environmental impacts to the Class "AA" ocean waters along the Keahole coastline. Construction will be limited to areas immediately surrounding the airport runway and terminal and therefore, should not result in discharges to State waters. The results of the 1998 Water Quality Monitoring Program report have confirmed no negative adverse impacts to nearshore or coastal water quality as a result of operations at KOA (Ibid, December 1998).

Future projects beyond the 2015 timeframe of the Master Plan update, however, such as a second parallel runway, will need to be carefully managed to maintain protection of class "AA" waters. An NPDES permit may be required if there is a potential for discharges to nearshore waters. Mitigative measures in the form of Best Management Practices (BMPs) and a water quality monitoring plan would be required to ensure State and Federal water quality standards.

1.7.9 AIR QUALITY

The Federal Clean Air Act does not view a commercial airport such as KOA as a direct source of air pollution. At the same time, volcanic activity on the Big Island is a major contributing source of air pollution throughout the State. On days when there is increased volcanic activity and there are Kona winds present, there is a noticeable haze which sometimes extends from the Big Island and Kona region, to major areas of the Hawaiian Island chain. The contribution of volcanic activity to air pollution levels are not directly discussed in the two air quality studies that have been conducted for the KOA expansion. Instead, the studies focused on air quality impacts to the surrounding area due to anticipated increases in airport activities.

1.7.9.1 Air Quality Impact Report - 1988

Impact analysis conducted in 1985 and 1986, based on the Airport Vicinity Air Pollution (AVAP) Model (Argonne National Laboratory, 1974) indicates that despite the projected increase in air and ground operations, air quality in the airport vicinity will result in no adverse impacts. Concentration estimates for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and total suspended particulates (TSP) were well below applicable State and Federal standards. Total and non-methane hydrocarbon concentrations were also estimated, although there are no longer standards for the latter. The results indicated levels well below the previous State standard of 100 micrograms per cubic meter ($\mu g/m^3$). A summary of projected pollutant concentrations compared to State standards are identified in **Table 1-3**. According to **Table 1-3**, air quality in the airport vicinity will be minimally affected.

1.7.9.2 Ambient Air Quality Monitoring Program - 1997

Monitoring of airborne particulate matter at KOA was completed in July, 1997. The purpose of the particulate monitoring was to fulfill the requirements of the KOA Special Management Area (SMA) Use Permit No. 325. **Table 1-4** provides a monitoring summary of particulate material with an aerodynamic diameter of less than 10 microns.

Followup with State Department of Health, Clean Air Branch, indicated the particulate material levels were well within State standards for the period May - July 1997. Based on the no adverse impact result of the study and the conditions of SMA Use Permit No. 325, the air monitoring station was removed.

1.7.9.3 Air Quality Summary

The blockage of the normal northeasterly tradewinds by Mauna Loa and Mauna Kea and the resulting reduced ventilation in the Kona area can result in a buildup of pollutant concentrations. For this reason, as the Kona region continues to develop close monitoring and periodic reevaluation of pollutant build-up resulting from reduced natural ventilation should be conducted as part of the normal environmental review process for evaluating major new developments. If there is an increase in allowable levels of air pollutants, DOH, Clean Air Branch, should be notified for appropriate action. To date, there have been no adverse impacts due to air pollution loading activities at KOA.

TABLE 1-3
KOA AIR QUALITY COMPARISON TO STATE STANDARDS

	Averaging Period	Concentration ($\mu g/m^3$)
Carbon Monoxide (CO)		
State Standard	1 hour	10,000
KOA (1990)		131 - 505
KOA (2005)		134 - 472
State Standard	1 hour	5,000
KOA (1990)		218 - 272
KOA (2005)		262 - 346
Nitrogen Dioxide (NO_2)		
State Standard	Annual Arithmetic Mean	70
KOA (1990)	24 hours	30 - 35
KOA (2005)		31 - 37
Sulfur Dioxide (SO_2)		
State Standard	24 hours	365
KOA (1990)		12 - 14
KOA (2005)		12 - 14
Total Suspended Particulate Matter (TSP)		
State Standard	24 hours	150
KOA (1990)		28 - 30
KOA (2005)		28 - 30
Total Hydrocarbons (THC, as methane)		
State Standard	3 hours	No State Std.
KOA (1990)		1,650 - 1,662
KOA (2005)		1,652 - 1,662

BACKGROUND LEVELS

CO	-	100 $\mu g/m3^3$	
NO_2	-	29 $\mu g/m^3$	(1975 DOH Monitoring at Hilo)
SO_2	-	12 $\mu g/m^3$	(1985 - 1986 DOH Monitoring at Kona)
TSP	-	28 $\mu g/m^3$	(1985 - 1986 DOH Monitoring at Kona)
THC	-	1,648 $\mu g/m^3$	(methane, 1979 - 1980 Monitoring at Honolulu International Airport)

SOURCE: Air Quality Impact Report, Keahole Airport, March 1988, State Department of Transportation, J.W. Morrow

TABLE 1-4
PM 10 MONITORING SUMMARY
KOA 1997

Date	24-Hour Average PM 10 Concentration (ug/m³)
5/04/97	11.0
5/10/97	10.2
5/16/97	13.2
5/22/97	11.7
5/28/97	10.5
6/03/97	10.9
6/09/97	11.6
6/15/97	11.7
6/21/97	12.8
6/27/97	12.1
7/03/97	N/A
7/09/97	13.7
7/15/97	10.7
7/21/97	17.3
7/27/97	13.5

SOURCE: Keahole International Airport PM 10 Monitoring Report For May - July 1997, B.D. Neal & Associates, August 1997.

1.7.10 VISUAL RESOURCES

KOA is situated on an open a'a and pahoehoe lava field. Views of the surrounding area from the airport include the North Kona coastline and mauka views to the east of the Queen Kaahumanu Highway and Hualalai Mountain beyond. The airport facilities stand out in stark contrast to the relatively barren lava field. Portions of the open lava field will be replaced by the construction of new airport buildings, roadways and pavement surfaces. Most of these facilities will be constructed on ground that has been previously cleared. The new facilities will increase safety while providing improved service for passengers and users at KOA. A pleasing visual environment will be created by use of landscaping to enhance the area and screen unattractive features. Formal gardens within the terminal complex will also provide visual relief from the immediate airport surroundings. Some of the existing architectural design themes will be incorporated into the design of new buildings to maintain the "tropical village" design character of the airport.

It is anticipated that no adverse visual impacts will result due to the proposed project. The new facilities will be based on use of the previous "tropical village" design theme of the airport which is expected to be consistent with the immediate and regional surroundings of the area.

1.7.11 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Future development associated with the KOA Master Plan Update is not expected to result in potential for significant adverse impacts to historic or archaeological resources. This is based on results of a prior 1987 archaeological survey and Archaeological Update and Public Access Shoreline Hawaii (PASH) Rights Interviews for Kona International Airport at Keahole, study which was completed in April 2000 (see Appendix H).

Prior development activities including construction of the Keahole Airport in 1970, NELH/HOST facility, and Queen Kaahumanu Highway have already resulted in major alteration and removal or destruction of sites which may have been of historic or cultural value.

The following summarizes the results of the April 2000, archaeological survey. See Appendix for the survey area and archaeological site locations:

- Confirmation of No Sites - Nine archaeological survey areas were examined with the goal of confirming earlier findings of no sites. In each of these areas no sites were found.

- Previously Identified Sites - Four areas which were previously surveyed were reassessed to determine significance. One of the four sites remains largely intact, while remaining sites that were previously identified as "no longer significant" were demolished as part of previous work for the 1987 KOA Master Plan/1988 KOA Master Plan Environmental Impact Statement.

  The remaining site which remains largely intact was recorded and described in appropriate detail. The area was determined to be "no longer significant".

- Inventory Survey - Four previously unsurveyed areas were examined to ensure no potential for significant adverse impacts. Two of the areas yielded historic data while the remaining two areas indicated no historic sites. In each case it was determined that there would be no significant impacts associated with development of the proposed project.

The survey indicates that most archaeological work completed for KOA have been small scale surveys undertaken in the vicinity of main airport facilities. A large scale survey was carried out in the late 1960s, but was never fully reported. Various additional small scale surveys were subsequently undertaken as part of various KOA Master Plan projects.

Although no further archaeological mitigation measures are required, three recommendations are made to provide improvements to future archaeological data collection and management:

Recommendation No. 1 - Update the existing State Historic Preservation Division GIS - This item is not within the scope of the proposed KOA Master Plan Update project, but would facilitate the future management of state archaeological resources.

Recommendation No. 2 - Update the GIS database for Keahole - This item is also not within the scope of the proposed project, but would facilitate future management of historic and cultural resources.

Recommendation No. 3 - The collections made during previous data recovery efforts at KOA should be recovered. It is believed that some of the collections held by Chiniago Inc. were taken over by an archaeological firm headed by Lloyd Soehren. This lead should be followed up with a phone call and trip to the Big Island to review any collections that might be held. Once the KOA collections are identified, arrangements should be made to curate them in a State approved repository (Ibid, April 2000).

1.7.12 PUBLIC ACCESS SHORELINE HAWAII (PASH ACT 50 SESSION LAWS OF HAWAII 2000) RIGHTS

A series of interviews with informants familiar with the history and use of the Keahole area were conducted in conjunction with the April 2000 archaeological survey. The interviews identified 7 PASH rights issues. A summary of these issues involve the following:

- Limited Access to Shoreline Within the Vicinity of Existing Airport Properties - Limited access to the shoreline is a concern and problem for residents in the Kona area wishing to use the shoreline for fishing and recreation. Most informants agree that the major uses of the area, however, were not compromised by construction of the airport.

- Compromising of Archaeological and Historical Sites - Archaeological and historical sites, both known and unidentified, are believed to exist within and surrounding KOA. Sites that carry the greatest degree of cultural significance for descendants of Keahole lands are human (ancestral) burials.

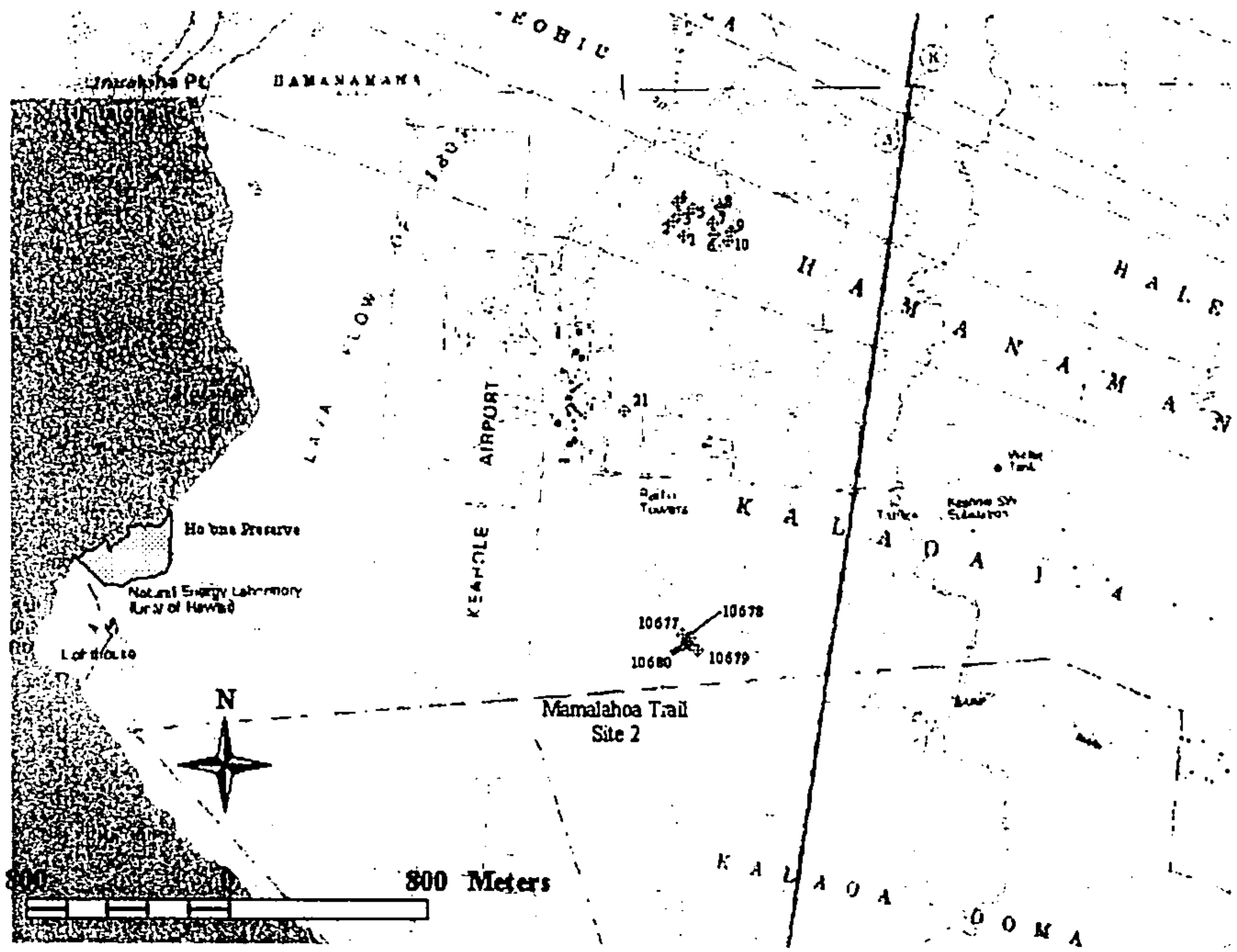


FIGURE 1–4 Archaeological site locations plotted on United States Department of the Interior Geological Survey Topographic Map (Keahole quadrangle).

A second group of sites includes known features that have very specific boundaries/localities. Informants have recalled that there were once various trails leading from Keahole to Hualalai. The primary concern is that these trails be maintained (restored if necessary), and made accessible as footpaths.

- Access to Prime Fishing Grounds - Several informants and interviewees have recalled the once abundant fishing grounds that lie along the Kona Airport shoreline. In recent years the fish supply has declined. Along with the fish supply, there are related concerns of noise, lights and jet exhaust traveling from the airport to the ocean.

- Loss of Native (Traditional) Plants - Plants along the shoreline were once used to make leis. According to one informant the area was very likely used for the gathering of traditional plants since this was a practice of most areas settled by Hawaiians. Some of these plants however, are no longer available because they have been pulled out by development of the airport area.

- Observation of Traditional Boundaries (Need to Treat Ahupuaa as One Unit) - In addressing PASH issues, it is clear that application of physical boundaries (as in the current project area) needs to be clarified. A major question is how to take into consideration the notion of an ahupuaa, while also working within designated, site-specific boundaries. Traditional and cultural customs and practices involve addressing the entire ahupuaa.

- Impacts to Aquifers and Seabeds - Two concerns were raised: 1) impacts to aquifers; and, 2) impacts to seabeds. Further research was requested by interviewees to evaluate impacts to water quality, including the quality of salt (collected in drying ponds) and the extent of pollutants mixing in deep water.

- Boundaries Compromised and/or Seen and Inseparable from NELH - According to interviews, PASH rights to KOA are nearly inseparable from concerns associated with NELH. The present location of NELH is within the same ahupuaa as KOA. With the exception of the Airport District Manager and public officials, most informants and area residents do not separate the two facilities, or the lands on which they are located. There are several areas of contention with NELH, including it (a) being a private enterprise using ceded lands, (b) possibly polluting the nearby shoreline, and (c) not being community oriented or cooperating with the community.

The seven issue areas identified above could require further community dialog or public informational meetings as future portions of the KOA facility are developed. This will be to ensure airport development sensitive to shoreline access requirements.

The PASH rights interviews indicate that although shoreline access is considered a problem, major uses including vehicular access, camping and fishing, were not compromised by construction of KOA. This has been due to the *existing provision of a shoreline access road* by DOT-A to maintain the public right to visit and use the shoreline. At the same time, land uses surrounding the KOA facility have resulted in some loss of access. The primary land use surrounding KOA, NELH, is not subject to development associated with the KOA Master Plan Update.

The continuing use of archaeological surveys to assess potential for negative adverse impacts to archaeological and historic sites (especially burials) will continue to be utilized by DOT-A whenever necessary. Proposed development sites for the KOA Master Plan Update were reviewed and evaluated by archaeologists and the State Historic Preservation Division to ensure "no effect" to significant sites.

Access to prime fishing grounds and the apparent decline in abundance of species previously found along the airport shoreline may be somewhat explained by increased fishing pressure over the past several decades throughout coastal waters of Hawaii. At the same time, coastal as well as ground water quality at Keahole has been evaluated in the report Water Quality Monitoring Program for the Keahole Airport Expansion, December 1998. The primary finding of the report was that water quality for the area continues to be within expected parameters with no deviant or abnormal levels of deleterious constituents detected.

There has been loss of some plant species immediately within the developed portions of the KOA facility, however, major portions of KOA remain undeveloped and contain many of the same plant species associated with the Keahole dry lowland environment. It is possible that the combination of both the on-going three year old drought and limited access south of KOA may have heightened the perception of loss of native plant species. Access to areas along the public shoreline access right of way, however, are available to the public.

The establishment of fences and restricted access surrounding portions of KOA are intended to maintain public and airport tenant safety. Public access, therefore, cannot be granted to the airfield and surrounding zones comprising the flight line, clear zones, aviation use support areas, and various locations surrounding the terminal. DOT-Air will continue to maintain restrictions to these areas in accordance with FAA and various other Federal, State, and County of Hawaii regulations governing operation and use of an active public airport.

Because of issues raised concerning the NELH facility, DOT-A will provide a copy of the Archaeological Update and Public Access Shoreline Hawaii (PASH) Rights Interviews for Kona International Airport at Keahole, April 2000, to NELH to advise them of public concerns raised in the report.

No further mitigation concerning the provision of public shoreline access at KOA are expected to be required. However, a copy of the archaeological update will be provided to NELH to advise them of potential public concerns.

1.8 SOCIOECONOMIC ENVIRONMENT - SUMMARY OF IMPACTS AND MITIGATION

1.8.1 HUMAN SETTLEMENT PATTERNS AND PROPOSED LAND USE

Construction of the Keahole Airport in 1970 has contributed to the maintenance of open space areas surrounding the airport. This has been partially due to FAA regulations requiring sufficient airspace and obstruction free areas, as well as the recent downturn in Hawaii's visitor industry, which has contributed to limited residential development in the Keahole Region and elsewhere throughout the State.

Existing residential developments surrounding KOA include: Keahole Agricultural Park, Kona Palisades Subdivision, Kona Wonder View Lots, and Kona Acres. Other commercial/industrial areas that have been developed to the south include Kaloko Industrial Park, and Honokohau Harbor. NELH and HOST Park are situated adjacent to KOA on leased airport lands and primarily serve as research facilities. Lands to the north are primarily in recreational uses.

Human settlement patterns are not anticipated to be adversely affected by the proposed KOA Master Plan expansion. The land surrounding the airport is set aside in open space and in land uses that are generally compatible with operation of the site for airport purposes. According to the 1997 FAR Part 150 Noise Compatibility Program Report (NCPR), existing residences are in locations which are outside of the 60 DNL noise contour, and there are no existing incompatible land uses within the future 5-Year Noise Exposure Map for the area.

No further mitigation is required for the 2015 timeframe of the KOA Master Plan update. However, because DOT-A is concerned about potential future expansion requirements, continued emphasis will be placed on limiting land developments which could involve noise sensitive uses. This would supplement an existing NCPR recommendation to discourage uses including residences, hospitals, day care facilities, and churches and schools, from locating within the airport vicinity (see Section 5.7 - Noise).

1.8.2 POPULATION CHARACTERISTICS

Development of the proposed KOA Master Plan is not expected to result in adverse impacts to the area population. The current KOA site was selected in the 1960s to replace the old Kona Airport which has since been redeveloped to serve park and recreational uses. The current KOA location is relatively distant from urbanized Kona, and since 1970, has supported land uses which are generally consistent with ongoing operation of an airport facility.

Direct and indirect population impacts may result due to new employment opportunities that will either help support tourism or provide services that are required by the airport. Area businesses may also create indirect employment opportunities as new residential growth away from the airport generates the need for additional goods and services.

The KOA Master Plan will generate new employment opportunities which in turn, may generate need for additional housing. This housing need will involve short as well as long term requirements, some of which can be fulfilled through the existing housing inventory. If new housing is required it is expected that new construction will be fulfilled in accordance with existing State and county rules and regulations governing development.

1.8.3 ECONOMIC CHARACTERISTICS

Hawaii's economy is primarily driven by tourism and Federal spending. The most recent tourism projections completed by DBED&T, indicate that statewide tourism will continue to grow through the year 2010, at an average rate of 2.4% per year. A rate that is significantly lower than was previously projected in the early 1990s. According to Aries Consultants, Ltd., visitor arrivals to KOA are similarly anticipated to increase, but at a slightly lower average rate of 1.7% per year.

Development of projects identified in the KOA Master Plan will result in the creation of new jobs. Job categories required will include both short-term construction and longer term operational employment related to support of new KOA facilities. An estimated 2,053 direct and 3,592 indirect construction related jobs will be generated. Estimates of longer term employment are more difficult to determine but will primarily be dependent on level of demand placed on use of new facilities.

It is expected that increased employment opportunities will benefit the area economy. Short term construction, however, may involve use of skilled and semi-skilled workers brought in from other parts of the Big Island and State. Upon completion of construction activities transient workers are expected to return to their places of residence outside the region. Longer term employment will provide greater opportunity for economic benefit to the region since resident employees will provide multiplier benefits based on spending of disposable income and payment of local (County) taxes and user fees.

Mitigation measures are not expected to be required. The employment opportunities provided from Master Plan expansion of the airport will provide both public revenues, in the form of taxable income and payment of user fees, and private benefits, in the form of worker compensation and business owner profits.

1.9 PUBLIC FACILITIES, SERVICES, AND AIRPORT SUPPORT UTILITIES - SUMMARY OF IMPACTS AND MITIGATION

1.9.1 ACCESS, CIRCULATION AND PARKING

A Level of Service (LOS) analysis was performed for the peak period to examine the necessity for roadway improvements along the highway corridor between the airport and Palani Road. From this and other analyses, the Federal Highway Administration (FHWA) determined that the Queen Kaahumanu Highway should be upgraded from a two-lane highway to a four lane divided highway from Henry Street in Kailua-Kona to the Airport Access Road (Environmental Assessment for

Queen Kaahumanu Highway Widening, Kailua to Keahole, County of Hawaii, May 1996). The schedule for this project is undetermined pending availability of construction funding.

The portion of proposed new highway located at the intersection of the airport entrance had a recent installation of a 3-legged signal intersection. The signalization of this intersection was completed in October 1996. This present configuration will be redesigned and improved as the highway is enlarged to a 4-lane divided roadway.

The existing airport access road is adequate to support the volume of traffic generated by the airport. Improvements, however, will be required to accommodate projected traffic increases. The existing airport access road is planned to be widened from two to four lanes. Circulation within KOA will be improved by widening and realignments of existing and new service roads. Improvements in traffic flows will eliminate the need for all traffic to go to the Overseas Terminal.

By 2015, provision of approximately 840 new public parking spaces will be constructed in the area to the east of the existing interisland parking lot. Approximately 400 new employee parking spaces will also be sited to the east and adjacent to the existing public parking area.

Ramp access, automobile circulation, and provision of new public and employee parking facilities will expand the current airport and improve overall access and egress from KOA.

1.9.2 POTABLE WATER SUPPLY

Water usage at the airport follows aircraft arrival and departure patterns. Most demands are due to passenger usage in the terminal area and from landscaping irrigation. On-site water requirements are currently being upgraded with construction of a new 1 million gallon tank which will include service to the airport and NELH area.

The potable distribution system is expected to meet domestic needs with only supplemental upgrades. A new 16-inch water main has replaced the existing 12-inch pipeline between the highway and Road "N". A future North Kona consortium tap will also replace the 12-inch municipal water line near the highway and will connect to the new 16-inch main.

Potable water will be supplied to the new proposed General Aviation (GA) and lease parcel areas through new 8 and 12-inch water lines to be installed along service roads. The proposed terminal facilities toward the north will be supplied through a connection extending the recently installed 16-inch water main.

1.9.3 WASTEWATER TREATMENT AND DISPOSAL

The existing wastewater treatment plant (WWTP) design capacity is periodically exceeded and is therefore inadequate for current terminal area demands. A larger capacity WWTP is under study and design. The new facility will be a secondary treatment lagoon type plant treating an average daily flow of 0.13 mgd with a peak treatment capacity of 1.25 mgd. The new facility is proposed approximately one mile north of the existing terminal facilities, offering sufficient buffer space for the dispersal of any odors. The new wastewater treatment facility is scheduled for completion by 2003. Since the new WWTP system will be self contained, no adverse impacts will result to the local municipal system. The treated effluent will be diluted with groundwater and will be naturally filtered and purified prior to eventual migration to the ocean. No significant impacts are anticipated to Class AA coastal waters. A program of groundwater monitoring and coastal water quality may be executed prior to WWTP development to ensure compliance with applicable water quality standards and to establish baseline data on water quality.

Saturation of the underlying basalt may occur and some odors could be generated without proper maintenance of the treatment plant. Therefore, regular maintenance of the treatment plant is necessary to insure no odor or injection well clogging problems. Effluent spray contact with humans can also be minimized by providing sufficient landscaped buffer zones that use potable water. Plant maintenance may be contracted to a contractor specialized in private sewage treatment facilities. Periodic inspections by qualified State personnel shall be conducted.

Future development of Fixed Base Operator (FBO) lease lots to the south will necessitate a wastewater pumping station (WWPS). Construction of this facility will help to ensure sufficiency of service to new facilities at the southern end of KOA. The WWPS will be a buried package facility. Odors are not anticipated in the vicinity from a properly designed and maintained facility.

1.9.4 STORM WATER DRAINAGE

Rainfall runoff in the airfield and parking area is handled by surface or sheet drainage utilizing a system of swales, ditches, and concrete bridge culverts to collect and direct storm runoff to natural drainageways or dry wells. Drainage at the terminal area is generally provided by a system of collection pipelines and intake boxes. There is no municipal drainage system in the area.

There are no defined waterways of any kind in the area which will be disrupted by the proposed airport expansion. Collected runoff will be disposed of in deep pits. The airfield and terminal improvements will significantly increase the amount of impervious area thereby increasing the amount of runoff. However, adequate drainage is available in the surrounding terrain, so the increased runoff generated from the airport facilities will be accommodated resulting in no impacts on adjacent developments including the HOST Park and NELH.

1.9.5 ELECTRICAL AND COMMUNICATIONS SYSTEM

The offsite power system is maintained by the Hawaii Electric Light Company (HELCO). A substation, located at the intersection of the Airport Access Road and Queen Kaahumanu Highway, will be used to provide electrical power for the expanded airport facilities. The current capacity of the HELCO system is 196.8 megawatts (MW) with peak demands reaching 169.6 MW.

On-site airport power and communications links consist of underground ducts along the airport access and circulation roads. Emergency backup generators and telecommunications switching facilities will occupy the electrical control building, near the existing air traffic control tower. This building will need some improvement to accommodate the additional backup power generators needed to ensure noninterruption to key airport facilities.

The proposed KOA Master Plan improvements will place additional demands on the HELCO power system. However, no other significant impacts are expected. Improvements to the off-site electrical system will be performed as necessary by HELCO as part of system upgrade procedures.

1.9.6 LIGHTING SYSTEM

The airfield utilizes existing high intensity white/amber edge lighting along the runway (HIRL) and medium intensity blue lighting along the taxiways (MITL). Flashing approach lights are used along the extended runway centerline about 2,500 feet off each end of the runway (MALSR). Bright omni-directional runway end/threshold lights are used to alert pilots of their location in relation to the runway ends, and red and white beams of light are used to inform incoming aircraft of their approach slopes (VASI). A rotating green/white civil airport beacon on top of the air traffic control tower is also operating. Parking lot lighting utilizes overhead lamps suspended on aluminum poles.

The proposed airfield and terminal lighting system will be expanded to enhance the existing system. New lighting fixtures will be added or expanded to new terminal buildings and parking lot areas. Impacts associated with installation of new airfield lights may include disturbance of the terrain in isolated patches off both ends of the runway. Light emitted from these facilities may cause some visual impacts.

The clear visibility of the airfield lighting system is essential for its function and for the safety of pilots and the flying public. Terminal and parking lot lighting, however, will utilize glare shields to reduce stray light.

1.9.7 FUELING SYSTEM

Aircraft fueling at KOA is currently provided by use of tanker trucks, which deliver fuel to the aircraft and aprons, and use of a fueling pit. Tanker trucks deliver fuel to the airfield, General Aviation (GA), and helicopter areas. The fueling pit is located in an area north of the terminal complex. Presently, there is no fueling system with hydrants servicing the aprons.

A proposed fuel farm is under consideration. Once a site is selected, the area will be graded and prepared for fuel storage and leased to a fuel supplier who will construct on-site tanks, fuel transfer pumps, fire protection, tanker loading and unloading racks. The future fuel farm will facilitate the refueling of overseas domestic and international flights.

Impacts resulting from expanded fueling facilities include possible contamination of ground and coastal waters from accidental release. In addition, increased traffic from fuel trucks will result from the need to maintain required fuel storage levels. Possible solutions involve appropriate design and construction of the fueling system. Storage tanks may be constructed above ground, with impermeable concrete foundations designed to contain any spillage. Pipelines may be installed with flexible couplings or joints to account for potential seismic induced ground movement. Improvements to the airport access and circulation roads will facilitate the delivery of fuel by large trucks.

1.9.8 POLICE SERVICE

Although the airport has its own security force operated by Wackenhut, an upgrade to Level III security will be required to accommodate an expanded airport. Personnel required will include police and privately contracted security personnel. The airlines would also need to hire additional security screening guards at the departure gates. The number of personnel required would be based on demand generated by passenger flights.

1.9.9 AIR RESCUE AND FIRE FIGHTING FACILITIES, AND MEDICAL SERVICES

No significant impacts are anticipated to Aircraft Rescue and Fire Fighting (ARFF) facilities as a result of the Master Plan expansion. The ARFF facility satisfies requirements for an INDEX C airport as described in Federal Aviation Regulations (FAR) Part 139.49. The ARFF and ARFF Training facilities also provide paramedical services which are sufficient to meet the needs of the proposed airport expansion. Ambulance requirements will be dispatched from Fire Station No. 7, located in Kailua-Kona approximately 9 miles away. Ambulances can be directed to Kona Hospital located approximately 20 miles from the airport.

1.9.10 SOLID WASTE COLLECTION AND DISPOSAL

The volume of solid waste is expected to increase with development of the proposed facilities. No adverse impacts are anticipated as the current practice of trucking refuse to the Puuanuhulu Municipal Sanitary Landfill is recommended for future operations. Additional dumpsters should be provided as required for immediate storage of solid waste awaiting disposal.

As practicable, DOT-A will consider the use of new technologies and practices that would facilitate a reduction in the volume of solid waste requiring disposal at the landfill. These potential practices may include future consideration for waste recycling and/or source reduction in conjunction with State and County of Hawaii policies and/or procedures to reduce the solid waste stream.

1.10 RELATIONSHIP TO LAND USES AND POLICIES

Expansion of KOA is consistent with the overall goals and objectives for development of the State of Hawaii. The expanded airport facilities will improve and maintain services, transporting people and goods while providing a direct link to the mainland. The growing visitor industry and high technology facilities in West Hawaii will benefit from expanded air carrier and air cargo operations. The economy of the Island of Hawaii will increase by the addition of both short term construction related, and longer term professional, technical, and service related employment.

Expansion of the airport will limit certain future development in the near vicinity. Future urban development (i.e., residences, schools, etc.) within areas exposed to high levels of noise will not be permitted.

1.11 ALTERNATIVES CONSIDERED

Alternative plans were considered for two groups of activities: 1) Airfield alternatives address the need to ensure sufficient operating conditions for the types of aircraft envisioned to be used at KOA. This will involve consideration of runway alternatives for aircraft takeoffs, landings, taxiing, and parking; and, 2) Airport terminal alternatives will address the needs of passengers, customers, and users of KOA.

The various facilities shown on the alternative plans can be recombined, deleted or supplemented to arrive at an ultimate plan.

A no action alternative was also considered that would maintain current conditions at KOA.

1.11.1 AIRFIELD ALTERNATIVES

Demand forecasts to the year 2015 do not warrant an alternative airfield configuration. At a future point a dual runway may be required to meet demand, safety, or need for enhanced operations. **Figure 1-3** identifies the location and potential configuration of this layout. As shown in **Figure 1-3** sufficient space now exists at the oceanward end of the airfield to accommodate a dual runway configuration. This area should be maintained in open space to ensure the ability to expand the airfield in the future.

1.11.2 TERMINAL LAYOUT ALTERNATIVES

The proposed Airport Land Use Plan is identified in **Figure 1-5**. Development of the Plan was based on analysis of three land use alternatives representing various approaches to the allocation of land uses and vehicular circulation. Each of the alternatives are based on the existing master plan and projects currently in progress. A description of these alternatives include:

1.11.2.1 Alternative A

This option is closely aligned with the prior 1987 Master Plan and projected CIP improvements for the next 6-year period. It contains the following features (**Figure 1-6**):

- A. The airport access road is on the present alignment.
- B. The loop road serving the terminals is expanded east of its present location and its alignment is consistent in front of all terminals.
- C. Road "N" acts as a service road connecting public and restricted uses.
- D. The Heliport, GA, and FBO areas are the same as on the 1987 Master Plan.

1.11.2.2 Alternative B

Alternative B (**Figure 1-7**) maintains most of the same land use relationships as on the 1987 Master Plan, with the following exceptions:

- A. The access road is located on the alignment of the proposed Road "P", which aligns it with the Overseas Terminal (OST).
- B. The terminal loop road is expanded to the east and the portion fronting the OST has been moved to permit greater depth.
- C. The terminal road loop configuration allows ground transportation to be directly accessed, thus relieving congestion at the north-south service road and access road.
- D. Only a portion of Road "N" is used as a road, however, it is retained as a utility corridor for its full length. A new parallel service road to the east links facilities from the north to the south.
- E. The Heliport has been relocated north of the ground transportation area.

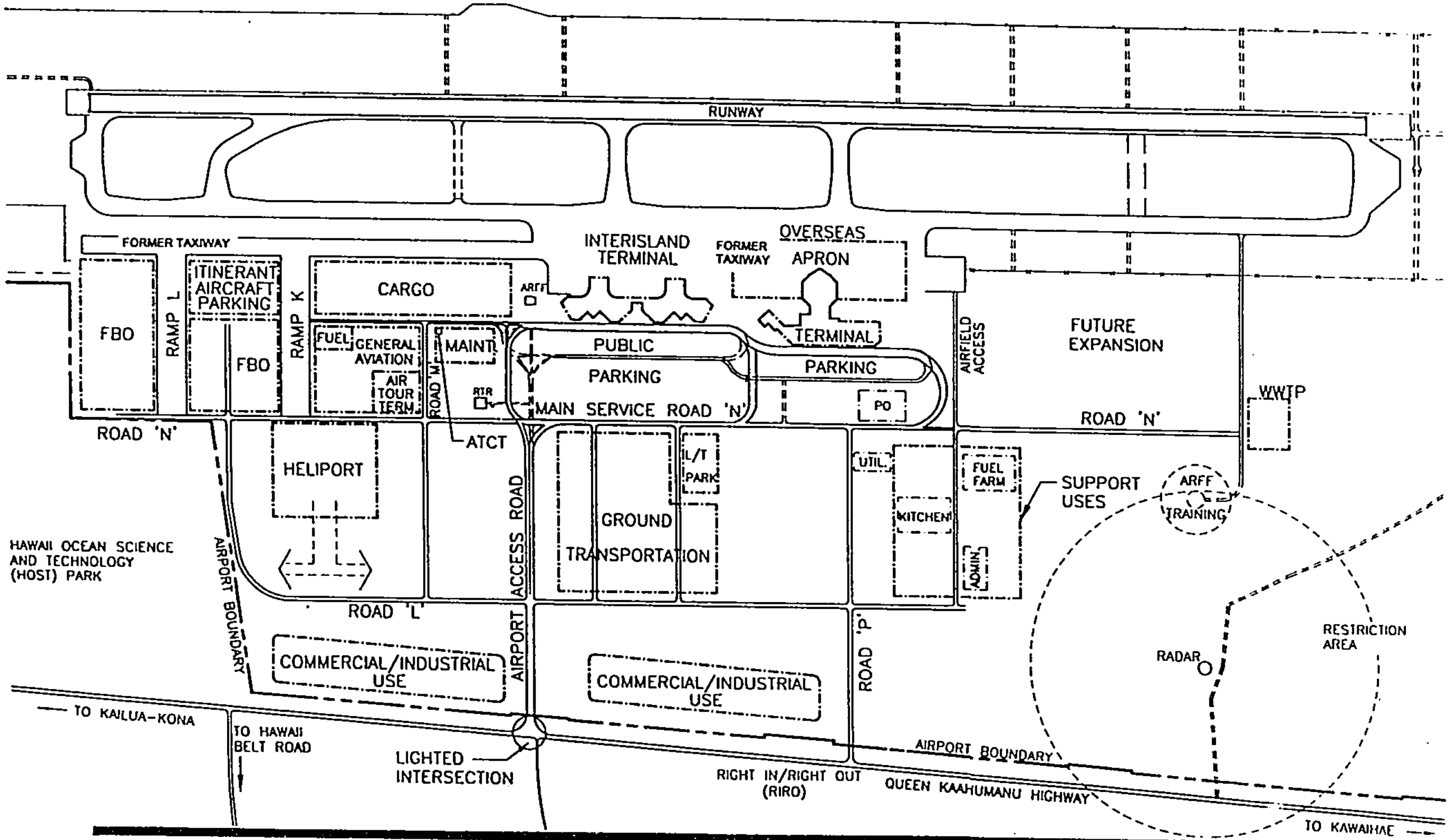


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FIGURE 1-5
PROPOSED AIRPORT LAND USE PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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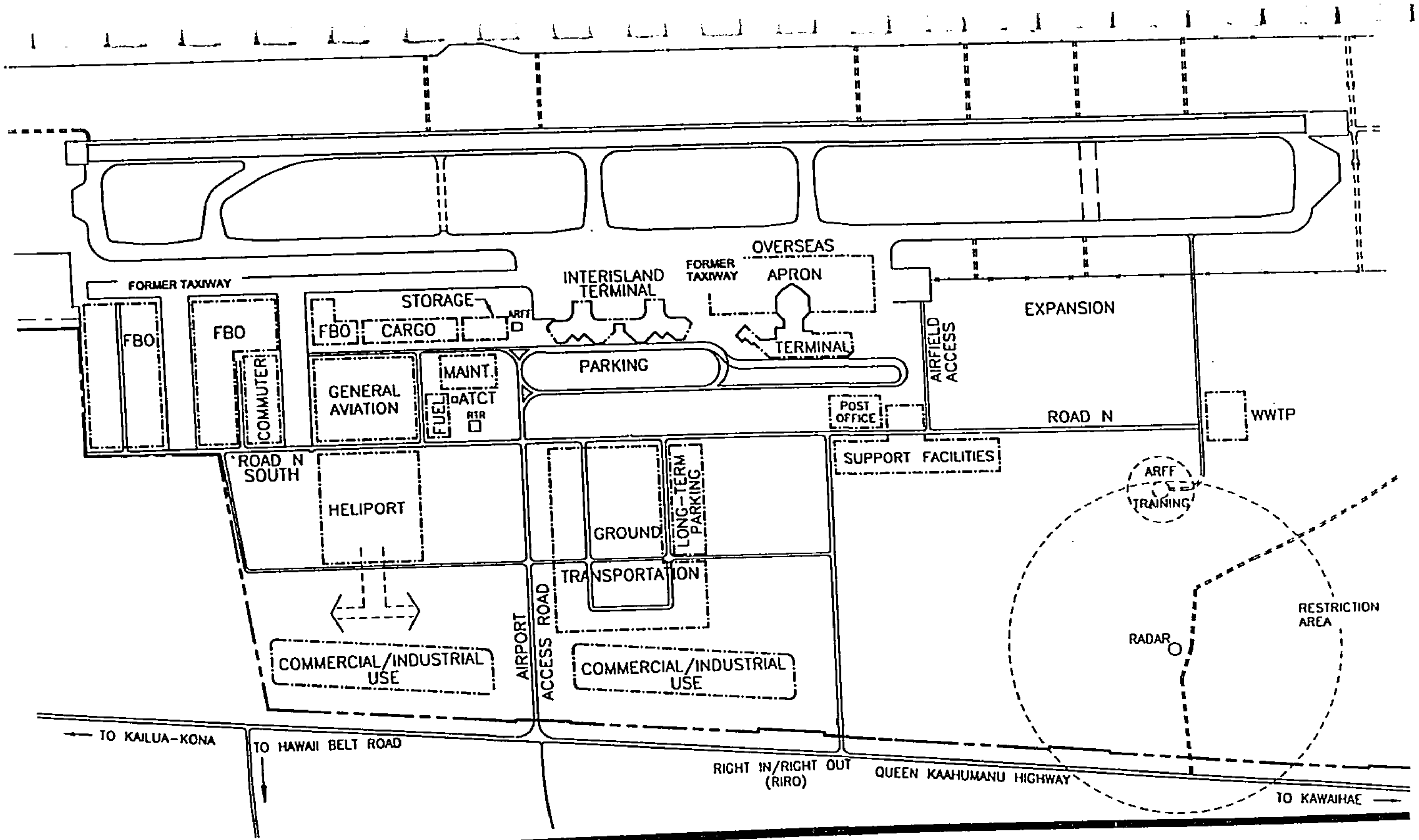

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FIGURE 1-6
AIRPORT LAND USE PLAN
ALTERNATIVE A
Kona International Airport at Keahole
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North Kona, Hawaii

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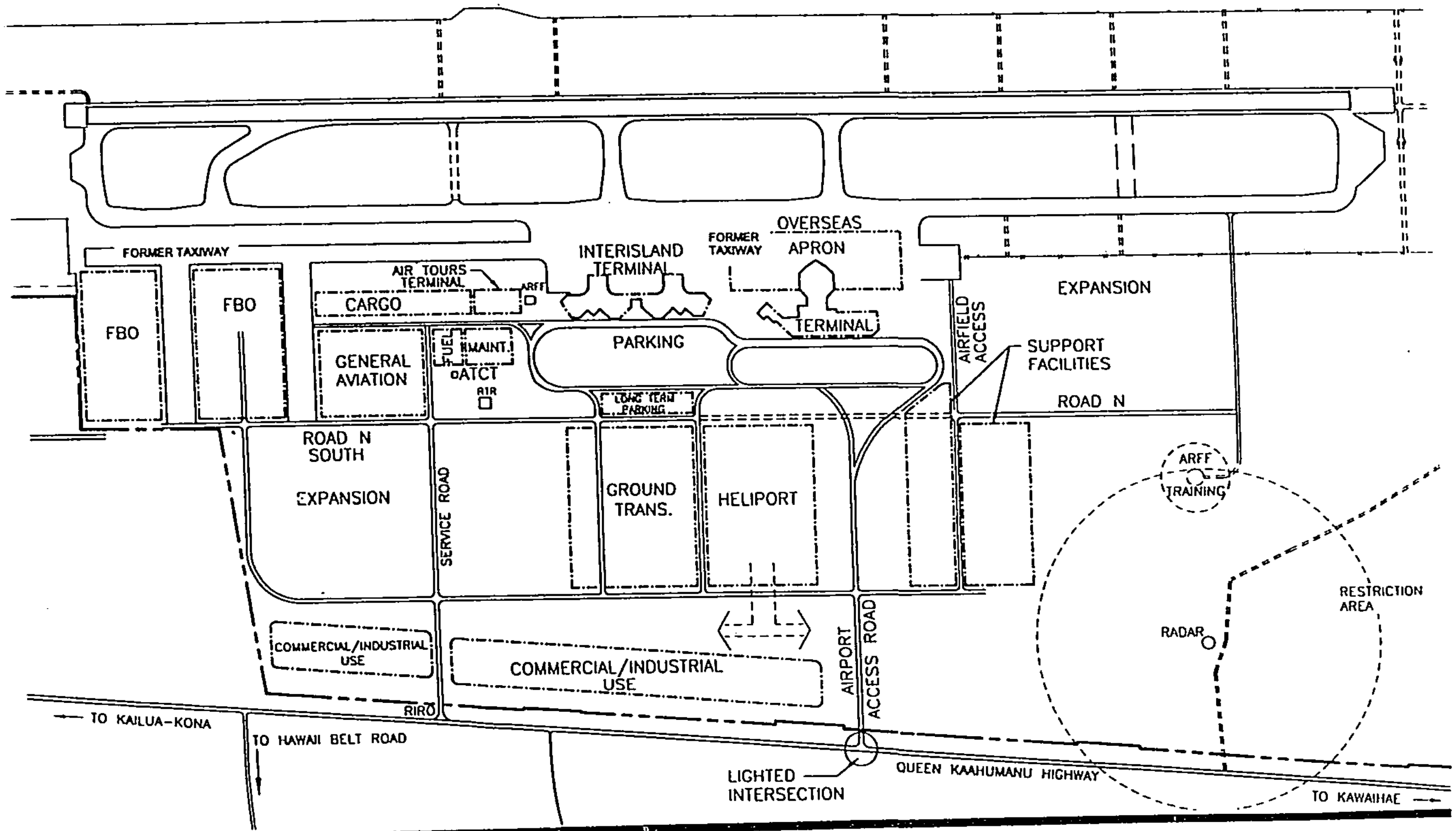

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FIGURE 1-7
AIRPORT LAND USE PLAN
ALTERNATIVE B
Kona International Airport at Keahole
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North Kona, Hawaii

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1.11.2.3 Alternative C

Alternative C (**Figure 1-8**) combines features of Alternatives A and B:

A. The access road is centered on the terminals area.
B. The terminal loop is expanded to the east to align with Road "N" and the loop in front of the OST is moved to the east.
C. There is direct access off the loop road to the ground transportation area, similar to Alternative B.
D. Portions of Road "N" are abandoned as in Alternative B.
E. The WWTP has been moved to the south to reduce distance and increase maintenance access to this facility.

1.11.3 OVERSEAS TERMINAL ALTERNATIVES

The OST is shown in all alternative plans immediately north of the Interisland Terminal. Initial concept plans are being developed as part of this master planning effort. It is anticipated the structure will be one story along the terminal loop road side, with an architectural style compatible with the Interisland Terminal.

Two alternative concept plans are being considered. A linear plan provides for gates aligned in a north/south orientation, to be accessed by a central concourse area. The second alternative involves a pier approach. Piers with waiting areas would extend from a central concourse, connected by passageways. Each pier would service a number of aircraft on each of three sides.

1.11.4 INTERISLAND TERMINAL

The Interisland Terminal was recently remodeled to accommodate more passengers. There are ten existing gates, with interisland flights usually not requiring use of more than four gates at any one time.

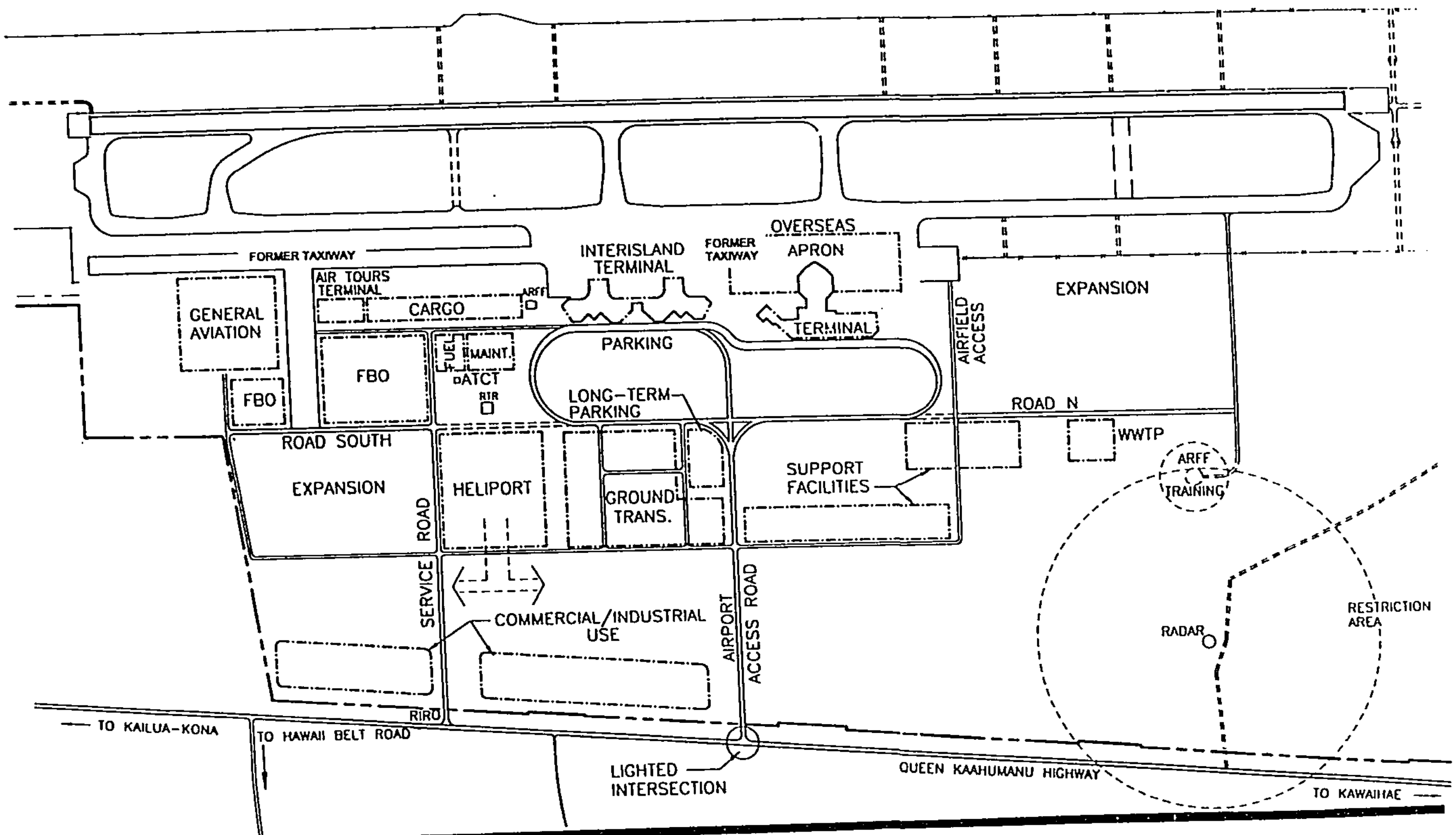

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FIGURE 1-8
AIRPORT LAND USE PLAN
ALTERNATIVE C
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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Interisland passenger growth is expected to increase to approximately 2,121,000 passengers annually in 2015, up from 2,081,368 passengers in 1995. It is expected that with limited improvements the existing gates and terminal facilities will be sufficient to meet this demand. Alternatives for the Interisland Terminal relate primarily to use by overseas carriers. At present the north terminal area is used for overseas passengers. One option is for "no action" and continue operations for an extended period of time. This would necessitate additional improvements to the Interisland Terminal to service the much greater number of passengers associated with overseas flights. The "no action" alternative is determined to be unacceptable because it will only provide a short term solution to a situation requiring a long range solution.

1.11.5 OTHER AIRPORT ELEMENTS

Other airport facilities that have been considered in the alternatives analysis included the following:

A. Heliport - A permanent heliport is proposed as part of terminal layout alternatives A and B. A major consideration is the amount of noise generated from this activity. Consequently, adjacent uses must be considered.

B. Commuter Terminal - This facility has been termed an "Air Tour Terminal." Because the principal use will be to serve sightseeing passengers, proximity to the other terminals is not essential.

C. General Aviation - All alternatives have this facility sited at the south end of the airport. It is anticipated this facility will be served by a new ramp with sufficient room for expansion, including tie-down areas.

D. Fixed Base Operators (FBO) - The south end of the airport will also be used to serve FBO's via subdivided lots with ramp access.

E. Commercial/Industrial Uses - Non-airport land uses between Queen Kaahumanu Highway and the relocated Road "L" should be evaluated for revenue generating potential for the State of Hawaii. Care should be exercised to give priority to uses that would support or compliment the airport.

1.11.6 NO ACTION ALTERNATIVE

A No Action alternative would involve taking no further action to implement the KOA Master Plan Update and would result in failure to address anticipated safety, health, and convenience issues associated with airport operations. Facilities which are currently providing acceptable levels of service would eventually become deficient. Facilities which are already operating at deficient levels can be expected to require increased maintenance and eventually, replacement. Continued operation of deficient facilities or their failure could also lead to safety and health hazards.

Anticipated impacts associated with the "No Action" alternative include, but are not limited to the following:

- Overseas Terminal (OST) - The current OST utilizes a temporary outdoor structure to house Federal Inspection Services (FIS). Although the facility is currently adequate, it is expected that with increasing growth of overseas and domestic mainland arrivals that there will be a commensurate increase in delays and inconvenience. The resulting inefficiency of operations from currently combined OST, domestic, and interisland flights is expected to result in increased congestion, delays, inconvenience, and safety problems.

- Wastewater Treatment Plant - The existing plant is already operating beyond capacity. Further reliance would eventually result in decreased performance, breakdowns, and failure. It is expected that as passenger levels increase, that recurring breakdowns would lead to an eventual shutdown due to health and safety concerns of the State Department of Health, and County of Hawaii.

- Air Traffic Control Tower (ATCT) - The existing ATCT will require replacement due to need to maintain adequate sight distances to aircraft using the runway. The lengthening of the runway from 6,500 feet to 11,000 feet has allowed for an increase in the size of aircraft capable of using Kona International Airport at Keahole. The 4,500 foot runway and taxiway extension was added to the northern end of the existing runway and taxiway. This northward runway/taxiway extension, along with the increase in the size of the aircraft using the airport, results in the existing ATCT being in a less than optimum location to maintain an adequate line of sight to the aircraft using the runway/ taxiway. Therefore, an ATCT in a location with better view planes, unobstructed by taxiing aircraft, is required to maintain safety and efficiency of operations.

- Relocation of various airport facilities including: General Aviation (GA), Air Tour Terminal, Heliport - The KOA Master Plan Update proposes to relocate these facilities to increase efficiency of movement of aircraft, goods, services, and people. It is expected that with no further action there will continue to be both inefficient movement, as well as continued inadequate conditions.

- Airfield Improvements including Itinerant Aircraft Parking, Ramp "K", and Overseas Apron - Itinerant aircraft must currently park on the paved area north of the Aloha/United apron where there is increased possibility for congestion with limited maneuvering space for aircraft. The KOA Master Plan Update proposes to relocate this use on an area of approximately 6-acres adjacent to Ramp "K", south of the cargo area.

  The No Action Alternative would negate development of these facilities to improve efficiency and improve use of space at KOA.

The net effect of the No Action Alternative could also indirectly affect the growth of the Kona district since no further improvements would lead to increased delays, loss of operational efficiency, and possible health, safety, and welfare problems for the general public. Existing facilities would not be able to accommodate the projected increase in population and growth of the tourist industry. Non-expansion would also limit or hinder the amount of people and goods traveling through Kona.

1.12 PERMITS AND APPROVALS

The following permits and approvals are required prior to implementation of the project:

AUTHORITY	APPROVAL REQUIRED
Federal Government	
Federal Aviation Administration	Approval of Airport Layout Plan
State of Hawaii	
Department of Transportation Highways Division	Construction Within State Right-of-Way (ROW)
Building Department	Building Permit
Dept of Business, Economic Development and Tourism	Coastal Zone Management Federal Consistency Determination

SECTION 2
PROJECT DESCRIPTION, PURPOSE, AND NEED

2.1 INTRODUCTION

This Environmental Assessment (EA) is prepared pursuant to the Kona International Airport at Keahole (KOA) Master Plan Update and FAR Part 150 Noise Compatibility Program. Funding for preparation of this document is provided through the State of Hawaii, Department of Transportation, Airports Division (HDOT-AIR), under State Project No. AH 2011-03.

This document is prepared in accordance with Chapter 343, Hawaii Revised Statutes and the rules and regulations of the Office of Environmental Quality Control; Chapter 200, Title 11, Hawaii Administrative Rules; National Environmental Policy Act (40 CFR Part 6); and the Airport Environmental Handbook (FAA, Order 5050.4A, October 8, 1985).

2.2 PROJECT LOCATION

KOA is located on the west side of the Island of Hawaii in the North Kona district (**Figure 2-1**). The airport is located west of the Queen Kaahumanu Highway, and is approximately seven miles north of Kailua-Kona, Hawaii. KOA is one of two airports on the island of Hawaii which are served by scheduled interisland and overseas carriers. KOA is the primary entry and departure port on the west side of the island, and Hilo International Airport is the primary entry and departure port on the east side of the island. KOA is approximately 56 nautical miles west of Hilo International Airport.

2.3 BACKGROUND, PURPOSE, AND NEED

As noted in the prior 1987 Keahole Airport Master Plan, the purpose of the expanded airport facilities is to meet projected aviation demands, provide unrestricted operations of all aircraft types, and site major facilities for operational safety and efficiency. The current KOA Master Plan Update provides for continued airport improvements to help meet these goals to the year 2015. Major airport facilities proposed by HDOT-AIR include the following:

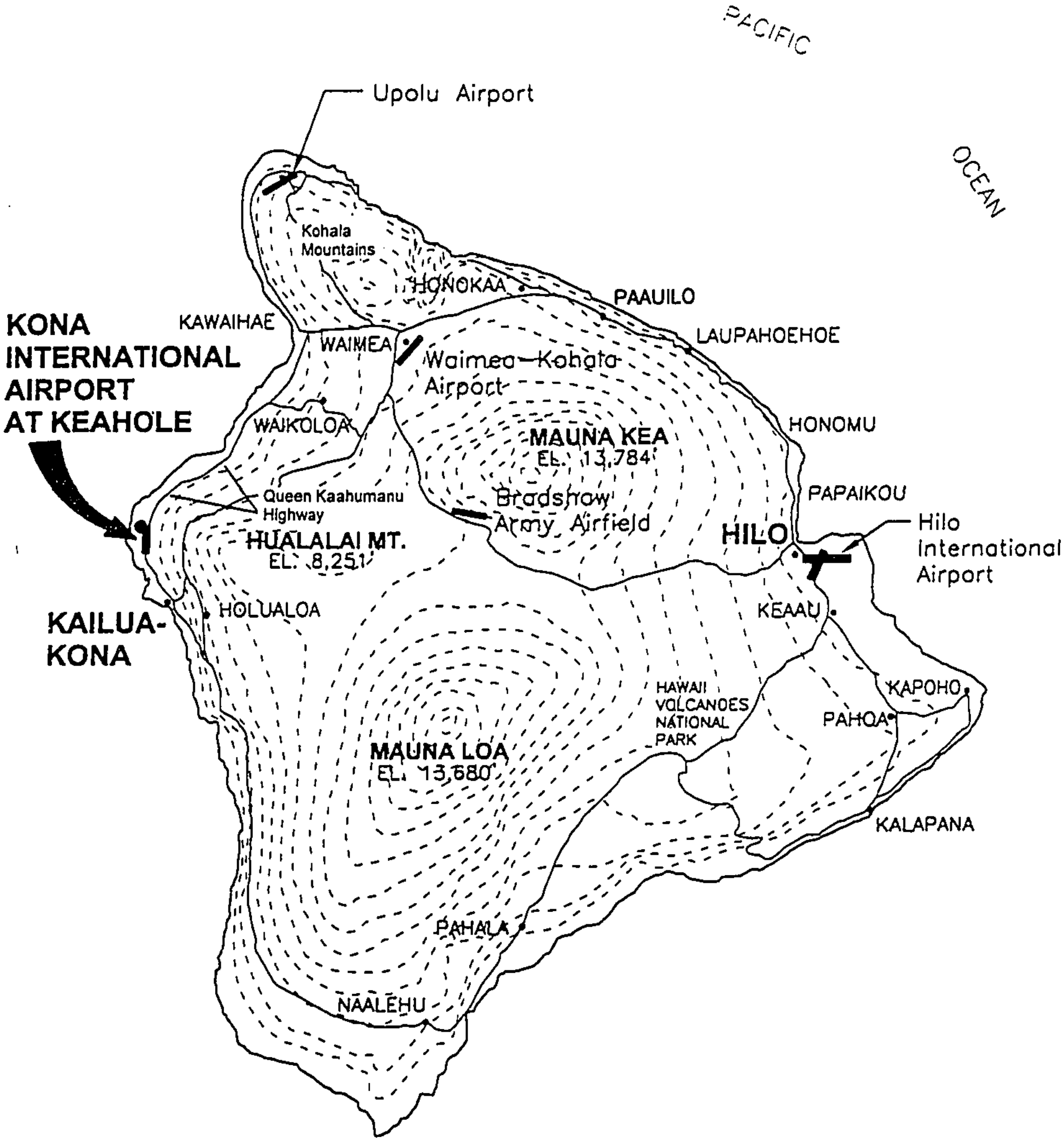

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FIGURE 2-1
LOCATION MAP
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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- New Overseas Terminal (OST) with support facilities including flight kitchen, overseas apron and loading bridges, parking, general aviation fuel storage site preparation, and utility and electrical distribution upgrades. This facility is proposed north of the existing interisland terminal. Improvements to serve interim overseas needs are in progress and are located at the interisland terminal area.
- Telecommunications System
- Wastewater Treatment Plant
- Air Traffic Control Tower
- General Aviation (GA) Site Preparation
- Heliport
- Air Tour Terminal
- Department of Transportation/Drug Enforcement Agency Administration Building
- Airfield Improvements
- Access Road and Utility Improvements
- Fuel Farm Site Preparation
- Postal Facility Site
- Miscellaneous Projects (including but not limited to: Ground Transportation Service and Ready Area; various parking projects; Telecommunications System upgrades; Air Cargo Facilities; etc.)

The proposed improvement projects identified above are implemented through the separate plans which together comprise the KOA Master Plan. These plans include the Airport Land Use Plan; Airport Layout Plan; Approach and Clear Zone Plan; Terminal Area Plan; Airport Utilities Plan; and Access and Circulation Plan. The following discussion of each of the separate plans will provide a description of existing conditions followed by a description of proposed uses. Further plan details are referenced in the "Kona International Airport at Keahole, Master Plan Update, November 1998." This section concludes with a description of airport areas requiring special design consideration.

2.4 AIRPORT DEVELOPMENT PLANS

The KOA Master Plan is based on an analysis of airport alternatives to meeting both airfield and terminal area requirements (see Section 4 - Alternative Plans Considered). These alternatives were reviewed by HDOT-AIR, Federal Aviation Administration (FAA), Keahole Kona International Airport Technical Advisory Committee (TAC), and the potentially affected public through a series of public informational meetings. The recommended master plan concept was further developed into the detailed plans presented below:

- 2.4.1 Airport Land Use Plan
- 2.4.2 Airport Layout Plan
- 2.4.3 Approach and Clear Zone Plan
- 2.4.4 Terminal Area Plan
- 2.4.5 Airport Utilities Plan
- 2.4.6 Access and Circulation Plan

2.4.1 AIRPORT LAND USE PLAN

There are no serious existing constraints involving severe changes in topography or unusual site conditions which would limit expansion of the terminal or airfield facilities. The location of existing roadways and facilities will have a significant impact on future development. A large area known as the "south ramp" has been graded in anticipation of future needs for GA, Fixed Base Operators (FBO), and related facilities. The Interisland Terminal and cargo facilities leave only the area to the north available for substantial expansion of new terminal facilities.

Queen Kaahumanu Highway is proposed to be widened from two to four lanes. This will improve airport access. One full turning intersection has already been allowed for airport access. Airport access from the highway, however, will be limited to right in/right out intersections which will be sufficient within the proposed 2015 timeframe of the KOA Master Plan. There is at present only one intersection to the Queen Kaahumanu Highway, located at the Airport Access Road. No other access intersections are proposed at this time.

The proposed KOA Land Use Plan is shown on **Figure 2-2**. Land areas allocated for various uses are general in area and allow for phased expansion of facilities. The proposed use that shows the most land use increase is the terminal area. The Land Use Plan also calls for the relocation of certain uses to other areas of the airport. This includes the GA, FBO, and air commuter/air tour operations. New uses include a heliport and support uses (flight kitchen and postal facility).

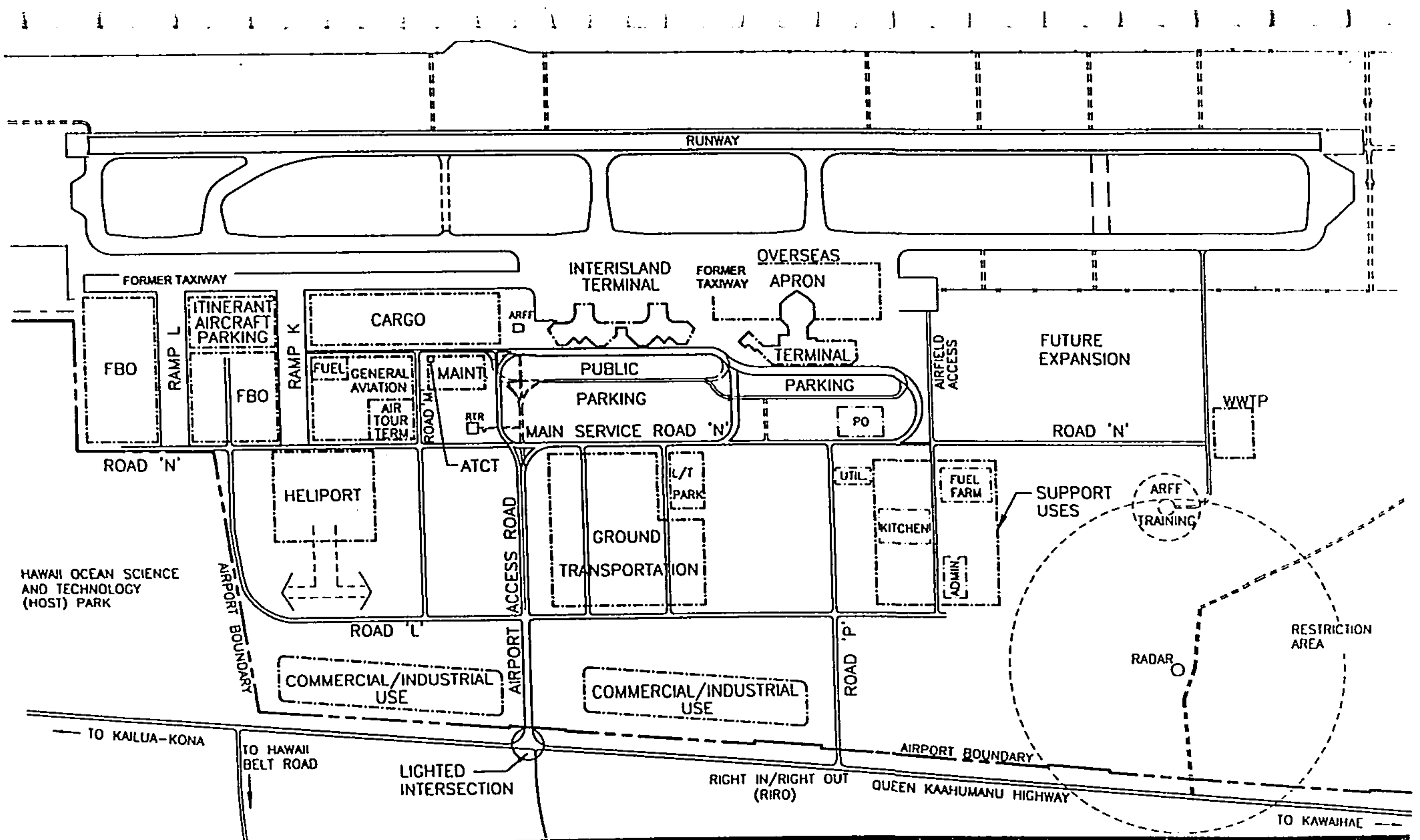

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FIGURE 2-2
PROPOSED AIRPORT LAND USE PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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A heliport is proposed to be located south and east of the terminal area. Land has also been set aside for FBO private or corporate users who desire access to the airfield. These parcels are located south of Ramp "K."

The Land Use Plan has provisions for airport expansion beyond the 2015 master planning period. Land has been set aside for terminal area expansion and other airport requirements.

The proposed gross land area allocated is shown in **Table 2-1** (net area available for use is 3,407 acres). Based on the gross land area allocated, approximately 47 percent of the land area will remain open. This represents an approximate ±20 percent change in the allocation of land from open to active airport use from the previous Master Plan.

2.4.2 AIRPORT LAYOUT PLAN

Based on projected aviation demands and results of the airfield capacity analysis, the existing 11,000-foot runway will suffice throughout the 20-year planning period addressed by the KOA Master Plan. A second runway will be required as aviation demands approach the capacity of the single runway. The current projections indicate this will be sometime beyond 2020 and land should continue to be reserved for a future parallel runway.

The airfield layout is shown in **Figure 2-3**, Airport Layout Plan (ALP). The ALP drawing shows the existing, relocated, proposed, and future (long-range) airport facilities. A parallel runway is not proposed in this Master Plan, although it is shown on the ALP as a long-range airfield facility. Long-range facilities are designated on this ALP for land reservation purposes. Development of these long-range facilities are not expected until after the year 2015, when forecast demands may reach a level as to warrant their need.

The airport reference point (ARP), as noted on the ALP, defines the geographic location of KOA. The ARP is located at 19°44'32.0" North latitude and 156°2'59.5" West longitude (WGS 84), at the centroid of the 11,000 feet by 150 feet runway. The magnetic declination at Keahole Airport for 1998 is estimated at 10°16' East of true north.

TABLE 2-1
AIRPORT GROSS AND NET LAND USE AREA

LAND USE	Area (Acres) Gross	Net
Airfield (Runway and Taxiways)	339	339
Runway Clear Zones	207	207
Terminal/Parking	87	87
Roadways	19	19
GA/Heliport/Cargo	74	74
Ground Transportation Area	44	44
Maintenance	3	3
Aviation Lease Parcels	20	20
WWTP/Fuel Storage Area	11	11
HOST Park	421	
NELH	322	
DLNR	50	
U.S. Postal Service	4	
Reserved-Future Airfield	395	395
Reserved-Future Aircraft Safety Areas (Clear Zones)	207	207
Reserved-Future Airport Related Land Uses	31	31
Undeveloped	1,970	1,970
TOTAL	4,204	3,407

2.4.3 APPROACH AND CLEAR ZONE PLAN

The Approach and Clear Zone Plan is a graphical illustration of imaginary airspace surfaces as defined in Federal Aviation Regulations (FAR) Part 77, "Objects Affecting Navigable Airspace." The plan identifies existing and ultimate approach slopes as well as surrounding physical features and community locations which may affect aircraft operations. The primary objectives in establishing the imaginary surfaces of approach and clear zones are to regulate near-airport development and prevent the erection of possible aircraft obstructions. The approach slope required for a precision runway is 50 to 1 for the first 10,000 feet and 40 to 1 for an additional 40,000 feet. Airfield facilities are identified in this section to help describe the relationship between existing airfield related structures and planned future development which may affect long term airfield activities.

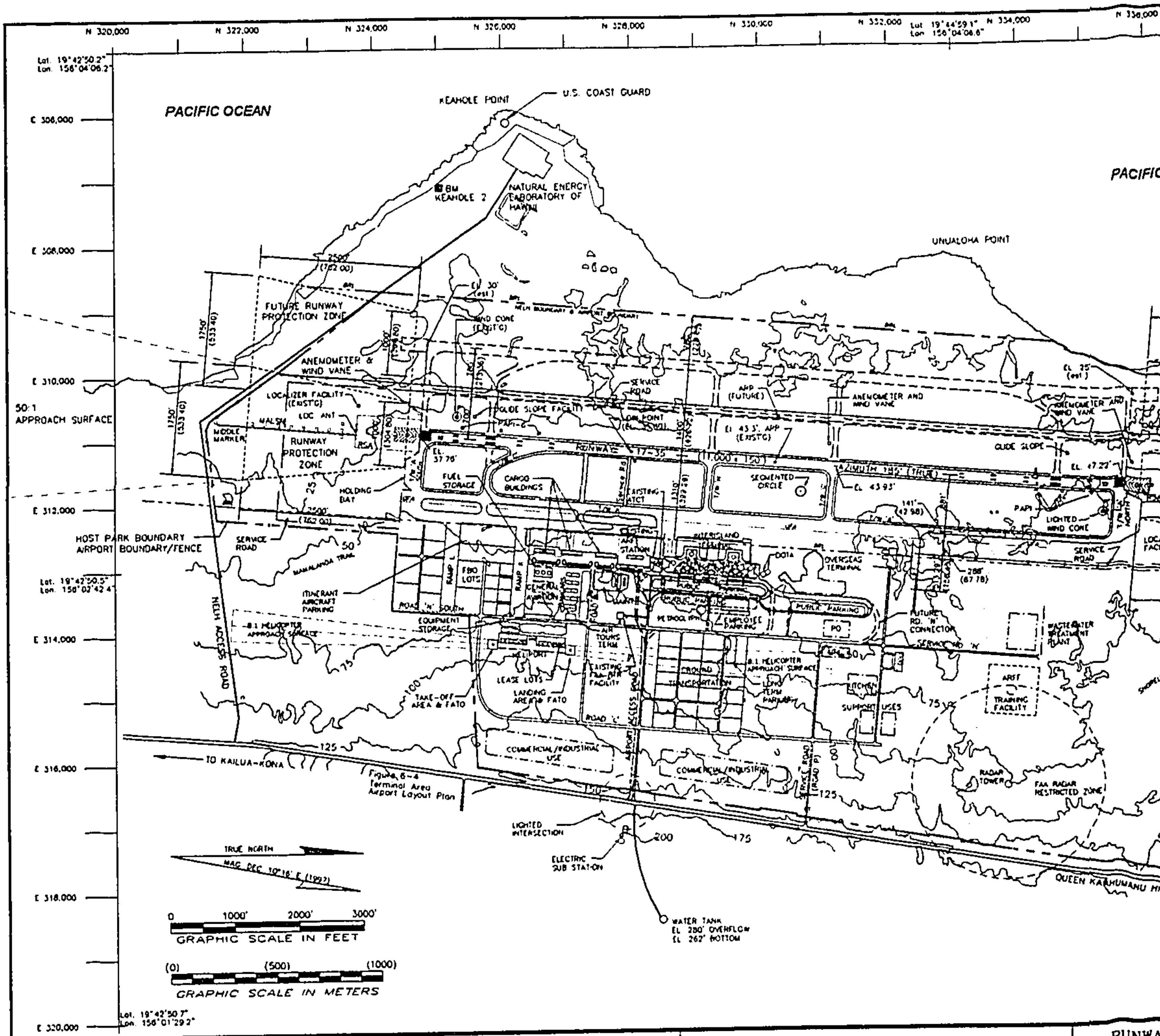
2.4.3.1 Airfield Facilities

The existing airfield facilities consist of the runway, taxiways, holding bays, shoulders, blast pads, and associated safety and clear zones. Airfield improvements in 1993 raised the FAA Airplane Design Group rating for KOA from Design Group IV to Group V. The airport is presently able to accept aircraft from FAA Aircraft Approach Categories A through D. Major existing facilities include:

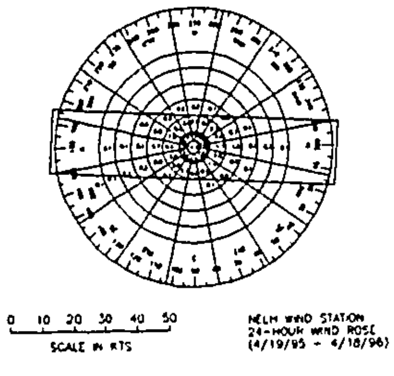
A. Runway
B. Taxiways
C. Holding bays
D. Facilities for reduction of jet blast effects
E. Other Facilities

A. Runway - The capacity of Runway 17/35 has been evaluated at approximately 60 operations per hour. The forecasted peak hour demand for the year 2015 is 28 operations. The single runway is expected to be adequate through the 20-year planning period of the master plan.

The existing runway centerline lies at an angle 5 degrees east of true north (or at an azimuth of 185 degrees, based on the Hawaiian Plane Coordinate Grid System, Zone 1, measured from true south). The total runway wind coverage is estimated at 99.29 percent, as shown by the wind rose on the ALP drawing, **Figure 2-3**. The record data used in preparing the wind rose was obtained in 1996.



WIND ROSE



NELH WIND STATION
24-HOUR WIND ROSE
(4/19/95 - 4/18/96)

LEGEND

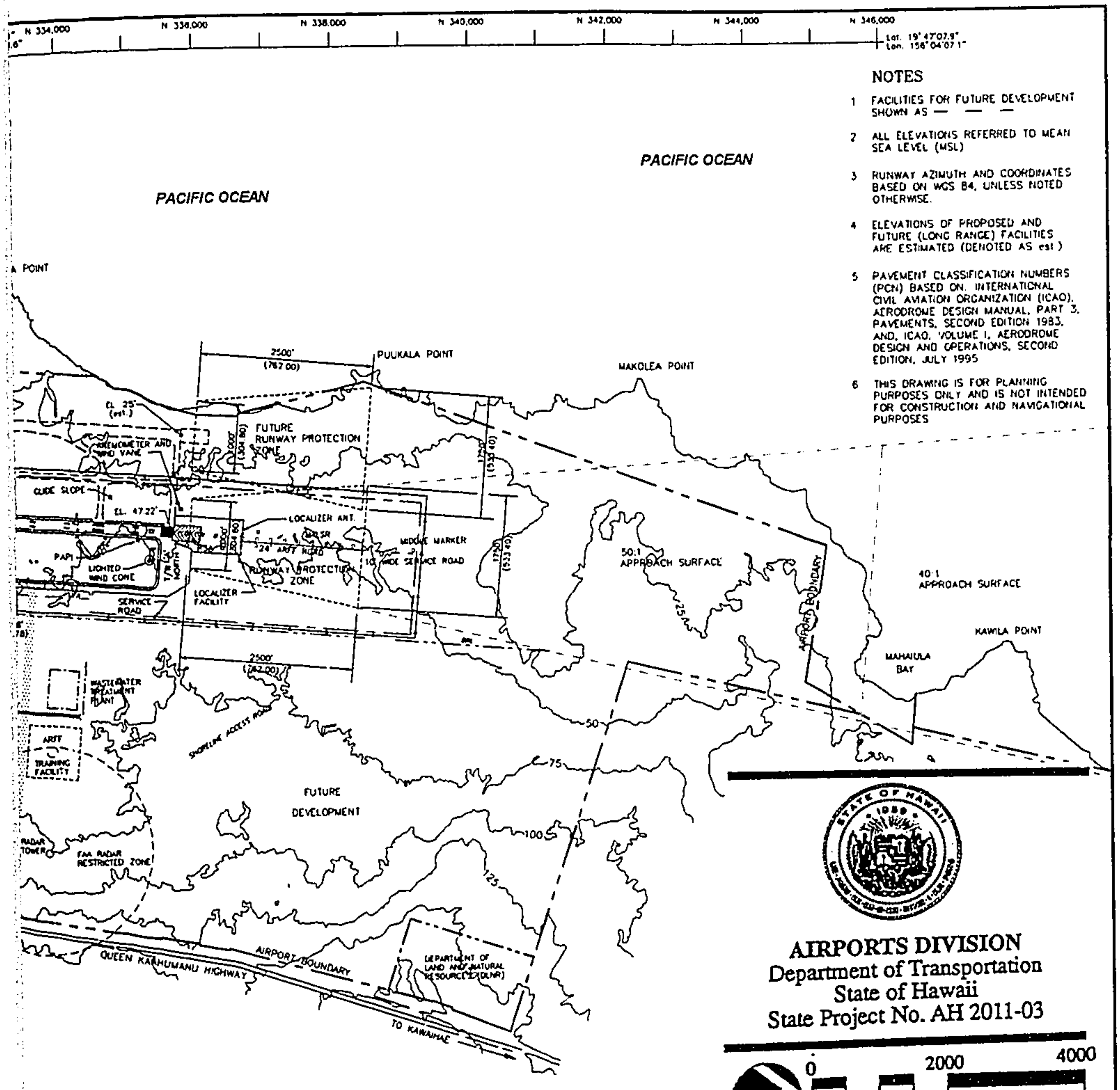
DESCRIPTION	EXISTING	PROPOSED	FUTURE
AIRFIELD FACILITIES			
TERMINAL FACILITIES			
AIRPORT BOUNDARY			
APPROACH SURFACE			
RUNWAY PROTECTIVE ZONE			
BUILDING / STRUCTURE			
BUILDING RESTRICTION LINE	BRL	BRL	
FENCE LINE			
GROUND CONTOUR	50		
ROADS			
PAVED			
UNPAVED			
PATH/TRAIL			
OBJECT FREE AREA	OFA	OFA	
SITE DEVELOPMENT			

AIRPORT DATA

DESCRIPTION	EXISTING	PROPOSED
AIRPORT REFERENCE POINT		
(ARP) COORDINATES:		
LATITUDE	19°44'32.0"(WGS 84) / 19°44'30.8"(NAD 27)	
LONGITUDE	156°02'59.5"(WGS 84)/156°02'54.4"(NAD 27)	
AIRPORT ELEVATION	47.22 FT.(14.40 M)	47.22 FT (14.40 M)
MEAN MAXIMUM DAILY	85.4°	85.4°
TEMP (HOTTEST MONTH)		
WEATHER FACILITIES	AWOS	ASOS
AIRPORT AND TERMINAL NAVIGATIONAL AIDS	ILS (LOC/DME,GS,MM, MALSR),PAPI-6,HIRL, MTL,RTR,BEACON, VORTAC	ILS (LOC/DME,GS,MM, MALSR),PAPI-6,HIRL, MTL,RTR,BEACON, VORTAC
PAVEMENT:		
RUNWAY	ASPHALT	ASPHALT
TAXIWAYS	ASPHALT	ASPHALT
AIR CARRIER / AIR CARGO APRONS	CONCRETE/ ASPHALT	CONCRETE

RUNWA

DESCRIPTION
RUNWAY IDENTIFI
INSTRUMENT RUN
APPROACH SURF.
APPROACH LIGHT
NAVIGATIONAL AI
RUNWAY LIGHTING
RUNWAY MARKING
RUNWAY SAFETY
SAFETY AREA WI
EFFECTIVE GRADI
PAVEMENT STREN
SINGLE
DUAL
DUAL TANDEM
DOUBLE DUAL
WIND COVERAGE
PAVEMENT CLASS NUMBER (PCN)
RUNWAY COORDIN
Longitude
Latitude



NOTES

1. FACILITIES FOR FUTURE DEVELOPMENT SHOWN AS — — —
2. ALL ELEVATIONS REFERRED TO MEAN SEA LEVEL (MSL)
3. RUNWAY AZIMUTH AND COORDINATES BASED ON WGS 84, UNLESS NOTED OTHERWISE.
4. ELEVATIONS OF PROPOSED AND FUTURE (LONG RANGE) FACILITIES ARE ESTIMATED (DENOTED AS est.)
5. PAVEMENT CLASSIFICATION NUMBERS (PCN) BASED ON. INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO), AERODROME DESIGN MANUAL, PART 3, PAVEMENTS, SECOND EDITION 1983, AND, ICAO, VOLUME I, AERODROME DESIGN AND OPERATIONS, SECOND EDITION, JULY 1995
6. THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND IS NOT INTENDED FOR CONSTRUCTION AND NAVIGATIONAL PURPOSES

RUNWAY DATA

OPOSED	DESCRIPTION	EXISTING		PROPOSED	
	RUNWAY IDENTIFICATION	17	35	17	35
	INSTRUMENT RUNWAY	YES	YES	YES	YES
4'30.8"(NAD 27)	APPROACH SURFACES	50 : 1	50 : 1	50 : 1	50 : 1
'02'54.4"(NAD 27)	APPROACH LIGHTING	MALSR, PAPI-6	MALSR, PAPI-6	MALSR, PAPI-6	MALSR, PAPI-6
22 FT (14.40 M)					
85.4'	NAVIGATIONAL AIDS	ILS	ILS	ILS	ILS
	RUNWAY LIGHTING	HIRL		HIRL	
ASOS	RUNWAY MARKING	PRECISION INSTRUMENT		PRECISION INSTRUMENT	
(LOC/DME,GS,MM, .SR),PAPI-6,HIRL, .RTR,BEACON, ITAC	RUNWAY SAFETY AREA	500'x1000' (152.4x304.8)	500'x1000' (152.4x304.8)	500'x1000' (152.4x304.8)	500'x1000' (152.4x304.8)
	SAFETY AREA WIDTH	500 FT (152.40 M)		500 FT (152.40 M)	
	EFFECTIVE GRADIENT	0.086%		0.086%	
	PAVEMENT STRENGTH				
	SINGLE	75,000 LBS		130,000 LBS	
	DUAL	200,000 LBS		210,000 LBS	
ASPHALT	DUAL TANDEM	400,000 LBS		572,000 LBS	
ASPHALT	DOUBLE DUAL TANDEM	850,000 LBS		850,000 LBS	
CONCRETE	WIND COVERAGE	99.29%		99.29%	
	PAVEMENT CLASSIFICATION NUMBER (PCN)	56		56	
	RUNWAY COORDINATES (at End)	11,000'x150' (3,352.8x45.7)		11,000'x150' (3,352.8x45.7)	
	Longitude	19°43'26.15", 19°45'14.79"(WGS 84) / 19°43'25.03", 19°45'13.68"(NAD 27)			
	Latitude	156°2'55.19", 156°2'44.97"(WGS 84) / 156°02'50.06", 156°02'39.84"(NAD 27)			

AIRPORTS DIVISION
Department of Transportation
State of Hawaii
State Project No. AH 2011-03

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FIGURE 2-3
AIRPORT LAYOUT PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.
R. M. Towill Corporation

JAN 1999

A centerline separation distance of 881 feet is used between the runway and taxiway "A." A distance of 1,310 feet is provided between the runway and the building restriction line (BRL). East of the runway, the BRL is located 1,310 feet from the runway centerline. West of the runway, the BRL is located 2,150 feet from the runway. The BRL is located well beyond the minimum 750 feet on the west side of the runway in order to restrict the development of structures in the area reserved for future airfield facilities.

The runway pavement is able to carry a gross weight of 572,000 lbs. (dual tandem gear configuration) and support annual aircraft activity of 159,000 operations.

B. Taxiways - There are a total of four primary taxiways, "A", "C", "H", and "G". All taxiways are 75 feet wide. North flow conditions (i.e., arrivals and departures are towards the north) require the use of Runway 35. Use of taxiway "A" is generally for widebody or major air carriers. Interisland arrivals on Runway 35 will be expected to exit the runway using taxiway "G."

Overseas departures during north flow conditions are expected to taxi on taxiways "A" and "A" south, to reach the south end of the runway. Interisland air carriers are expected to follow the same route. Light aircraft departures may enter the runway from either T/W "A" south, taxiway "G" or "H".

During south flow conditions, Runway 17 will be used. The overseas air carrier arrivals will be expected to exit the runway using taxiway "C". The distance of this exit from the Runway 17 threshold is 9,300 feet. Most of the interisland arrivals on Runway 17 will exit on taxiway "H" and taxi directly to the interisland apron. The light aircraft types will be expected to exit the runway using taxiway "G" or "H." These aircraft should then proceed on taxiway "A" to the light aircraft parking area.

Most of the interisland departures during south flow conditions will be expected to enter the runway from taxiway "G" and take-off from a threshold located at approximately 6,300 feet from the departure end of the runway. All overseas carriers will be expected to taxi on taxiways "A" and "A" north, to the north end of the runway for departure. The light aircraft departures are expected to taxi on taxiway "H" and take off from the same threshold used by the interisland carriers. The arrival and departure ground circulation patterns will ultimately be determined by the aircraft traffic controllers and pilots.

C. Holding Bays - Aircraft holding bays are located along the north and south ends of taxiway "A", which allows for bypass of aircraft to and from the runway. The trapezoidal holding bays, which have a 200-foot long outer edge, are 162.5 feet wide, with 25-foot wide shoulders. The size and strength of the existing holding bay along taxiway "A" south, will be upgraded to accommodate up to two wide body jet airplanes. This upgrade will facilitate the north flow departures (Runway 35 operations).

D. Facilities for Reduction of Jet Blast Effects - The primary facilities used in reducing the effects of jet blast include stabilized (paved) shoulders and blast pads. Presently, the airfield has 35-foot wide stabilized shoulders along the runway and taxiways. This shoulder dimension corresponds to FAA Airplane Design Group V standards.

The dimensions of the blast pads at the north and south ends of the runway are 200 feet wide by 400 feet long, as prescribed by the FAA for Group V.

E. Other Facilities - The National Weather Service (NWS) currently operates only out of Hilo International Airport in Hilo. Since the 1987 Master Plan, facilities at KOA consisted of a Limited Automatic Weather Recording Station (LAWRS). NWS has since upgrade this system to a Automated Surface Observation Station (ASOS), which was commissioned on December 17, 1997. The ASOS is expected to fulfill all weather observation requirements at KOA for the foreseeable future.

2.4.3.2 Approach and Clear Zone Plan

The Approach and Clear Zone Plan for the proposed airport layout is presented in **Figure 2-4**, and is prepared based on requirements of Federal Aviation Regulations (FAR) Part 77, "Objects Affecting Navigable Airspace." The location of KOA is favorable because most of the approach surfaces are designated over the ocean. Overland portions of the surfaces begin approximately 10,000 feet from the runway threshold on Runway 17 approaches and 5,000 feet on Runway 35 approaches. The terrain beneath the approach surfaces and within the clear zones is rough, with no natural obstructions. Currently there are no developments proposed which would penetrate the runway approach surfaces. However, a portion of the airport's horizontal surface is penetrated by the slopes of *Hualalai Mountain* towards the east.

2.4.4 TERMINAL AREA PLAN

The Terminal Area Plan (**Figure 2-5**) includes facilities for air carriers, airport support facilities, other airport related land uses, and land reserved for future terminal expansion. The terminal plan is required to ensure sufficient space for airport related terminal activities to the year 2015. The terminal plan, therefore, identifies specific construction activities to either increase space or better manage facilities.

2.4.4.1 Terminal Area Plan Overview

The proposed terminal complex is arranged in a linear pattern which takes its form from the existing layout of major facilities. Because of proposed land uses and constraints in the South Ramp area (see 2.4.1-Airport Land Use Plan), the major expansion of terminal facilities will be north of the existing Interisland Terminal complex. The major facilities proposed include:

A. Air carrier facilities
B. Aviation related land uses
C. Non-aviation related land uses

A. Air Carrier Facilities - Air carrier facilities include: passenger services (ticketing, holding area, concessions, etc.), airline operational spaces (offices, baggage area, etc.), and aircraft parking area (apron).

1. Interisland Terminal Facilities - There are ten (10) arrival/departure gates currently at KOA. Seven (7) are used for interisland service. The remaining

are used for overseas carriers and/or reserved for unexpected arrivals or delayed aircraft. By the year 2015, all 10 gates will be needed to accommodate the projected 2,121,000 interisland passengers. The current overseas carrier usage will need to be relocated to new facilities.

Interisland terminal facilities will require approximately 110,000 square feet of terminal space to meet the requirements projected for the year 2015. This will not require an increase in gross area, but will require small improvements within existing areas and the reassignment of gates from overseas usage to interisland use.

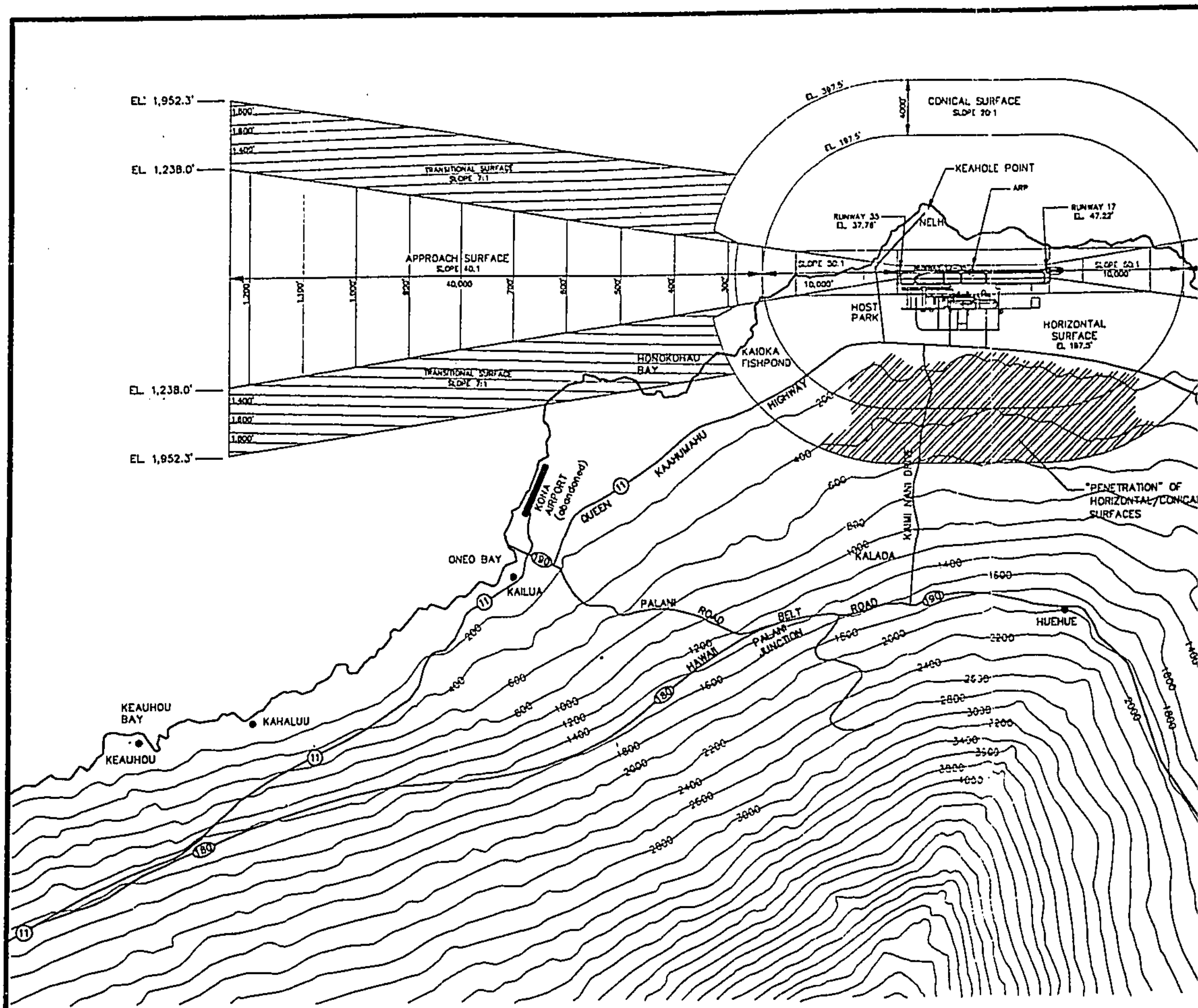
A breakdown of space provided is presented in **Table 2-2**. The layout of the terminal area should provide for the efficient flow of passengers and baggage.

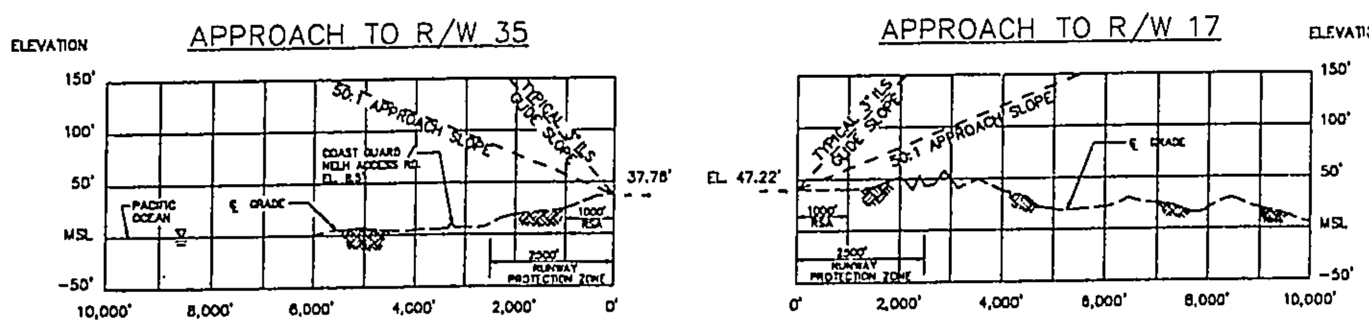
One problem in planning for interisland terminal facilities is the need to provide additional operating space for the interisland carriers. The existing terminal facilities were designed for only two carriers. Currently there are two interisland carriers and three overseas carriers operating in this space.

With expanded facilities, each of the interisland carriers would be given additional space. Each carrier would be able to operate out of their own complex, thereby eliminating some of the operational inefficiencies presently experienced.

From 1993 through 1997, a three phase improvement project has been implemented to upgrade the interisland terminals. The improvements have included enlarging the secure wait area, expanding baggage facilities for the north terminal and constructing additional covered space in the wait areas near the gates.

Additional refinements are planned, which includes expansion of baggage facilities in the south area.

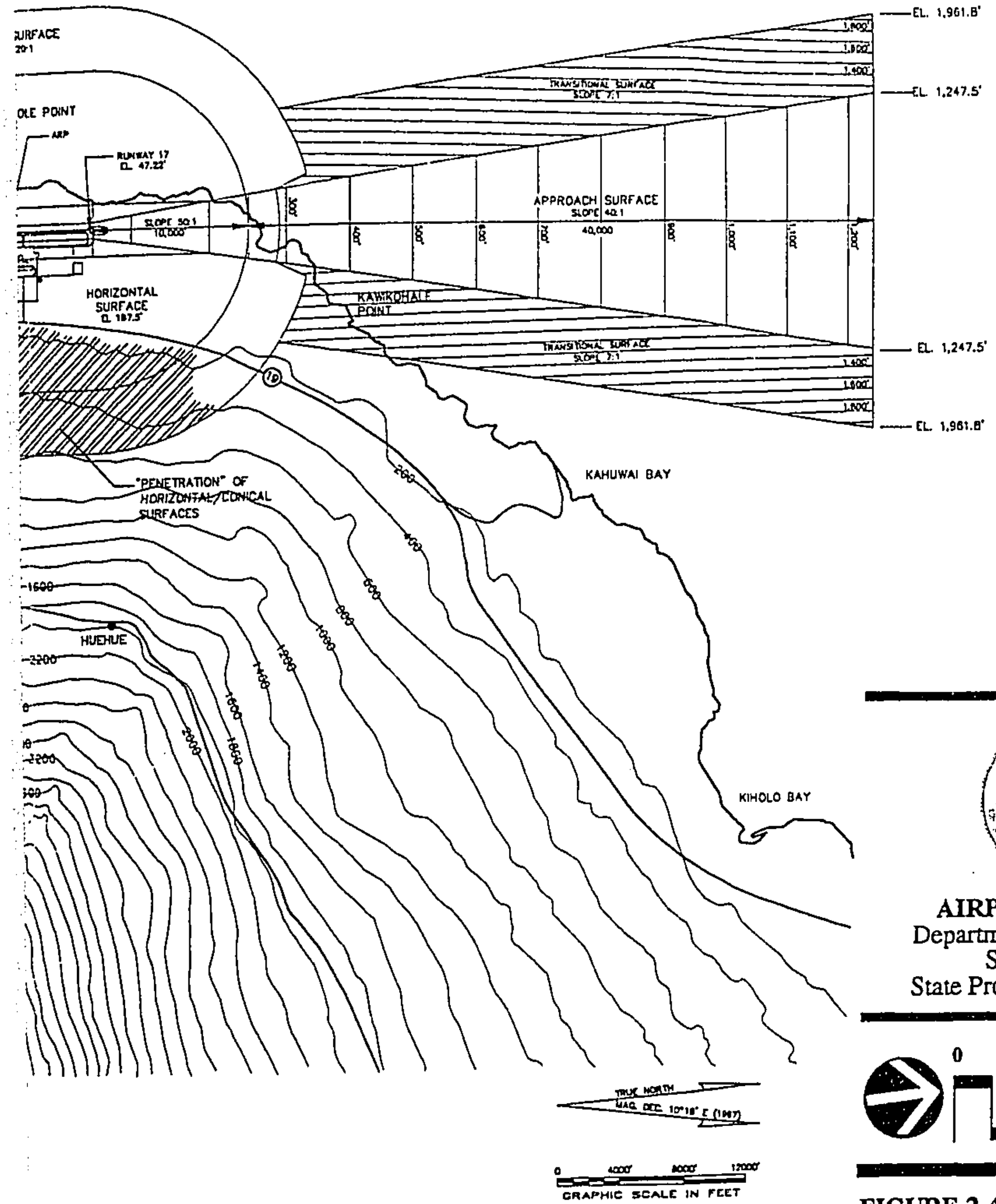




RUNWAY APPROACH PROFILES

LEGEND

SYMBOLS	DESCRIPTION
	ROADS
	HIGHWAY ROUTES
●	COMMUNITIES
4000	GROUND CONTOURS
	AIRPORT IMAGINARY
	AREAS OF IMAGINAR



LEGEND

SYMBOLS	DESCRIPTION
	ROADS
(19)	HIGHWAY ROUTES
●	COMMUNITIES
4000	GROUND CONTOURS
	AIRPORT IMAGINARY SURFACES
//////	AREAS OF IMAGINARY SURFACE PENETRATION

NOTES

1. AIRPORT ELEVATION: 47.22' (14.4 M.)
2. AIRPORT REFERENCE POINT (ARP) COORDINATES:
   EXISTING: 19°44'32.0" LAT.
   156°02'59.5" LONG.
   WGS 84

   19°44'19.9" LAT.
   156°02'44.4" LONG.
   NAD 83
3. ALL ELEVATIONS REFERENCED TO MEAN SEA LEVEL (MSL).
4. THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND IS NOT INTENDED FOR CONSTRUCTION AND NAVIGATIONAL PURPOSES.
5. FAA REQUIRES 50:1 APPROACH SLOPE. 3° SLOPE PROVIDED FOR ILLUSTRATION ONLY.

AIRPORTS DIVISION
Department of Transportation
State of Hawaii
State Project No. AH 2011-03

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FIGURE 2-4
APPROACH & RUNWAY CLEAR ZONE PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.
R. M. Towill Corporation

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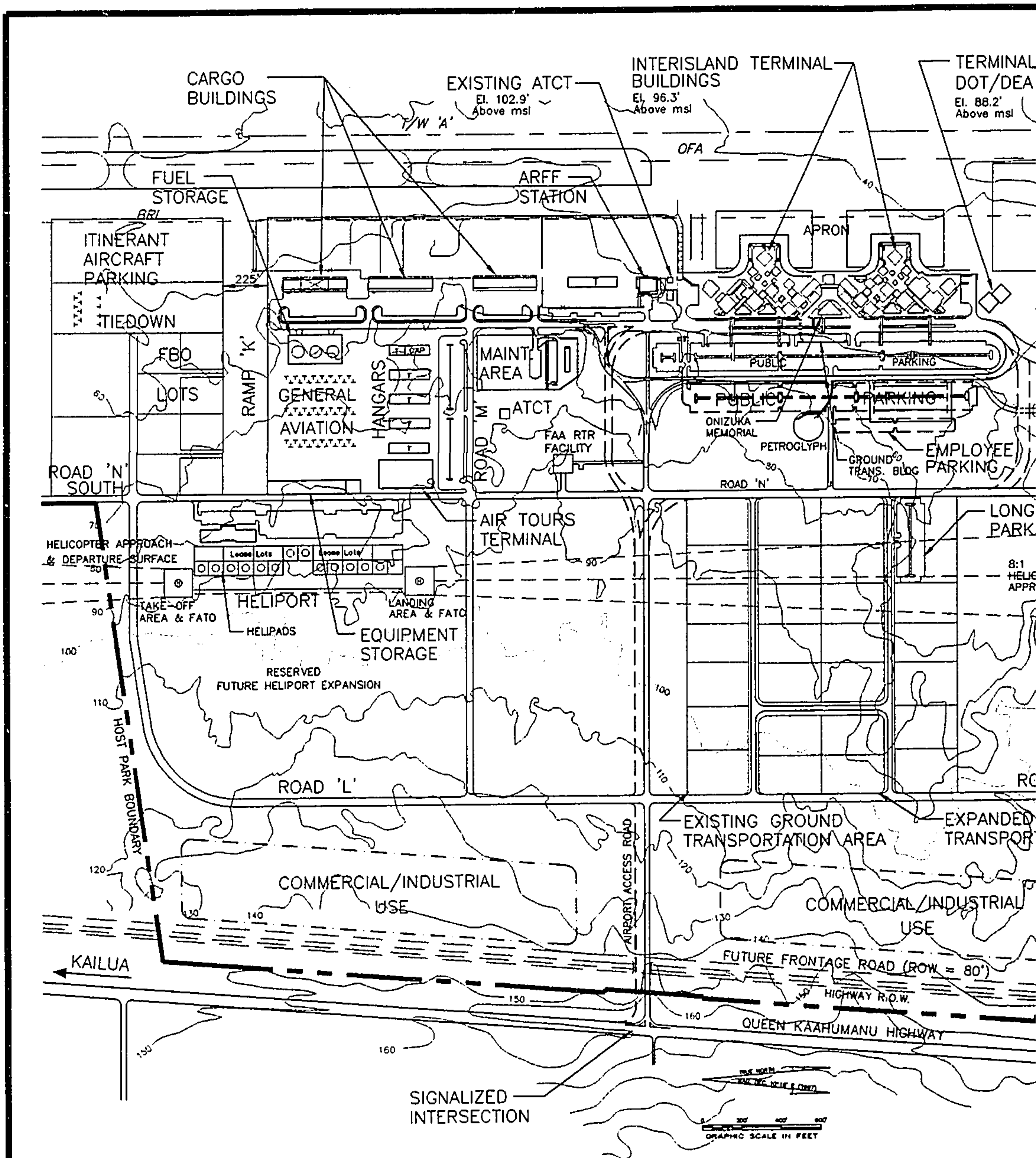
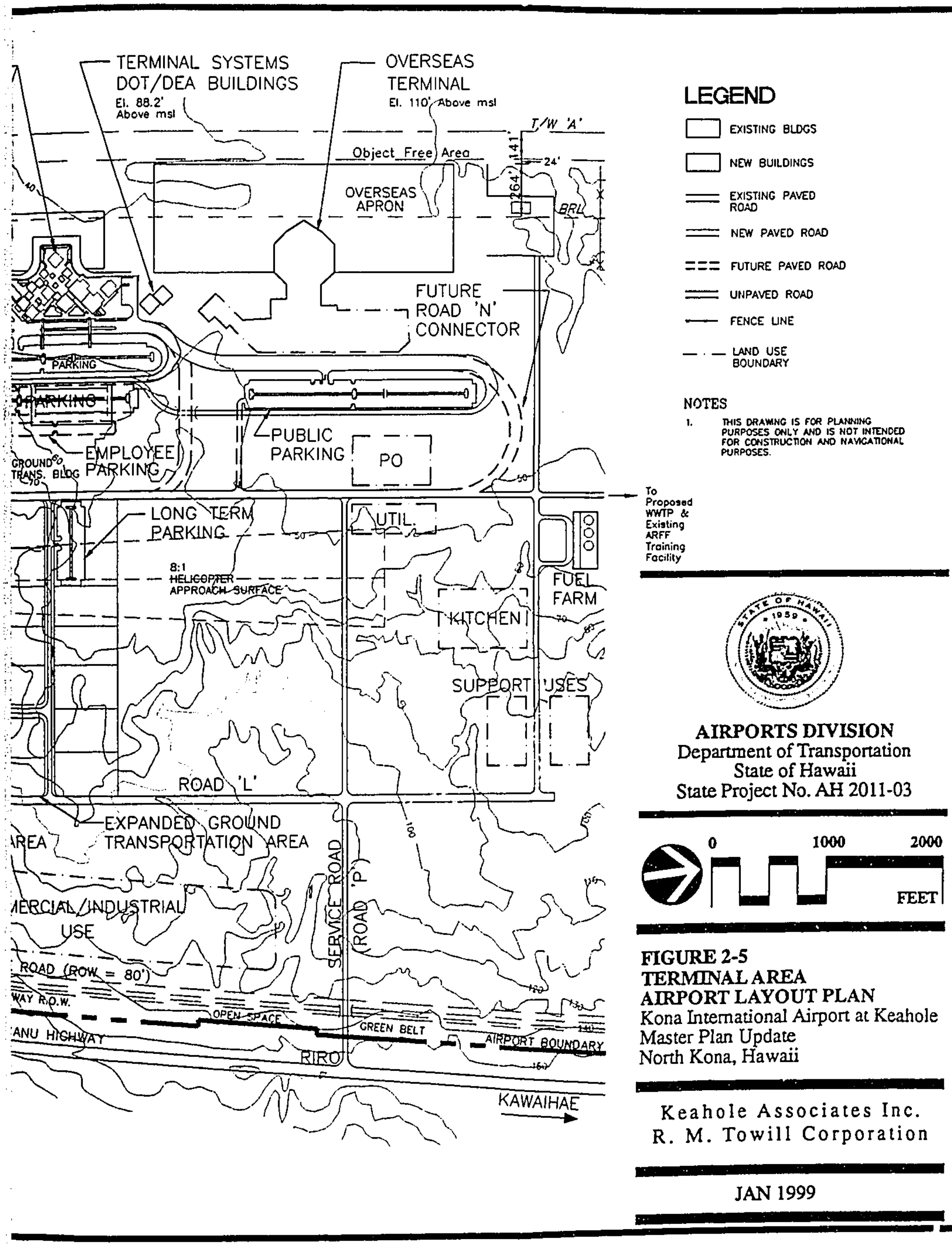

CARGO BUILDINGS
EXISTING ATCT
El. 102.9' Above msl
INTERISLAND TERMINAL BUILDINGS
El. 96.3' Above msl
TERMINAL DOT/DEA
El. 88.2' Above msl
T/W 'A'
OFA
FUEL STORAGE
ARFF STATION
BRL
APRON
ITINERANT AIRCRAFT PARKING
TIEDOWN
FBO
LOTS
RAMP 'K'
GENERAL AVIATION
HANGARS
MAINT. AREA
ATCT
ROAD 'M'
FAA RTR FACILITY
PUBLIC PARKING
ONIZUKA MEMORIAL
PETROGLYPH
GROUND TRANS. BLDG
EMPLOYEE PARKING
ROAD 'N'
ROAD 'N' SOUTH
AIR TOURS TERMINAL
HELICOPTER APPROACH & DEPARTURE SURFACE
Lease Lots
TAKE-OFF AREA & FATO
HELIPORT
LANDING AREA & FATO
HELIPADS
EQUIPMENT STORAGE
RESERVED FUTURE HELIPORT EXPANSION
HOST PARK BOUNDARY
ROAD 'L'
EXISTING GROUND TRANSPORTATION AREA
EXPANDED TRANSPOR
COMMERCIAL/INDUSTRIAL USE
AIRPORT ACCESS ROAD
COMMERCIAL/INDUSTRIAL USE
FUTURE FRONTAGE ROAD (ROW = 80')
HIGHWAY R.O.W.
KAILUA
QUEEN KAAHUMANU HIGHWAY
SIGNALIZED INTERSECTION
GRAPHIC SCALE IN FEET
LONG PARK
8:1 HELIC APPR



AIRPORTS DIVISION
Department of Transportation
State of Hawaii
State Project No. AH 2011-03

FIGURE 2-5
TERMINAL AREA
AIRPORT LAYOUT PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.
R. M. Towill Corporation

JAN 1999

TABLE 2-2
PRELIMINARY ESTIMATE OF PASSENGER
TERMINAL BUILDINGS SQUARE FEET SPACE REQUIREMENTS
Kona International Airport at Keahole (1995-2015)

Public Spaces	Existing*	2000	2005	2010	2015
Ticketing Lobby	13,380	16,000	32,000	32,000	32,000
USDA Inspection	350	1,200	2,400	2,400	2,400
Security Check	800	800	2,400	2,400	2,400
Baggage Claim	14,700	20,000	40,000	40,000	60,000
Restrooms	7,800	7,800	12,000	12,000	16,000
Gate/Hold Area	6,440	13,000	30,000	30,000	45,000
Circulation/Mech/Elec	10,500	15,000	40,500	40,500	50,000
SUBTOTAL	**53,970**	**62,100**	**159,300**	**159,300**	**207,800**
Airline Space	Existing	2000	2005	2010	2015
Ticketing/Office	5,400	10,000	14,000	16,000	18,000
Airline Lounge	550	550	2,550	3,550	4,550
Baggage Service	300	600	1,600	2,100	2,600
Baggage Make-up	9,000	9,000	29,000	29,000	29,000
Circulation/Mech/Elec	3,800	6,500	11,750	12,750	18,000
SUBTOTAL	**19,050**	**26,650**	**58,900**	**63,400**	**72,150**
Other Space	Existing	2000	2005	2010	2015
Food/Beverage	10,650	10,650	15,000	15,000	15,000
News Stand	400	400	1,400	1,400	1,900
General Merchandise	1,800	2,500	6,500	6,500	7,500
Duty Free	0	200	4,000	4,000	6,000
FIS	18,000	18,000	24,000	24,000	32,000
Circulation/Mech/Elect.	7,500	7,500	12,500	12,500	16,500
SUBTOTAL	**36,550**	**39,550**	**63,400**	**63,400**	**78,900**
TOTAL	**109,570**	**128,300**	**281,600**	**286,100**	**358,850**

* Existing Areas based on data provided by Department of Transportation Airports Division Property Management Section.

2. Overseas Terminal (OST) - Overseas traffic is expected to be the major growth area at KOA. By the year 2015 it is projected that 1,368,000 domestic and international overseas passengers will use the airport annually. This number of passengers represents a 400 percent increase in overseas passenger activity between 1992 and 2015. To accommodate the expected growth, a new OST will be located north of the existing terminal facility as shown in **Figure 2-5**. Initially, it will be a three gate, 250,000 square feet facility that can in the future be expanded to a five gate facility. The departure area is planned as a two-story structure for the use of boarding bridges with one-story ticketing and baggage facilities along the peripheral road. Due to the increased size of the overseas aircraft and additional facilities required, the OST is expected to require greater depth than the interisland terminals.

   Adjacent to the terminal will be a new hardstand and fuel hydrant system for aircraft parking and related apron extension. The parking positions are set back from the taxiway to provide additional space on the apron for the larger overseas aircraft.

B. Aviation Related Land Uses - Other aviation related land uses include: Fixed Base Operators (FBO), GA facilities, air cargo, postal facilities, heliport, and air tour facilities. All these facilities will have direct access to the airfield.

1. Fixed Base Operators (FBO) - Fixed base operators are currently housed in specially modified bays in two hangars south of the Aircraft Rescue Fire Fighting (ARFF) facility. These two hangars currently have no vacancies. New leases will be granted in the future FBO area. The existing hangars will be relocated to provide expansion area for air cargo and related uses. Based on the projected doubling of based aircraft, it is proposed that hangar space be doubled. New FBO facilities are proposed to be located south of the GA area and adjacent to the general aviation ramp and hangar space.

   In general, the FBO should be located away from the air carriers operating area (apron), yet still have access to the airfield. The FBO facilities, located at the southern end of the airport, effectively places them away from the air carrier operations. This location provides for adequate expansion space and a separate access which does not conflict with commercial air carrier operations.

2. General Aviation - Although forecasts of GA uses project only modest growth from 20,000 aircraft operations by year 2000 to 23,000 aircraft operations by 2015, current data suggests these levels are likely to be exceeded given current levels of growth and 1997 GA operations of 37,549 aircraft. Given this recent trend, usage of general aviation facilities should be carefully monitored with commensurate facility upgrades provided as needed.

   New facilities are proposed as the current GA area cannot provide for additional growth because it is located between the interisland service and air cargo service areas. The GA area will require an additional 12 aircraft parking spaces for a total of 52 aircraft parking spaces (55 in 2020) as well as more hangar space. Land allocated for future GA facilities is approximately 20 acres. New facilities should provide for 55 aircraft tie downs and approximately 40,000 square feet of hangar space in four structures (T-hangars).

   In terms of overall airport operations, it is desirable to locate GA operations away from the scheduled air carrier operations due to security requirements. Because GA operations are generally open to allow individual users access to their aircraft it is desirable to locate their parking area away from the air carrier operations to reduce security risks. Operationally, it is also desirable to locate the GA area away from the air carrier operations to reduce hazards from jet blast damage to the generally lighter aircraft. Avoidance of ground interaction between large and small aircraft types is also a priority. The proposed location of the GA facilities presents an optimal solution to both security and operational requirements by creating a self contained area separate from rest of the airport. The separation of vehicular traffic will reduce congestion and conflicts.

3. Air Cargo - Future plans for air cargo facilities propose that they be consolidated and separated from the terminal complex and GA area.

Approximately 50,000 square feet of floor space is projected as being required by year 2005.

A new air cargo building is proposed at the south end of the airport adjacent to existing cargo buildings. The addition of the new building is expected to provide sufficient expansion to meet the existing 7,000 SF additional space requirements as well as future needs. The location of the cargo building at the south end of the airport has the advantage of separating passenger vehicular traffic from cargo traffic and reduce the volume of truck traffic within the terminal area.

4. Heliport - Currently, based helicopter operators at KOA utilize space at the south end of the terminal complex, adjacent to the air tour facilities.

The new heliport is proposed east of the proposed GA site. Helicopter facilities will include parking spaces for the aircraft as well as space for based tour operators and space for service facilities. Additional parking spaces are needed for itinerant operators. Approximately 19 acres is designated for the helicopter facilities with the initial phase (12 pads) requiring approximately 11 acres of the total. Planned building space provides for approximately 10,000 square feet of operating area, a service area, and passenger holding spaces. Air space requirements for the heliport should be designed for a Class II (small public heliport) operation.

Situating the heliport in a distinct location provides a means to separate this use from fixed-wing operations that have different operating requirements, i.e., runway or taxiway requirements. The heliport is also located in an area where people desiring to use this service need not access it through the passenger terminal area. Additionally, this site provides a flight path separate from the runway.

5. Air Tour Facilities - Air Tour facilities are currently located in a temporary area at the south end of the existing terminal complex, adjacent to Taxiway 'A' and the cargo area. Companies operating in the area include: Rainbow Pacific Helicopters; Classic Aviation; Sporty's Academy; Bradley Pacific;

Circle Rainbow; Safari Air; Mokulele Air; Big Island Air; Air Service; and Mauna Loa Helicopters. These operators are intentionally separated from the passenger terminals because there is little to no need for interaction.

There is a priority to provide large commercial aircraft utilizing the cargo area with good access to Taxiway 'A'. This is due to both size and limitations on maneuverability of larger commercial aircraft. At the same time, Air Tour operators are operating in inadequate conditions from mobile trailers with limited plumbing and with automobile parking provided on a gravel area. For this reason it is proposed that as funds permit, that the Air Tours facility be relocated to a permanent site adjacent to the General Aviation area. This relocation would permit some separation of Air Tours aircraft from larger commercial aircraft, while providing for a permanent, more stable location.

6. Itinerant Aircraft Parking - There is a need for additional itinerant parking space, especially for larger aircraft. It is proposed that an area (approximately 6 acres) be allocated in the south ramp area adjacent to Taxiway "A".

7. Support Uses - A separate area has been established for the fuel farm (7 to 10 acres), utilities facility, flight kitchen (4 acres), postal facilities (4 acres), and administrative uses. This is a change from the prior master plan and is recommended to remove uses which would interfere with aircraft operations and improve use of limited space along the flight-line.

   The support use facilities are sited such that public traffic will not need to pass through the area. Direct access to the airfield ramps is allowed for those uses that require such access. Also, the new location provides ample room for expansion of each site as future demands warrant.

8. Other Airport Land Uses - Other land uses on the airport property include space reserved for future airport expansion beyond the 20-year planning period and areas designated for aircraft safety zones and areas which can be

released for other airport and non-airport related development. These areas have been delineated in **Figure 2-2**, Airport Land Use Plan.

C. Non-Aviation Related Land Uses

1. Ground Transportation Service and Ready Area - The current ground transportation service facilities are located just north of the airport access road on 16 acres of land (including roadways). The area is subdivided into 12 one-acre lots, all currently under lease. Existing facilities for the car rental agencies are separated as follows: the ready and customer service areas are located adjacent (across the street) to the interisland terminal area; and, the vehicle service area is located away from the terminal complex. There are car rental companies which use the ready area, however, many have transferred their operations exclusively to the ground transportation area.

Eventually, all rental activities will be moved to the base yard and the existing service area will be vacated. This will provide additional parking spaces to be used for public parking which will satisfy interim expansion needs.

Additional space will be required at the baseyard to accommodate future expansion of existing car rental agencies as well as to provide for other ground transportation services. The ground transportation area is proposed to be expanded by an additional 24 acres. Improvements to this area will be limited to the roadway, utilities and site grading. Future users of this area will be required to make the necessary parcel improvements, such as paving and building construction.

This area can also be used for other airport related industrial and commercial enterprises. A long term parking lot is proposed. Additional users of this area may create more opportunities for the generation of airport revenue. It is important that this area directly tie into the terminal peripheral road to minimize traffic congestion on the airport access road.

2. Airport Leased Space - In order to provide additional opportunity for airport users, 20 acres south of the airport complex have been set aside for private development. This area is proposed to be subdivided into two-acre and three-acre lots with access to the airfield. No costs have been allocated for land improvements other than for general site grading.

2.4.5 ACCESS AND CIRCULATION PLAN

The Access and Circulation Plan (**Figure 2-6**) addressed in this section consists of the following:

2.4.5.1 Airport Access
2.4.5.2 Peripheral Loop Road
2.4.5.3 Circulation Pattern
2.4.5.4 Public Parking Facilities
2.4.5.5 Employee Parking Facility
2.4.5.6 Ramp Access and Circulation

2.4.5.1 Airport Access

The existing airport access road is currently adequate to support the volume of traffic at the airport. However, improvements will be required to accommodate projected traffic increases. These improvements include:

A. Widening of the access road from two lanes to a four-lane divided roadway in order to facilitate the movement of vehicles in and out of the airport.

B. Road "N" and "P" are already programmed and funded for construction. Road "N" will serve as the north-south connector until replaced by Service Road "L" (relocated east from its earlier master plan location and scheduled to be named Halalu Street), the major north-south route linking most airport uses. Road "N" will then be integrated into the terminal peripheral loop system. All service roads will be two 12-foot lanes with 8-foot parking lanes.

   Service road "M" (scheduled to be named Oopu Street) is designed to provide access to the GA area, and aviation lease parcels.

C. The intersection of Queen Kaahumanu Highway and airport access road will also require improvements to facilitate turning movements. The present configuration with signalization, will be redesigned and improved as the highway is enlarged to a 4-lane divided roadway. This improvement is projected for construction sometime after the year 2000.

2.4.5.2 Peripheral Loop Road

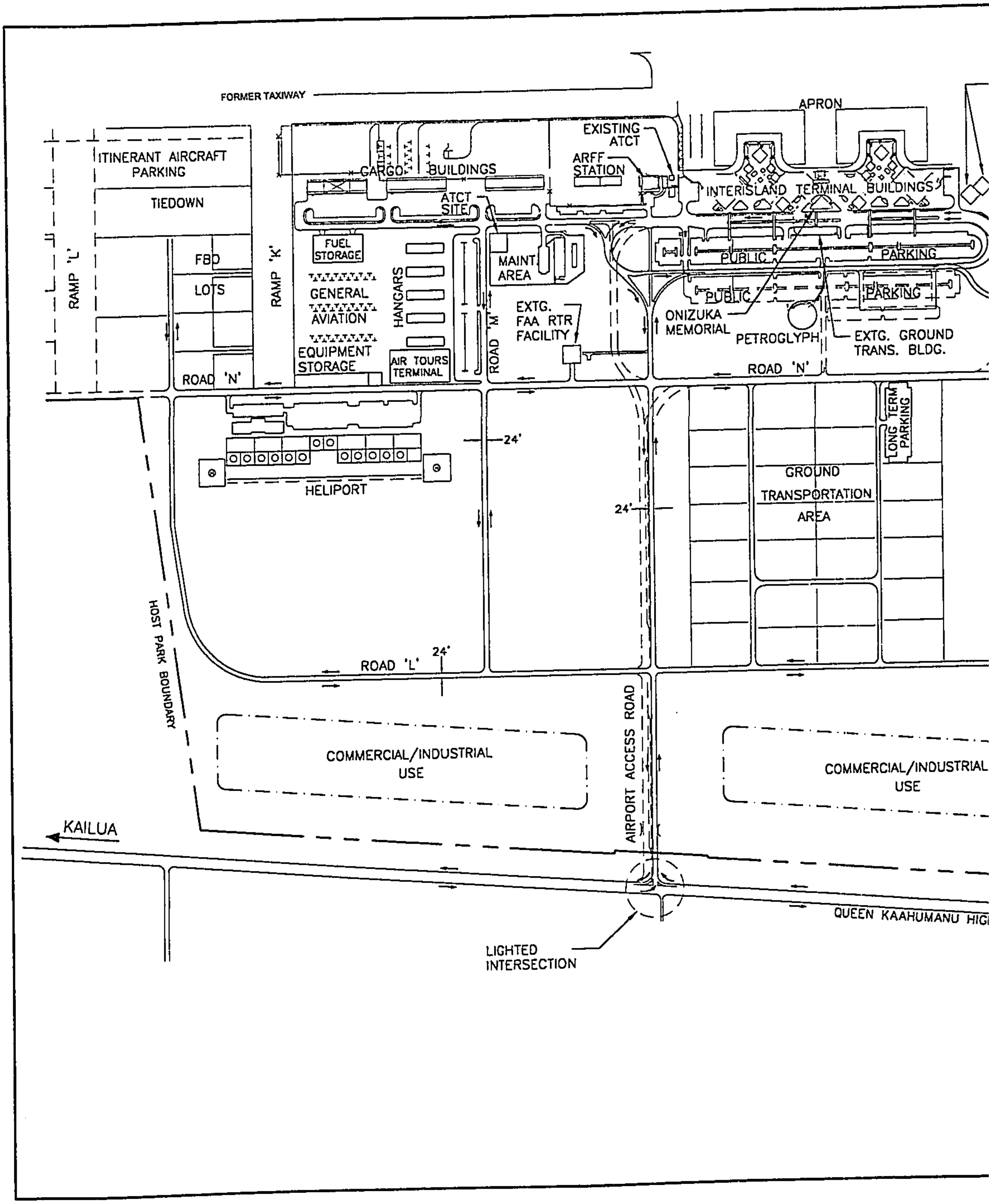
To ease congestion, the roadway fronting the terminal buildings has been widened to 5 lanes with an island separating the lanes into a three-lane and a two-lane roadway. The two-lane roadway segment adjacent to the public parking area is designated for bus, taxi, and limousine parking, and baggage truck loading zone and through traffic. Expansion to the north of the existing peripheral road will serve additional parking needs and the OST for most of the planning period. The peripheral road between the public parking area and the employee parking area will eventually be an internal driveway. As indicated before, Road "N" will eventually become the east portion for the peripheral loop.

2.4.5.3 Circulation Pattern

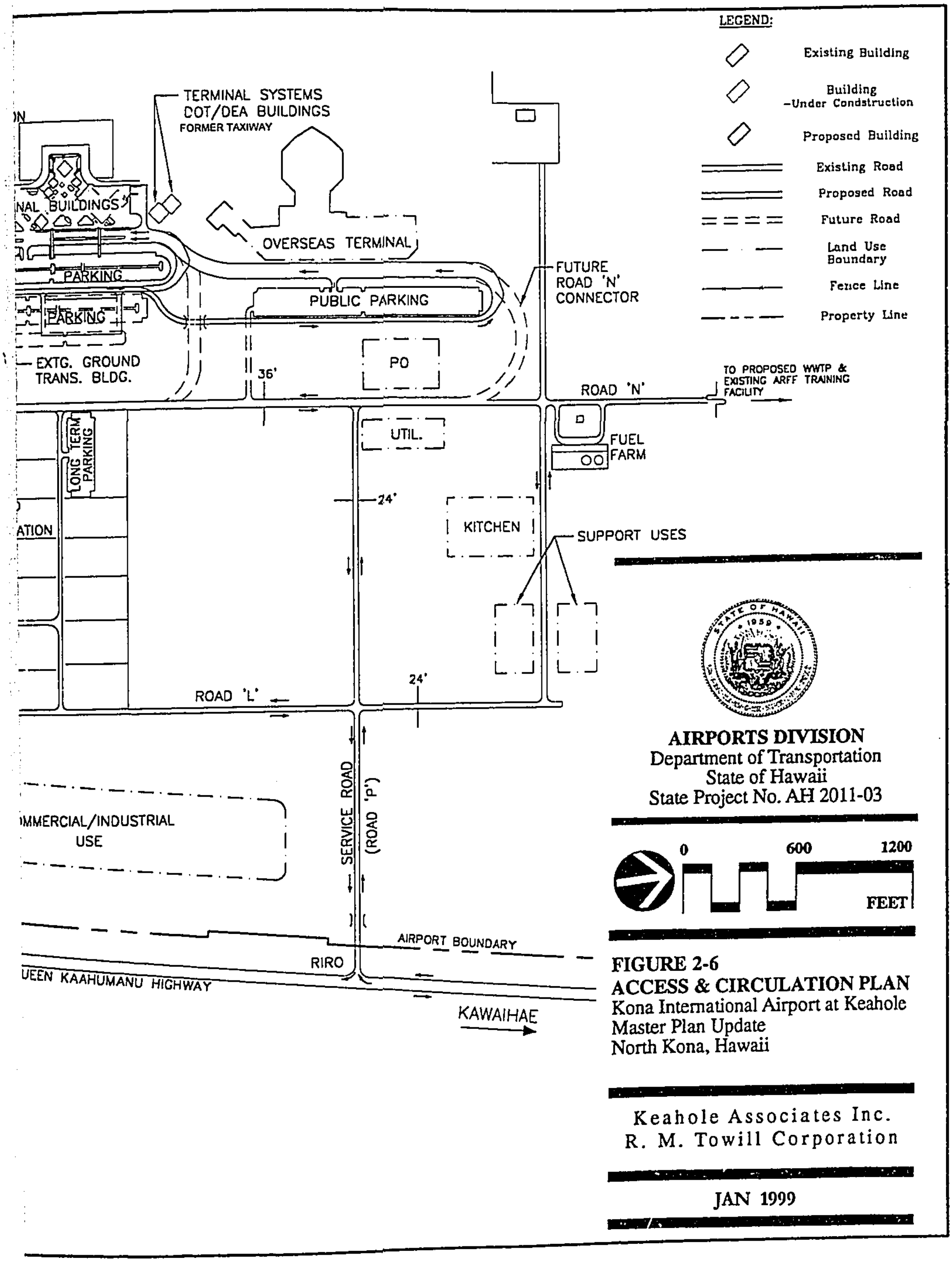
The existing automobile circulation pattern is retained in the proposed plan. The airport access road from the Queen Kaahumanu Highway will continue to have two-way traffic flow, and the peripheral road around the airport parking lot will continue to have only one-way traffic. A cut-off loop to directly service the interisland terminals will eliminate the need for all traffic to go to the OST.

2.4.5.4 Public Parking Facilities

In 1995, 508 parking spaces were available for public parking on short-term and 92 spaces for long-term (monthly) basis. The existing parking area is also being used for car rentals, 75 spaces. By the year 2015, approximately 840 or more public parking spaces will be required to accommodate the projected needs of airport users. New public parking facilities are in the area east of the interisland parking and the future OST.



FORMER TAXIWAY
APRON
EXISTING ATCT
ARFF STATION
ITINERANT AIRCRAFT PARKING
TIEDOWN
CARGO BUILDINGS
ATCT SITE
INTERISLAND TERMINAL BUILDINGS
RAMP 'L'
FBO LOTS
RAMP 'K'
FUEL STORAGE
GENERAL AVIATION
EQUIPMENT STORAGE
HANGARS
AIR TOURS TERMINAL
ROAD 'M'
MAINT. AREA
EXTG. FAA RTR FACILITY
PUBLIC PARKING
PUBLIC PARKING
ONIZUKA MEMORIAL
PETROGLYPH
EXTG. GROUND TRANS. BLDG.
ROAD 'N'
ROAD 'N'
24'
HELIPORT
24'
LONG TERM PARKING
GROUND TRANSPORTATION AREA
HOST PARK BOUNDARY
24'
ROAD 'L'
AIRPORT ACCESS ROAD
COMMERCIAL/INDUSTRIAL USE
COMMERCIAL/INDUSTRIAL USE
KAILUA
QUEEN KAAHUMANU HIG
LIGHTED INTERSECTION



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State of Hawaii
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FIGURE 2-6
ACCESS & CIRCULATION PLAN
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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2.4.5.5 Employee Parking Facility

Employee parking at the KOA is currently at a premium, especially since monthly rentals also use the employee lot. To accommodate the planned growth in employment, additional employee parking stalls will be required. While there are approximately 300 employees in 1995, the number of stalls available is uncertain, since they are not marked and the area is shared with monthly rentals. The ultimate facility will be properly marked and sized to service approximately 400 vehicles. The proposed employee parking facility will be located east of the public parking area within the peripheral loop road. A separate parking facility for long-term users is also proposed within the ground transportation area. Car rental shuttle busses are planned to provide shuttle service to the terminal and other areas of KOA for these users.

2.4.5.6 Ramp Access and Circulation

Access to the flight line is provided at several locations. The access points shall be controlled by gates with access limited to authorized vehicles only. The primary north access will be immediately north of the OST. Vehicular traffic on the flight line will be directed towards a roadway designated in a portion of the apron between the hardstand and the taxiway. Vehicles will be able to traverse the entire apron area without crossing between or around any parked aircraft.

2.4.6 AIRPORT SUPPORT UTILITIES PLAN

Support utilities including potable water, wastewater, drainage, electrical, and lighting systems, etc., are a key component to ensuring safety and efficiency of daily operations at KOA. Support utilities which will need to be upgraded as part of the airport expansion include the following:

- 2.4.6.1 Potable Water System
- 2.4.6.2 Wastewater System
- 2.4.6.3 Drainage System
- 2.4.6.4 Electrical and Communications System
- 2.4.6.5 Lighting System
- 2.4.6.6 Fuel

The airport support utility plans are presented in **Figure 2-7**, for water and sewer, and **Figure 2-8** for electrical and telecommunications. The plan shows only the major airfield and terminal area utility corridors and appurtenances. The necessary building connections and smaller system components are not illustrated, however, the costs of these facilities have been included for estimating purposes in the Implementation Plan.

2.4.6.1 Potable Water System

The average daily water demand based on proposed airport facilities for the year 2015 is estimated at nearly 0.350 mgd. The current average daily demand runs about 0.160 mgd. Water is presently supplied through a Hawaii County 12-inch main along Queen Kaahumanu Highway. The present size of this main is adequate to convey the required ultimate flows. On-site water requirements are currently being upgraded with construction of a new 1 million gallon tank to provide potable service and meet fireflow storage for the airport, NELH, and HOST Park area.

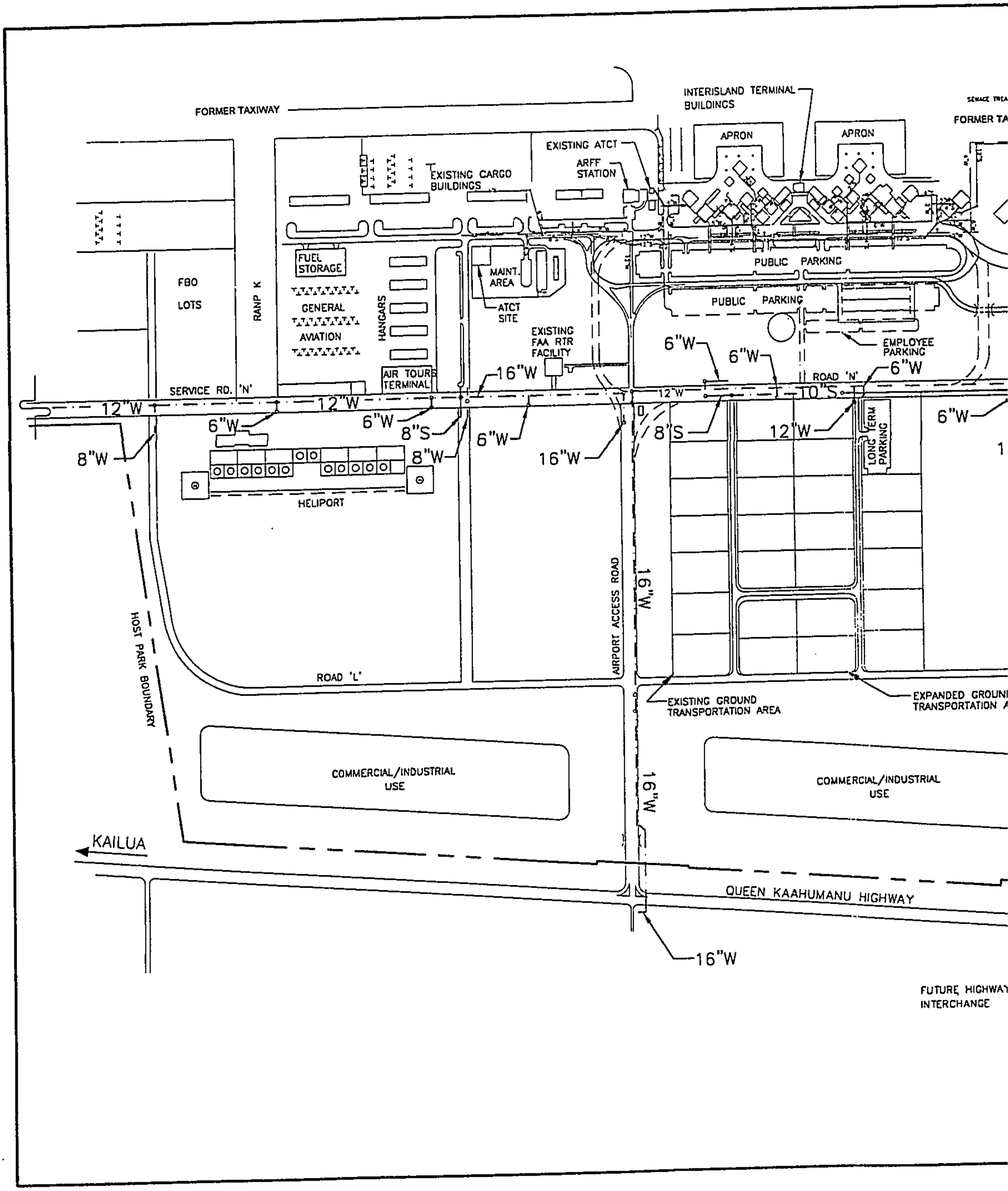
The storage capacity of this tank can deliver the required terminal fireflow of 2,300 gpm at a flow duration of +3 hours.

Potable water will be supplied to the proposed GA and lease parcel areas through new 12 and 8-inch water pipes along the service roads. The proposed terminal facilities toward the north will be supplied through a connection extending the existing 12-inch system.

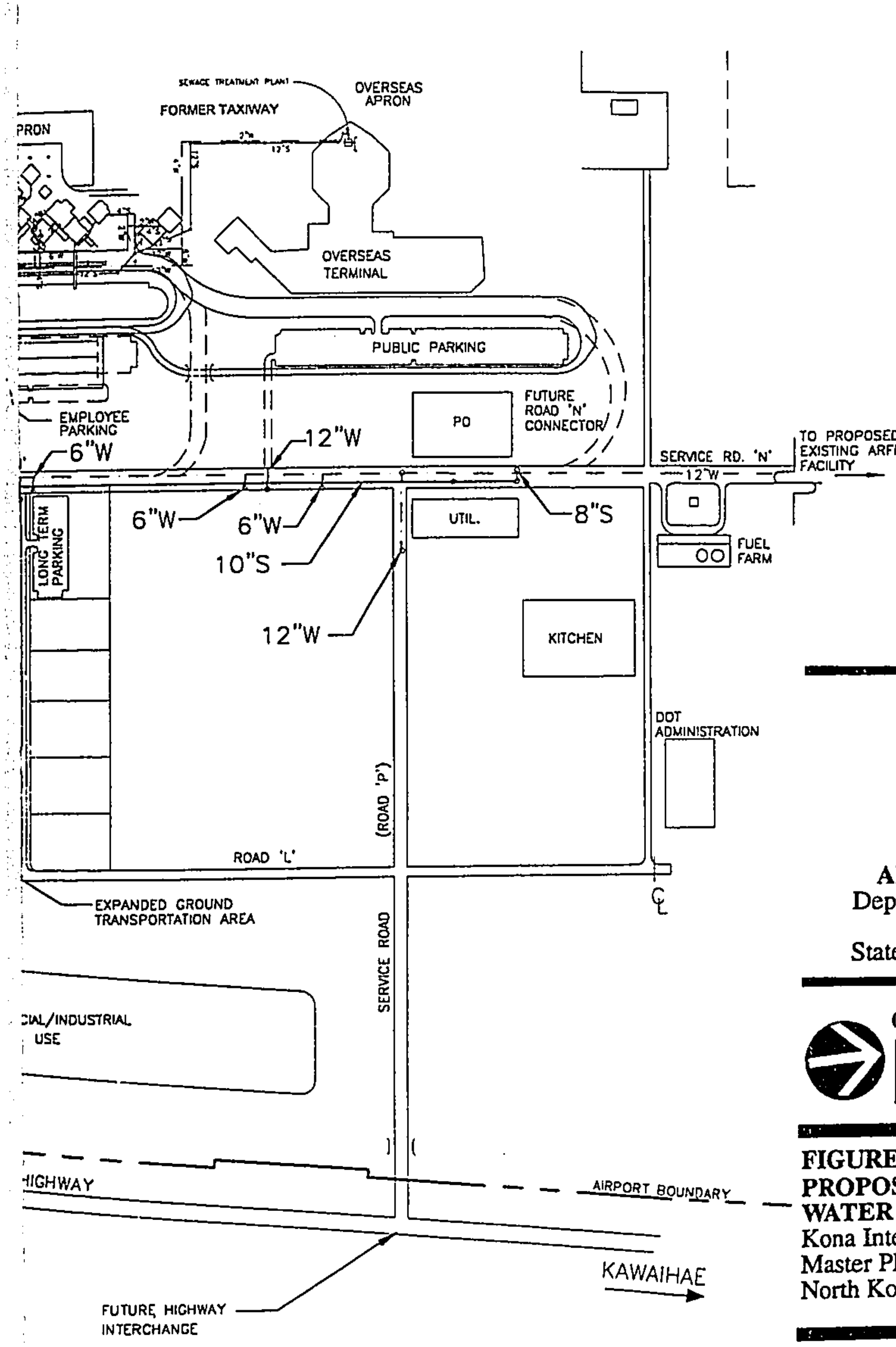
Hawaii County Department of Water Supply presently limits water consumption south of the maintenance facility. The new facilities will demand a considerable amount of potable water. Competing developments along the arid Kona coast will make the water supply a valuable resource. As a conservation measure, future landscaping is planned to use effluent reuse for irrigation.

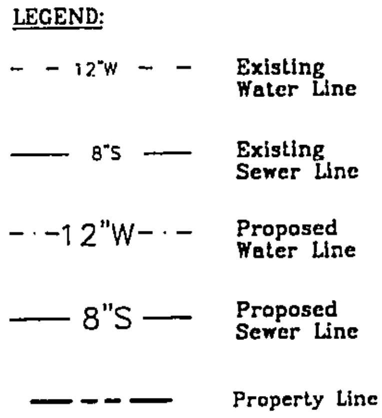
2.4.6.2 Wastewater System

The airport currently disposes of sanitary sewage by means of an on-site wastewater treatment plant (WWTP). The design capacity of the existing facility is 0.04 mgd. A larger capacity WWTP is under study and design at this time. The new facility will be a lagoon type plant treating an average daily flow of 0.13 mgd with a peak of 1.25 mgd. This new facility is proposed about a mile north of the proposed terminal facilities. The treated effluent will be used for landscape irrigation purposes to reduce potable water demands. The existing injection wells will serve as a backup disposal during the rare wet weather occurrences at Keahole.



FORMER TAXIWAY
INTERISLAND TERMINAL BUILDINGS
APRON
APRON
FORMER TA
EXISTING ATCT
ARFF STATION
EXISTING CARGO BUILDINGS
FUEL STORAGE
MAINT. AREA
ATCT SITE
FBO
LOTS
RANP K
GENERAL
AVIATION
HANGARS
PUBLIC PARKING
PUBLIC PARKING
EMPLOYEE PARKING
EXISTING FAA RTR FACILITY
AIR TOURS TERMINAL
SERVICE RD. 'N'
ROAD 'N'
12"W
12"W
12"W
12"W
6"W
6"W
6"W
6"W
6"W
6"W
6"W
8"S
8"S
8"W
8"W
16"W
16"W
16"W
16"W
16"W
TO "S"
LONG TERM PARKING
HELIPORT
AIRPORT ACCESS ROAD
ROAD 'L'
HOST PARK BOUNDARY
EXISTING GROUND TRANSPORTATION AREA
EXPANDED GROUN TRANSPORTATION A
COMMERCIAL/INDUSTRIAL USE
COMMERCIAL/INDUSTRIAL USE
KAILUA
QUEEN KAAHUMANU HIGHWAY
FUTURE HIGHWAY INTERCHANGE





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FEET

FIGURE 2-7
PROPOSED AIRPORT WATER & SEWER PLAN
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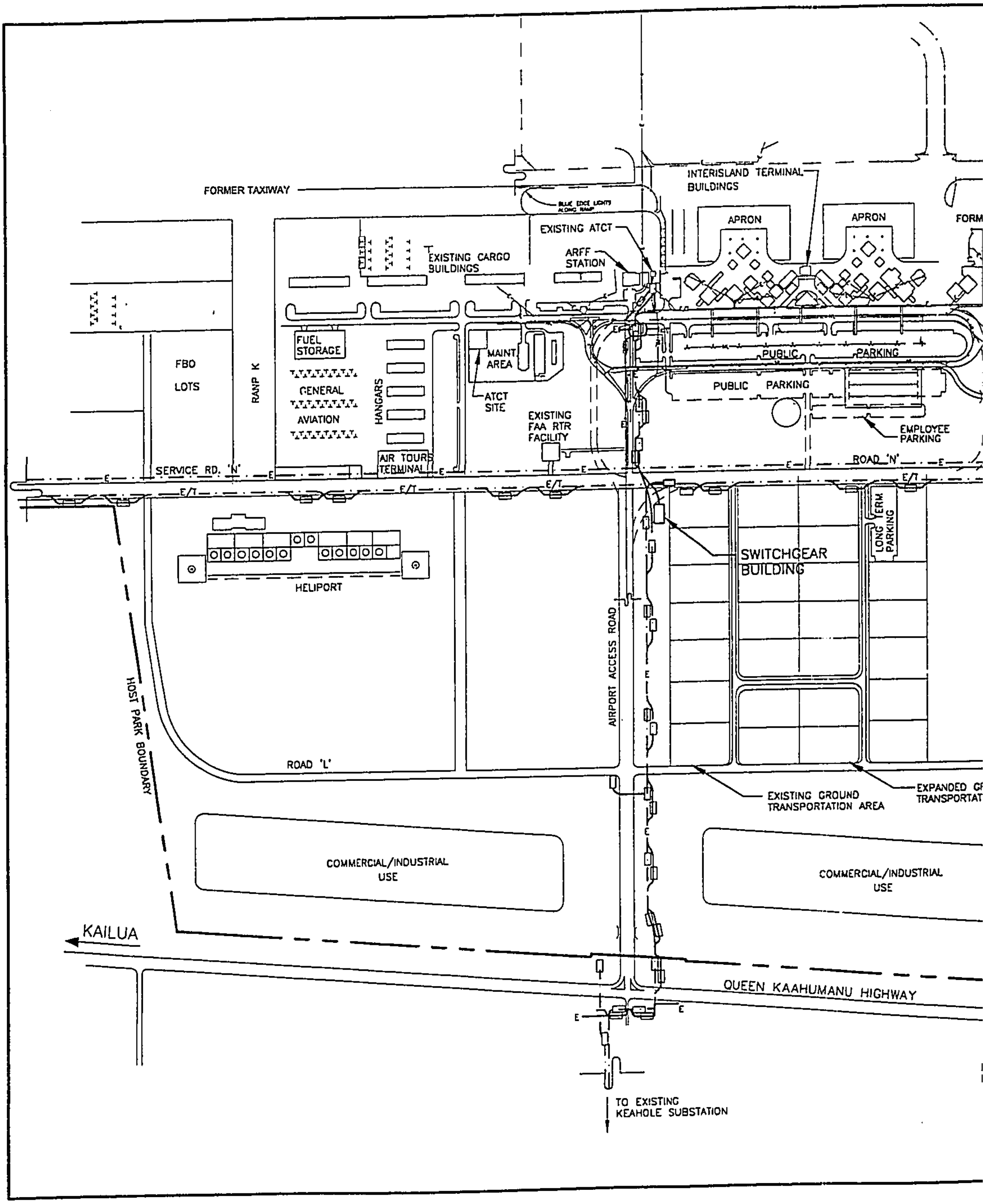

FORMER TAXIWAY
INTERISLAND TERMINAL BUILDINGS
APRON
APRON
EXISTING ATCT
ARFF STATION
EXISTING CARGO BUILDINGS
FUEL STORAGE
FBO
LOTS
RANP K
GENERAL
AVIATION
HANGARS
MAINT AREA
ATCT SITE
EXISTING FAA RTR FACILITY
PUBLIC PARKING
PUBLIC PARKING
EMPLOYEE PARKING
AIR TOURS TERMINAL
SERVICE RD. 'N'
ROAD 'N'
E/T
LONG TERM PARKING
SWITCHGEAR BUILDING
HELIPORT
AIRPORT ACCESS ROAD
HOST PARK BOUNDARY
ROAD 'L'
EXISTING GROUND TRANSPORTATION AREA
COMMERCIAL/INDUSTRIAL USE
COMMERCIAL/INDUSTRIAL USE
KAILUA
QUEEN KAAHUMANU HIGHWAY
TO EXISTING KEAHOLE SUBSTATION

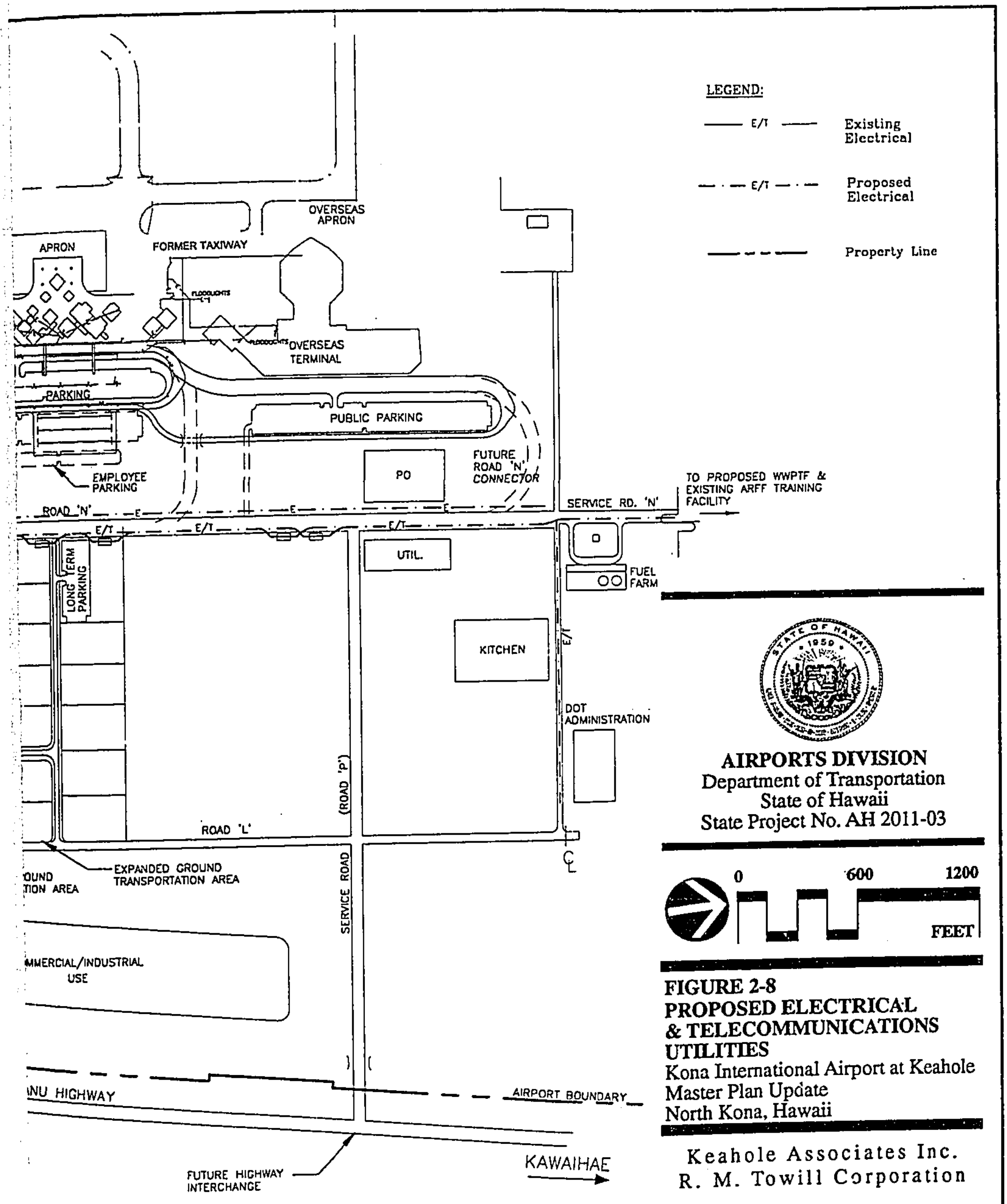

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FIGURE 2-8
PROPOSED ELECTRICAL & TELECOMMUNICATIONS UTILITIES
Kona International Airport at Keahole
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North Kona, Hawaii

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A wastewater pumping station (WWPS), located near the overseas terminal building, will be necessary to convey flows out to the WWTP. The proposed WWPS is a package type of unit consisting of minimal above ground appurtenances. It is recommended that both the treatment and pumping facilities have complete backup power support.

Presently, operation and maintenance of the existing facility is contracted out to a private company. Similar specialty contracting services are recommended in the future.

2.4.6.3 Solid Waste Disposal

KOA uses 16 to 18 solid waste dumpsters located throughout the airport. The waste is trucked three times a week to the Puuanuhulu Municipal Sanitary Landfill. The volume of solid waste is expected to increase dramatically with the development of the proposed facilities. The current practice of trucking the refuse away to Puuanuhulu Landfill is recommended for future operations.

2.4.6.4 Drainage System

Keahole Airport is located on old lava fields and the porous nature of this material makes for excellent drainage. Presently, the airfield is drained with dry wells located at various sites.

Airfield drainage facilities are typically designed based on a 5-year storm. At Keahole, a 5-year storm is estimated to produce a rainfall intensity of 1.7 inches per hour. The quantities of runoff disposed of by the drywells is estimated to range from 40 to 130 cfs per dry well.

Terminal area, apron, and parking lot drainage will be handled with an upgraded system of drainage inlets and swales.

2.4.6.5 Electrical and Communications System

An existing electrical substation, located just east of Queen Kaahumanu Highway, provides electrical power for the airport. This substation is tied into an existing 69 KV overhead transmission line along Queen Kaahumanu Highway. A 12.47 KV transmission line within an underground concrete duct bank brings electrical power from the substation along the south side of the present access road to the on-site electrical control building. This building contains control and relay facilities for all of the airport lighting, electrical, and communications (telephone, airport intercom) systems. In addition, this building houses the emergency power facilities.

2.4.6.6 Lighting System

The existing airfield lighting system consists of High Intensity Runway Lights (HIRLs) and Medium Intensity Taxiway Lights (MITLs). Other existing airfield lighting facilities include Medium Intensity Approach Lighting Systems (MALS) and Runway Alignment Indicator Lights (RAILS) off both runway ends. Visual Approach Slope Indicator (VASI) systems and runway end/threshold lights will also be used.

The proposed terminal area lighting system consists of apron floodlighting, hangar/warehouse lighting, and terminal interior lighting. The current monthly average use for the airport is approximately 725 KW.

2.4.6.7 Fuel

Hawaii Fueling Facilities Corporation (HFFC) is proposing a fuel farm (bulk storage facility) to supply air carrier fuel needs northeast of the terminal area. The HFFC plan calls for two 10,000 barrel tanks and truck fill stand with future hydrant system. Sufficient space for expansion to accommodate a total of eight tanks will be available. The proposed site will be north of the planned Overseas Terminal.

A second fuel storage area is proposed adjacent to the general aviation area for GA and helicopter users.

2.5 AREAS OF SPECIAL DESIGN CONSIDERATION

The visual setting at KOA is an important part of the visitor experience which can contribute to, and at the same time provide, an anticipation of the North Kona environment beyond.

The natural landscape of the Keahole area is one that is open and provides expansive views of the shoreline to the mountains. The environment is rather harsh and dry with sparse vegetation. Generally, there is little color except for the sparse vegetation and the blacks and browns of the lava fields. The Keahole area has very little annual rainfall and is classified as an arid to semi-arid environment. Given this setting, it would not be appropriate to transform KOA into a tropical oasis. Landscaping should enhance the built environment while acknowledging and working with the natural environment.

The 1987 Master Plan considered design issues and there is a landscape master plan; however, it is necessary to update, improve and implement design standards.

It is recommended that a Design Guide Plan be prepared to define appropriate visual themes, treatments and standards. This would be a vehicle for positively influencing future design of projects and, in turn, evaluating design proposals. Such a plan would contain graphic and text information and include the following items:

A. Architectural Character:
- Design vernacular
- Approved materials & colors
- Scale/proportion/textures/unifying elements
- Building lighting/signage
- Special treatments/critical areas

B. Landscaping:
- Approved plant materials (drought resistant)
- Design themes/features
- Grading/screening
- Special treatments, e.g. entry treatments/parking lots/roadways

C. Signage

D. Street furniture:
- Lighting
- Benches
- Trash receptacles
- Barriers, etc.

E. Design review requirements:
A procedure is needed for the review and approval of design proposals.

The unique theme of the Airport as embodied by the interisland terminal should be the keynote for future development. Newer construction has mostly ignored this precedent. While some materials will need to change with certain functional uses, there is no reason that scale, proportion and character cannot be compatible.

New facilities must consider the context and the perception of facilities from vehicles on Queen Kaahumanu Highway, the Airport Access Road and the Peripheral Loop System.

The Overseas Terminal will pose a challenge to the designer for it will, of necessity, be a larger facility than the interisland terminal. The curb side scale can remain consistent with the structure increasing toward the apron side. Colors, roof lines, openness of interior areas and other techniques can be used to maintain the unique Kona theme.

SECTION 3
MASTER PLAN IMPLEMENTATION

3.1 MASTER PLAN PHASING

Implementation of the KOA Master Plan will be in three (3) phases, with each phase approximately seven (7) years in length: Phase 1 (Fiscal Years 1998-2003), Phase 2 (Fiscal Years 2004-2009), and Phase 3 (Fiscal Years 2010-2015+). Construction of facilities in each phase will vary according to availability of funding and need. Projects that are recommended and the rationale for each of the development phases are described below. A cost summary is provided at the end of this section.

3.1.1 PHASE I (FY 1998-2003)

The first development phase addresses access, circulation, infrastructure improvements on the airport's land side, and increased aircraft parking and safety on the airfield side. Improvements during this first phase will prepare the airport for the future overseas terminal.

The facilities proposed in Phase I (**Figure 3-1**) are described below. The land side projects are discussed first.

A. Wastewater Treatment Plant: The existing facility is operating beyond capacity and is located where the future OST is proposed. The proposed eight acre site is located near the end of Road "N" (Paoo Street). The project will call for site and facility development, as well as an effluent reuse system.

B. Fuel Farm Site Preparation: A Jet-A fuel farm is proposed mauka of the terminal area, near the Road "N" (Paoo Street) and Road "P" intersection. This project calls for grading, access and utility service to an approximate 3.5 acre site. The site will include on-site tanks, fuel transfer pumps, a hydrant system and loading/unloading racks.

C. General Aviation Fuel Storage System Site Preparation: The future relocation of GA operations and proposed OST will require a new GA fuel storage system. Future GA operations are proposed mauka of the cargo area, off Ramp "K". This project calls for grading, access, and utility service to an approximately 2 acre site.

D. Air Cargo Building III: A new building is proposed for additional cargo storage. The new cargo building will be 13,000 square feet and will be situated south of the existing cargo buildings.

E. Postal Facility Site Preparation: An approximate 4 acre site will be prepared for a postal facility. The project scope includes site grading and drainage, and access and utility infrastructure. The U.S. Postal Service will be responsible for construction of the building and related structures.

F. Road "P": The construction of fuel, postal, and flight kitchen facilities will increase the traffic along the airport access and terminal loop roads. To alleviate congestion that may be caused from large tanker trucks and service vehicles, the paving of a restricted access Road "P" is targeted for Phase I. The roadway runs approximately 2,900 feet and has already been graded. This project will call for paving, drainage, lighting, and striping of the roadway.

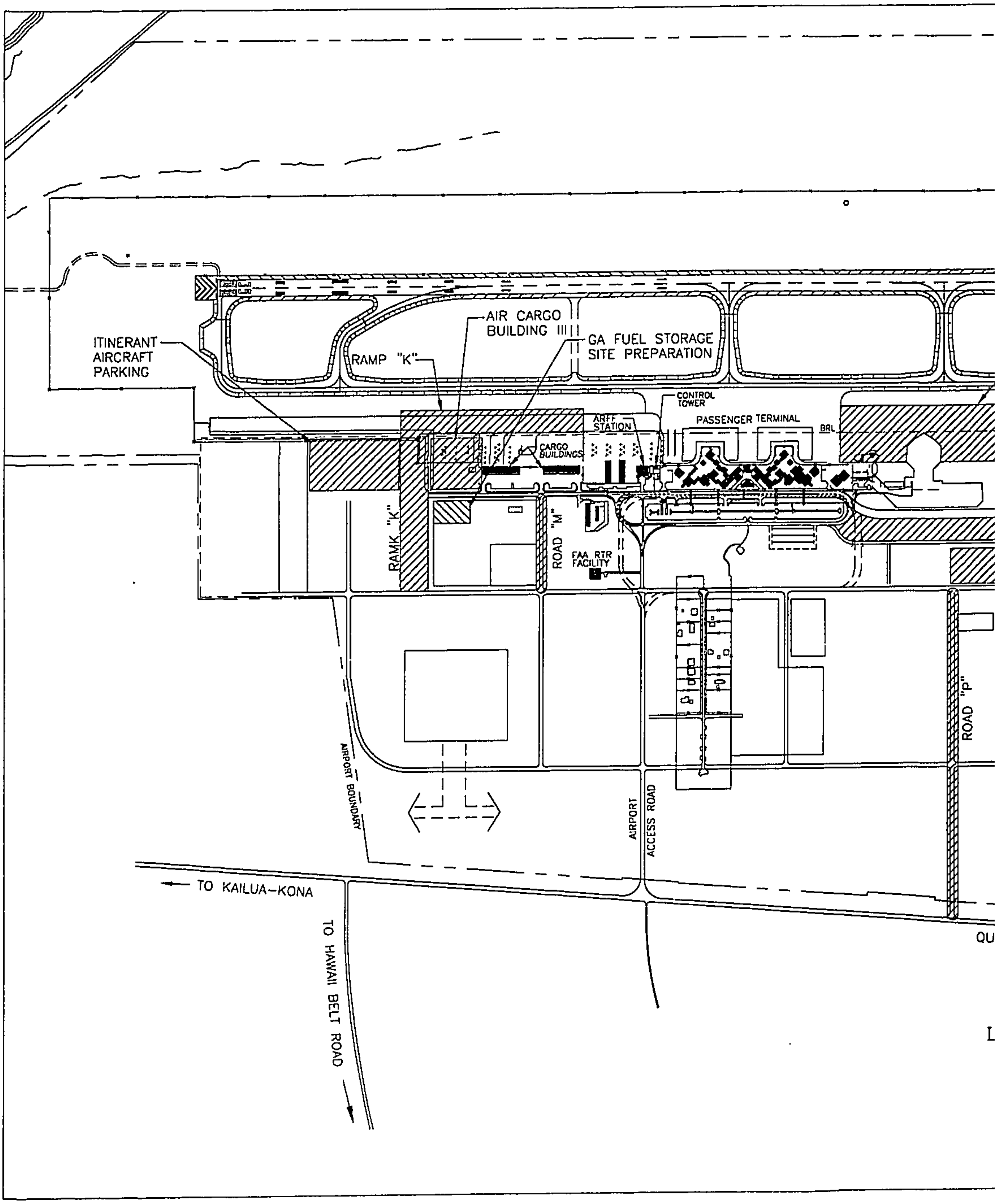
G. Road "M": The paving of approximately 800 feet of roadway is proposed. This will divert movement away from the terminal loop road by a connection from Road "N" (Paoo Street) to the cargo area.

H. Telecommunication System: The existing Key system will be replaced by a PABX system which will upgrade service to airport administration, air carriers, tenants, and concessionaires. This upgrade is imperative for the development of the OST.

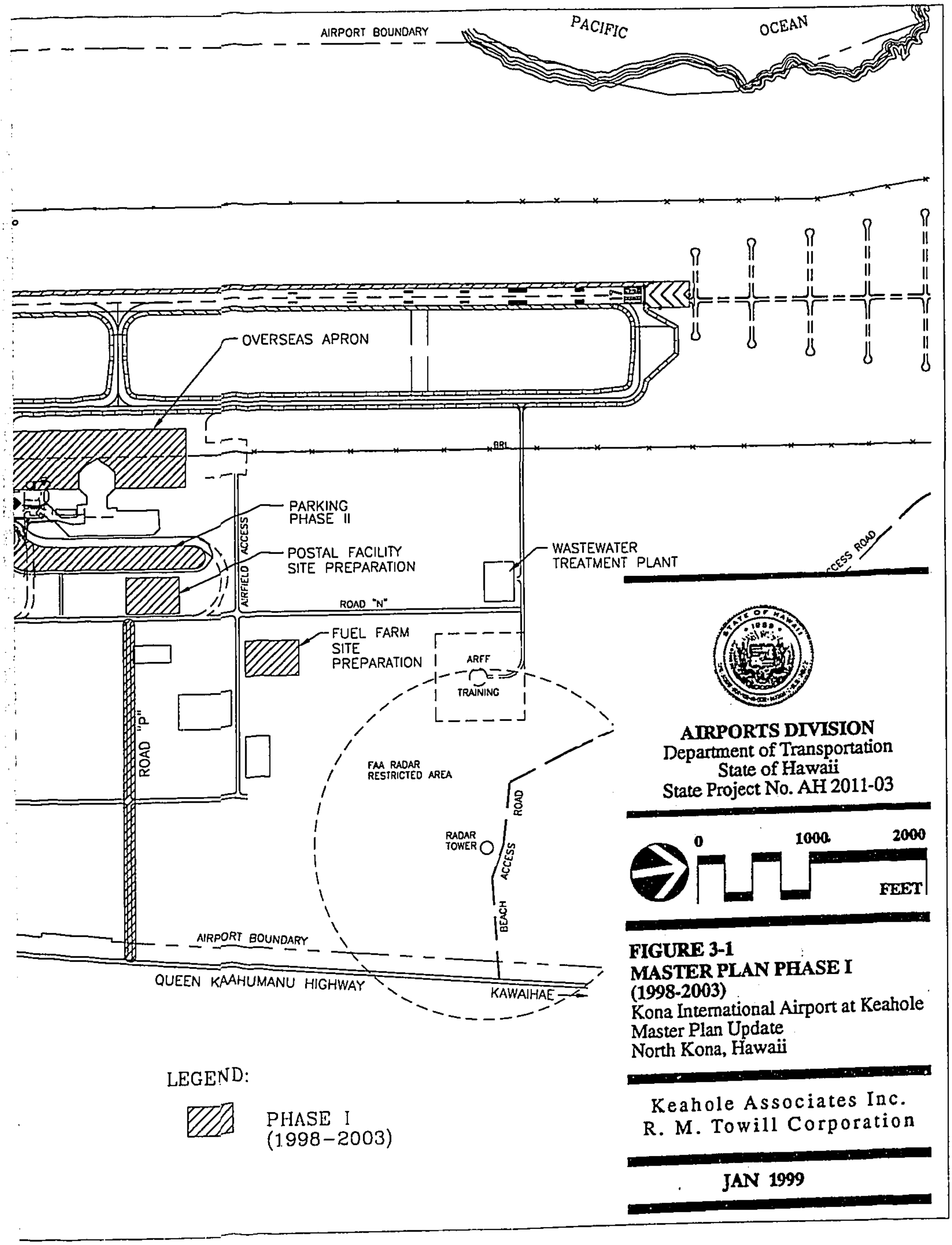
I. Parking Phase II: Ground transportation operations and public parking requirements will continue to increase with expanded overseas domestic and international flights. This project will extend the existing loop road north along with the parking area. Also included are provisions for OST utility service; wastewater, potable water, electrical, telecommunications, and storm drain systems.

Airside improvements for Phase I include:

A. Itinerant Airline Aircraft Parking: Presently itinerant aircraft park on the paved area north of the Aloha/United apron. This project will grade and pave approximately six acres for itinerant aircraft parking adjacent to Ramp "K", south of the cargo area.



ITINERANT AIRCRAFT PARKING
AIR CARGO BUILDING III
GA FUEL STORAGE SITE PREPARATION
RAMP "K"
CONTROL TOWER
PASSENGER TERMINAL
BRL
ARFF STATION
CARGO BUILDINGS
RAMK "K"
ROAD "M"
FAA RTR FACILITY
ROAD "P"
AIRPORT BOUNDARY
AIRPORT ACCESS ROAD
TO KAILUA-KONA
TO HAWAII BELT ROAD
QU



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State Project No. AH 2011-03

FIGURE 3-1
MASTER PLAN PHASE I
(1998-2003)
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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B. Ramp "K": This project will complete the pavement from the taxiway overlay project between the existing GA area and proposed FBO area. This ramp will service the FBO, Air Tour, GA, and itinerant airline aircraft.

C. Overseas Apron: Approximately 15 acres will be graded and paved, north of the interisland aprons. This will provide overseas aircraft parking at the proposed new OST. In the near term, the hardstand provides additional apron area for existing overseas flights.

D. Air Traffic Control Tower (ATCT): A new ATCT will be constructed on a site as selected by an ongoing FAA site planning study. The new tower will correct safety issues due to an obsolete facility.

A Design Guide Plan should also be included as part of this first phase. The Design Guide will help to ensure appropriateness and consistency to the future design of facilities. The scheduling and scope of projects for Phase II and III, may be revised according to updated demands.

3.1.2 PHASE II (FY 2004 - 2009)

Phase II facilities include terminal and landside improvements. The major project during Phase II is the OST. This facility and other developments are described below (**Figure 3-2**):

A. Overseas Terminal: Construction of a new permanent OST facility is proposed in 2004. The OST will service domestic overseas and international flights and will provide a permanent solution to the use of temporary federal inspection and customs facilities.

B. Air and Water Monitoring: This project is required for compliance with anticipated environmental permits for construction of the OST. Testing of air and water samples prior, during, and after construction will be conducted.

C. Electrical Distribution and Emergency Generator: Power and air conditioning requirements will increase with construction of the proposed OST. This project calls for construction of two buildings: 1) emergency generator building with an emergency chiller plant for DOT/DEA facilities, and 2) main chiller plant and cooling tower to supply the OST and portions of the interisland terminals.

D. Flight Kitchen Site Preparation: This project calls for site preparation, access, and utilities provision for an approximate four acre site at KOA. The flight kitchen will provide facilities to accommodate meals for the overseas domestic and international flights.

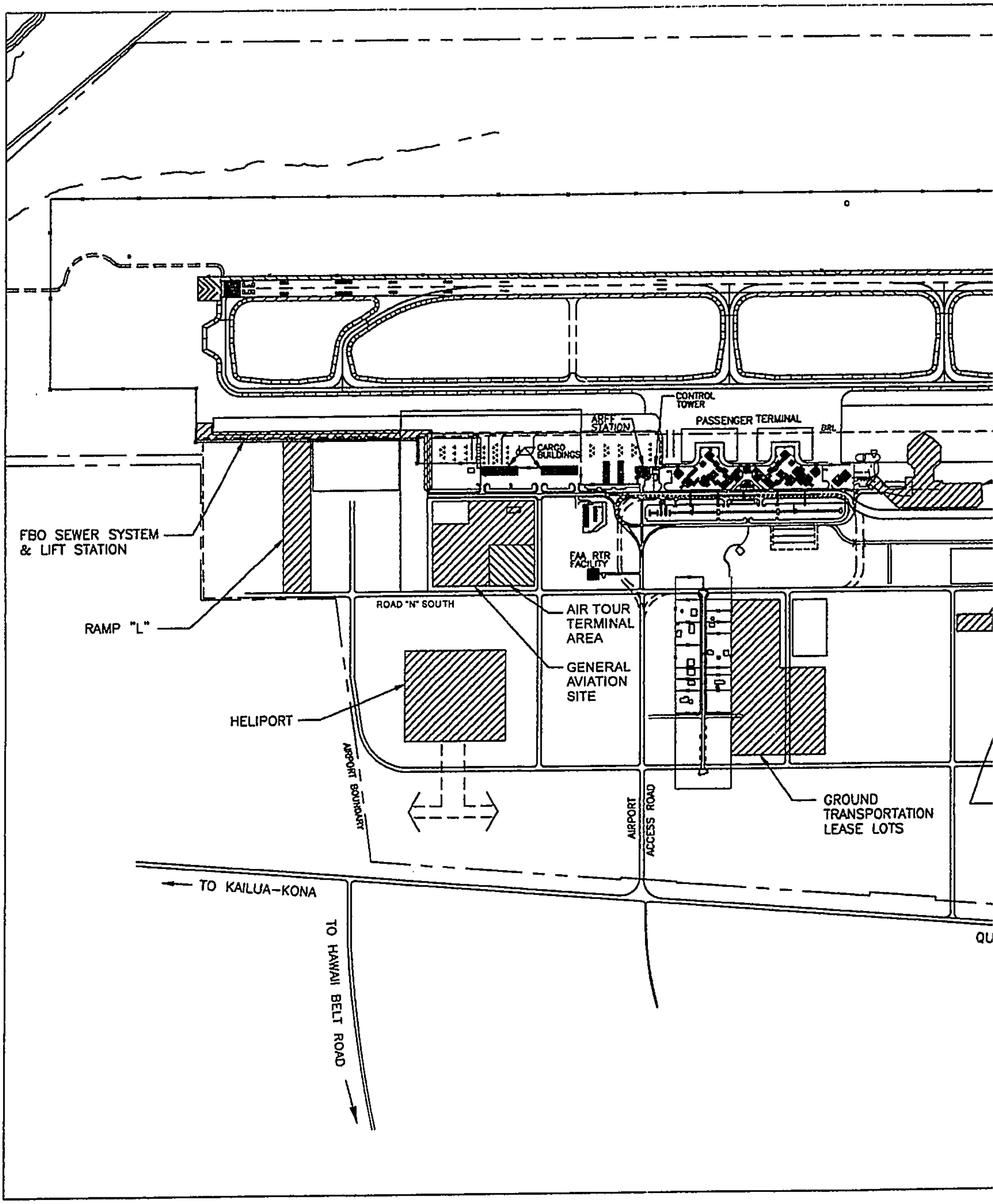
E. Ground Transportation Lease Lots: This project will provide an area for expansion of ground transportation services with access from existing Road "L" (scheduled to be named Halalu Street). Grading, access, and utilities will be provided to an approximate 24 acre site.

F. GA Site Development and Hangars: This site provides an area for GA operations separate from the air carrier terminals and apron. This project consists of finish grading, paving, and marking of approximately 20 acres. Roughly 4,000 square feet of hangar space will also be provided for accommodation and maintenance of GA aircraft.

G. Air Tour Terminal: This facility will provide terminal service for base air taxi, tour, and itinerant aircraft. Site work, structural, and utility service will be provided.

H. Heliport Phase I: A designated heliport area will be constructed in compliance with NTSB/FAA regulations. 12 helipads, located on six lease lots are proposed for development.

I. Ramp "L": As the FBO lots are developed to the south, a second ramp will be required. Ramp "L" will be constructed south of and parallel to Ramp "K". Lighting and striping will be as required by FAA regulations.



CONTROL TOWER
ARFF STATION
PASSENGER TERMINAL
CARGO BUILDINGS
FBO SEWER SYSTEM & LIFT STATION
RAMP "L"
ROAD "N" SOUTH
AIR TOUR TERMINAL AREA
GENERAL AVIATION SITE
FAA RTR FACILITY
HELIPORT
AIRPORT BOUNDARY
AIRPORT ACCESS ROAD
GROUND TRANSPORTATION LEASE LOTS
TO KAILUA-KONA
TO HAWAII BELT ROAD

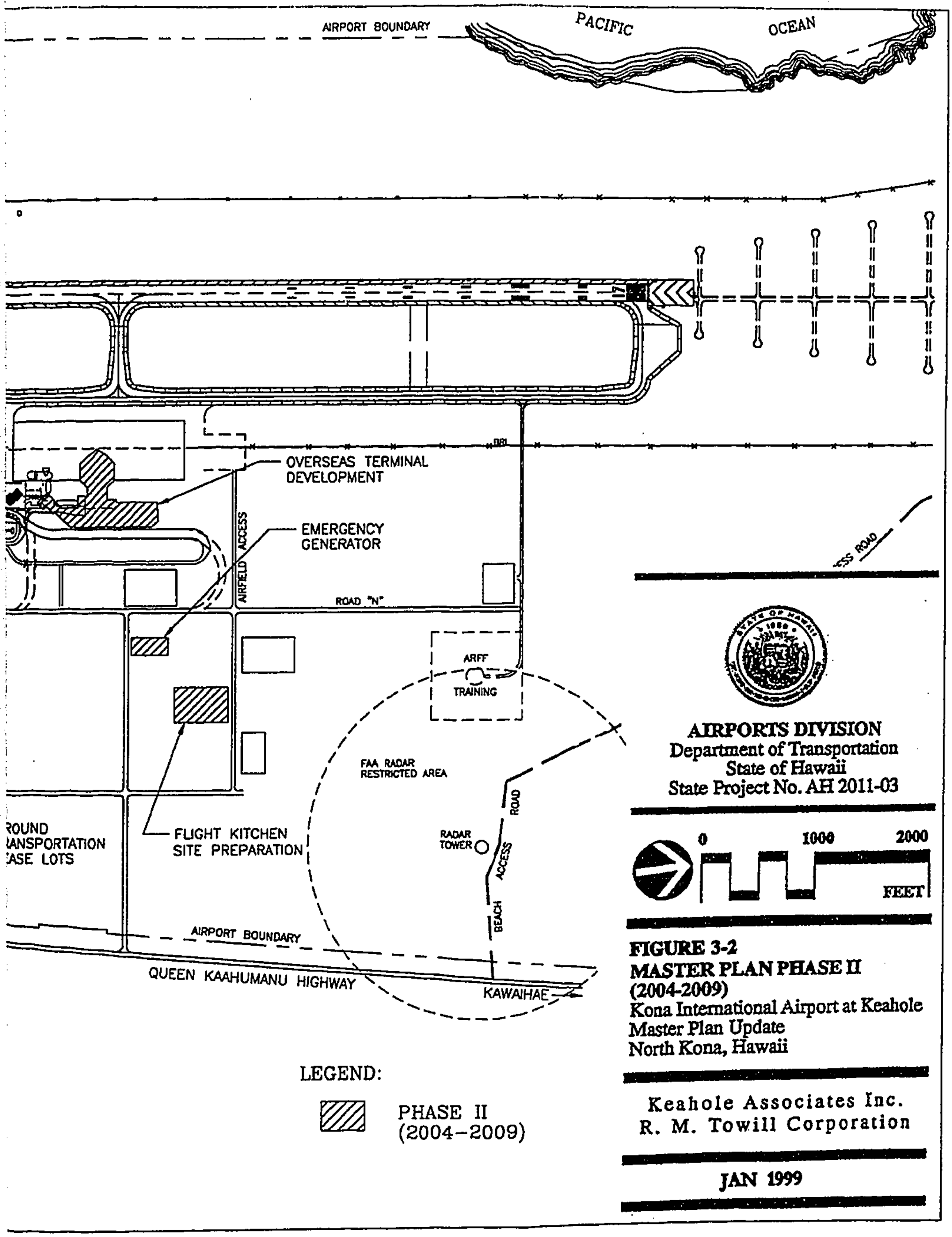


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FIGURE 3-2
MASTER PLAN PHASE II
(2004-2009)
Kona International Airport at Keahole
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North Kona, Hawaii

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J. FBO Sewer System and Lift Station: As the FBO lots are developed to the south, a wastewater trunk line and pump station will be constructed to provide sewerage service.

K. Road "N" (Paoo Street) South: Along with airfield access, Road "N" (Paoo Street) will be completed to the end of the FBO lots to provide vehicular access to the leased properties.

L. Quarry: This project will consist of a site designation study and provisions for access to the site.

3.1.3 PHASE III (FY 2010 - 2015+) AND BEYOND

Phase III facilities involve long term improvements that will require reassessment in the 2002 Master Plan. Major projects for this phase are described below (**Figure 3-3**):

A. Connecting Road "L": This project entails the grading, paving, striping, and lighting of a direct access road from the main Airport Access Road to the GA/FBO area.

B. Long Term Parking: This project calls for development of a long term parking area for passengers on overnight or extended leave. Work will involve grading, paving, and striping of an approximate six acre site, north of the proposed ground transportation lease lots.

C. DOT/DEA Administration Building: The existing DOT/DEA administration building will be moved away from the terminal area to allow expansion of terminal facilities. A potential location is next to the flight kitchen and postal facility.

D. Keahole to Kawaihae Fuel Corridor: This project will provide a fuel transmission system between Kawaihae Harbor and a proposed KOA Fuel Farm.

3.2 MASTER PLAN COST ESTIMATE

Master Plan cost estimates are provided in **Table 3-1** and **Table 3-2**. Costs are based on construction bid tabulations of projects completed or in progress at KOA as well as other airports in the State. Cost figures were also obtained from previous projects undertaken by consultants and from standard cost references. Cost figures are shown in 1997 dollars and include a contingency amount for construction. Costs estimates do not include taxes, land acquisition costs, other non-construction costs, O&M, furniture, equipment, interior finishing, or moving expenses.

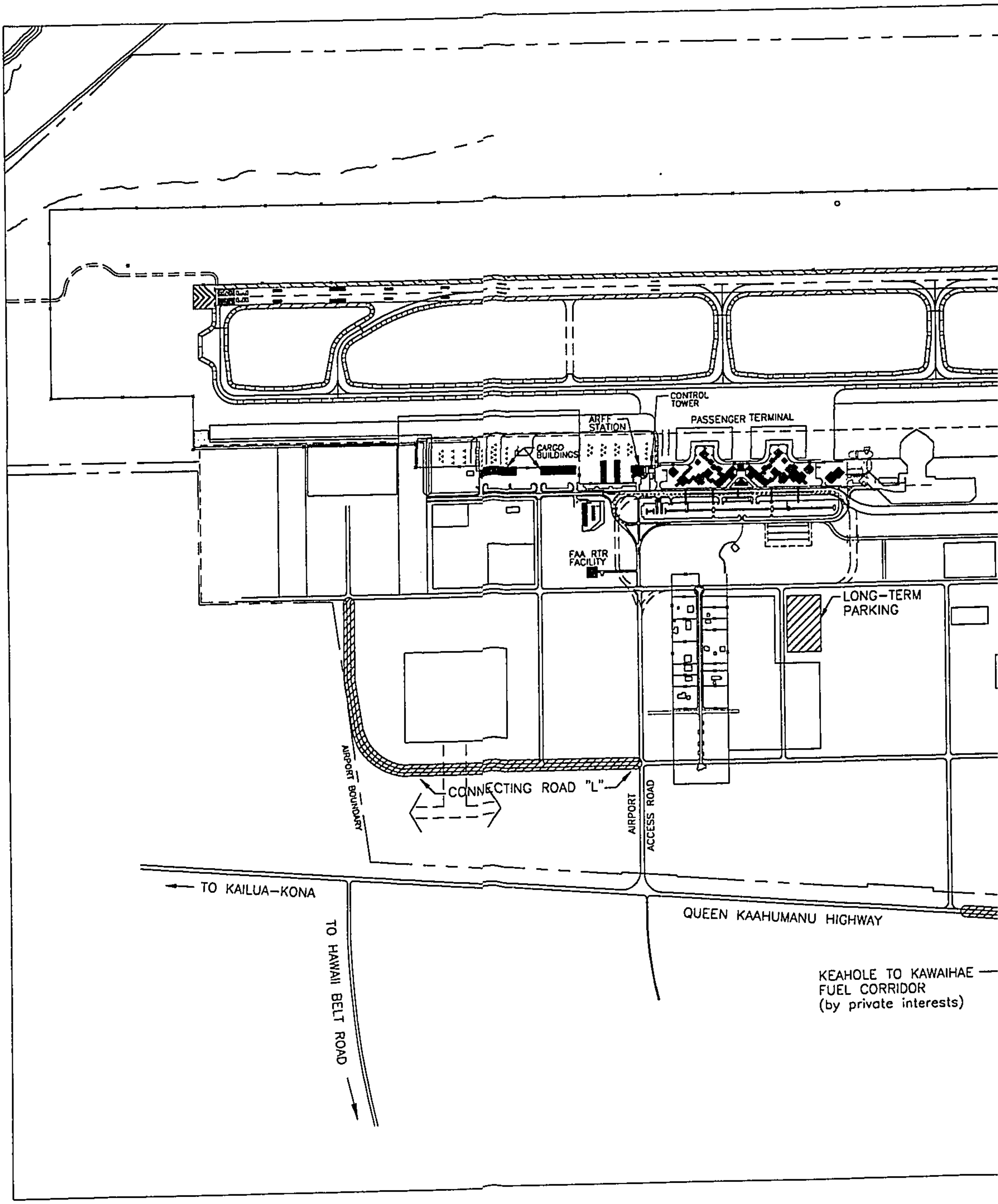
TABLE 3-1

MASTER PLAN COST ESTIMATE

PROJECT TITLE		COST ($ MIL)
AIRSIDE PROJECTS		
Itinerant Aircraft Parking		1.58
Ramp "K"		1.90
Overseas Apron		6.40
Air Traffic Control Tower		7.91
Ramp "L"		2.03
	SUBTOTAL	19.82
LANDSIDE PROJECTS		
DOT AIRPORT FACILITIES AND OPERATIONS		
Wastewater Treatment Plant		16.28
Air Cargo Building III		1.83
Road "P"		2.33
Road "M"		1.00
Telecommunication System		0.59
Parking Phase II		0.76
KOA Master Plan & NCP Update		0.50
Design Guide		0.10
Overseas Terminal Development		35.64
Overseas Terminal Air Monitoring		0.10
Overseas Terminal Water Monitoring		0.10
Elec. Distribution/Emergency Generator		6.76
Air Tour Terminal		2.93
Heliport Phase I		5.30
FBO Sewer System and Lift Station		1.92
Road "N"(Paoo Street) South		1.20
Connecting Road "L"		3.14
Long Term Parking		2.50
DOT/DEA Administration Building		4.00
Keahole to Kawaihae Fuel Corridor		2.28
	SUBTOTAL	89.26
LEASED PROPERTIES AND FACILITIES		
Fuel Farm Site Preparation		1.93
General Aviation Fuel Storage System		1.86
Postal Facility Site Preparation		1.65
Flight Kitchen Site Preparation		1.82
Ground Transportation Lease Lots		5.55
General Aviation Site Development		6.86
GA Hangars		1.92
Keahole Quarry		0.11
	SUBTOTAL	21.70
	GRAND TOTAL	130.78

TABLE 3-2
PHASING PLAN COST ESTIMATE
(cost in millions)

PROJECT	PHASE I (FY98-03)	PHASE II (FY04-09)	PHASE III (FY10-15)
AIRSIDE PROJECTS			
Itinerant Aircraft Parking	1.58		
Ramp "K"	1.90		
Overseas Apron	6.40		
Air Traffic Control Tower	7.91		
Ramp "L"		2.03	
LANDSIDE PROJECTS			
DOT AIRPORT FACILITIES AND OPERATIONS			
Wastewater Treatment Plant	16.28		
Air Cargo Building III	1.83		
Road "P"	2.33		
Road "M"	1.00		
Telecommunication System	0.59		
Parking Phase II	0.76		
KOA Master Plan & NCP Update	0.50		
Design Guide	0.10		
Overseas Terminal Development		35.64	
Overseas Terminal Air Monitoring		0.10	
Overseas Terminal Water Monitoring		0.10	
Elec. Distribution/Emergency Generator		6.76	
Air Tour Terminal		2.93	
Heliport Phase I		5.30	
FBO Sewer System and Lift Station		1.92	
Road "N" (Paoo Street) South			1.20
Connecting Road "L"			3.14
Long term Parking			2.50
DOT/DEA Administration Building			4.00
Keahole to Kawaihae Fuel Corridor			2.28
LEASED PROPERTIES AND FACILITIES			
Fuel Farm Site Preparation	1.93		
General Aviation Fuel Storage System	1.86		
Postal Facility Site Preparation	1.65		
Flight Kitchen Site Preparation		1.82	
Ground Transportation Lease Lots		5.55	
General Aviation Site Development		6.86	
GA Hangars		1.92	
Keahole Quarry		0.11	
TOTALS ($ Millions)	$46.62	$72.24	$11.92


CONTROL TOWER
ARFF STATION
PASSENGER TERMINAL
CARGO BUILDINGS
FAA RTR FACILITY
LONG-TERM PARKING
AIRPORT BOUNDARY
CONNECTING ROAD "L"
AIRPORT ACCESS ROAD
TO KAILUA-KONA
TO HAWAII BELT ROAD
QUEEN KAAHUMANU HIGHWAY
KEAHOLE TO KAWAIHAE FUEL CORRIDOR (by private interests)

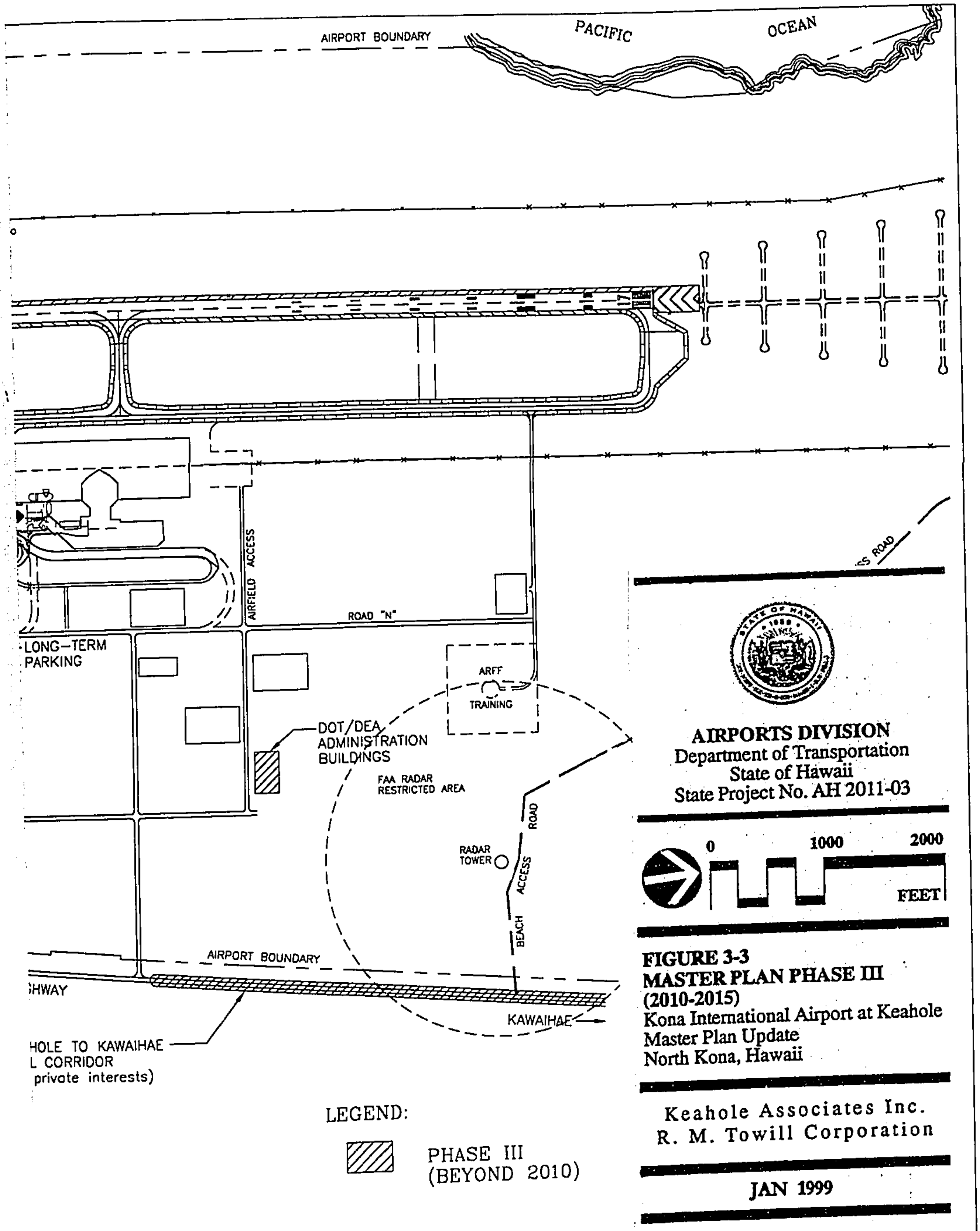


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FIGURE 3-3
MASTER PLAN PHASE III
(2010-2015)
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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SECTION 4
ALTERNATIVE PLANS CONSIDERED

4.1 OVERVIEW

This section describes the Alternative Plans which were considered during development of the KOA Master Plan Update. The analysis concentrated on a review of updated information on landside development activities since airfield and airside related facilities are expected to be adequate for the master planning timeframe.

Section 4.2 - Methodology, describes the factors that were considered in reviewing the various alternative plans; Section 4.3 - Airfield Alternatives, provides a summary of airfield alternatives that were considered to improve aircraft handling efficiency; Section 4.4 - Land Use Alternatives, examines various land use arrangements as a means of meeting operational needs at KOA, and Section 4.5 - No Action Alternative, describes the result of taking no further action to implement the KOA Master Plan Update.

4.2 METHODOLOGY

A number of factors were considered in reviewing facility requirements at KOA. These factors included the following:

- Annual passenger and aircraft operation forecasts were prepared as part of an update for the State Airport System Plan (SASP) in a report from Aries Consultants, Ltd, *Update of Hawaii Aviation Demand Forecasts, October 1994*. These projections show an estimated 3,780,000 passenger enplanements/ deplanements and 91,900 annual aircraft operations for KOA in the year 2020.
- Federal Aviation Administration (FAA) Advisory Circulars were consulted for specific requirements and guidance on airfield and terminal planning. These Advisory Circulars are referenced in the text as they apply. The alternative plans also took into consideration requirements for airport access, parking, car rental areas, and other airport related land uses.
- Comments received from FAA, HDOT-AIR, the project Technical Advisory Committee (TAC), and public informational meetings were also considered in formulating the alternative plans.

4.3 AIRFIELD ALTERNATIVES

4.3.1 AIRFIELD OVERVIEW

This section describes three concepts for the KOA airfield and assesses the service of the recently extended runway. The purpose of reviewing these alternatives is to determine which layout, if required, may best serve the airport's increasing passenger and aircraft activity.

4.3.2 AIRFIELD PLANNING CRITERIA

The smooth operation of aircraft activity involves overseas and local users. Projected demands, operational delays, and airfield capacity are the primary factors in determining need for a second runway. Concerns regarding the possibility of airport closures due to runway accidents are shared by all users of single runway airfields. In addition, the rising interaction or mix of aircraft is of concern to many light aircraft operators. These operational parameters point to the desire for a second runway. The alternative airfield plans are based on many variables. The most significant of these include:

- Aviation Forecasts
- Plan Implementation
- Agency Requirements
- Aircraft Operations
- Environmental Impacts
- Public Input

Each airfield alternative proposes upgrades to the following facilities:

- Runway(s)
- Holding Bays
- Safety Areas and Clearways
- Taxiways
- Shoulders and Blast Pads

Utilities associated with airfield development, such as airfield lighting, drainage, and navigational aids have not been addressed in these alternatives. Planning and evaluation of these facilities are included in the recommended airfield plan as presented in the KOA Master Plan Update.

4.3.3 LAND CONSTRAINTS

Alternatives proposing a second runway call for development towards the west of the existing runway. The coastline encroaching inland, north of Unualoha Point, will limit parallel runway separation to about 1,400 feet.

4.3.4 FAA REQUIREMENTS

The FAA establishes requirements for airports based on the criteria of Aircraft Approach Categories and Airplane Design Groups. These criteria were used in the development of all alternative plans and include the following:

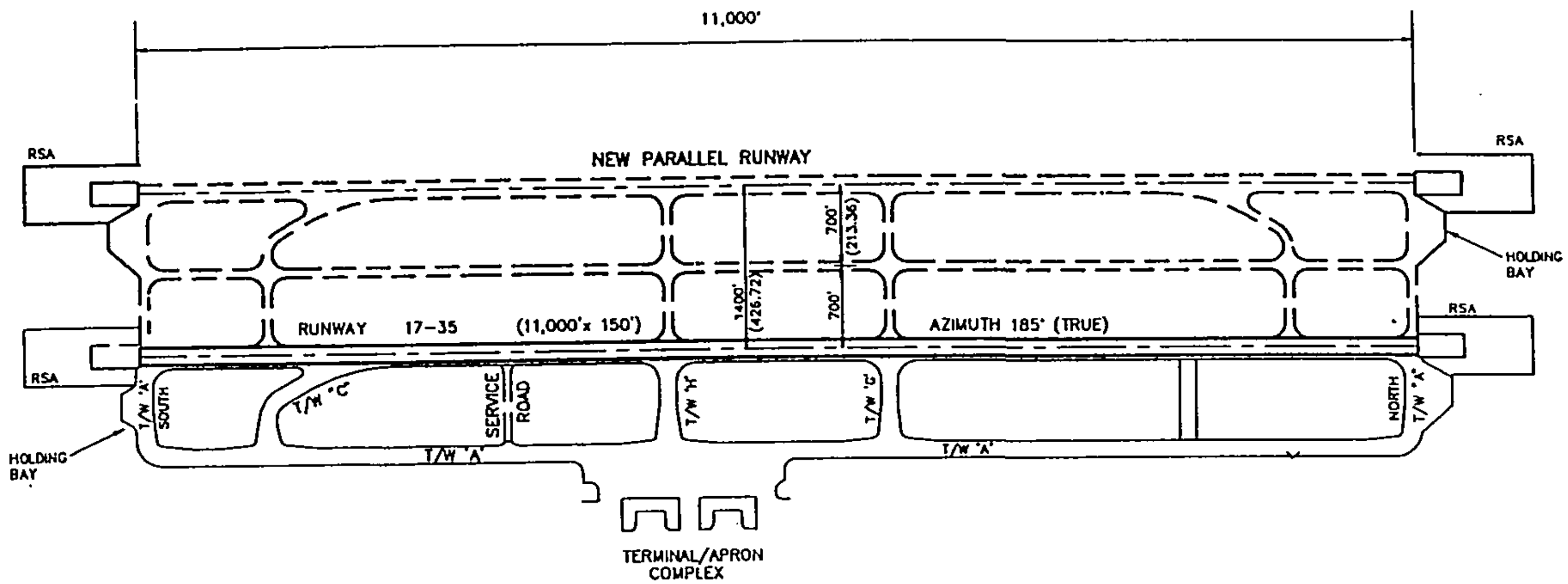
- Aircraft Approach Category - The FAA uses five Aircraft Approach Categories to determine the level of airfield service. KOA currently serves as a *transport airport*, accommodating aircraft in Approach Categories A through D. Forecasted aircraft types are also expected to be within these categories.
- Airplane Design Group - The Airplane Design Group categorizes airplanes by wingspan and relates this statistic to specific airport design requirements. According to FAA, KOA falls within Airplane Design Group V. Ample separation distances are provided in each alternative to allow for future upgrade to Airplane Design Group VI standards.
- Critical Aircraft - The aircraft which imposes the greatest demands on the airfield is termed the critical aircraft. Runway length and pavement strength are usually the most limiting parameters. The critical aircraft at KOA is the Boeing 747-400. This determination is based on forecasts of expected aircraft types through the year 2020.

4.3.5 ALTERNATIVE RUNWAY PLANS

4.3.5.1 Major Features

Three dual runway schemes were evaluated (**Figure 4-1** through **Figure 4-3**). These plans are summarized as follows:

Alternative 1: Add parallel runway 11,000 ft. long;
Alternative 2: Add parallel runway 6,500 ft. long, South end of existing runway; and,
Alternative 3: Add parallel runway 6,500 ft. long, North end of existing runway.



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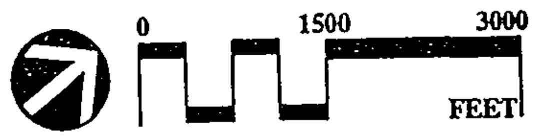

FIGURE 4-1
AIRFIELD LAYOUT PLAN
ALTERNATIVE 1
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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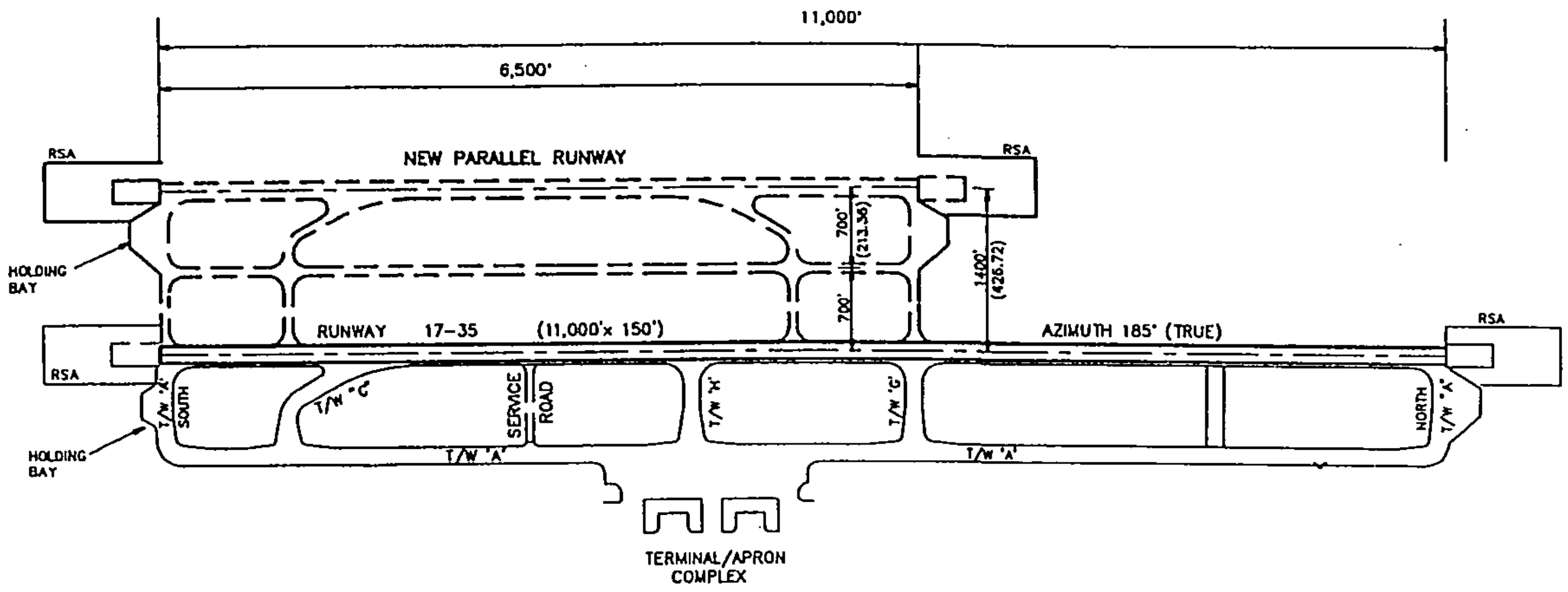

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FIGURE 4-2
AIRFIELD LAYOUT PLAN
ALTERNATIVE 2
Kona International Airport at Keahole
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North Kona, Hawaii

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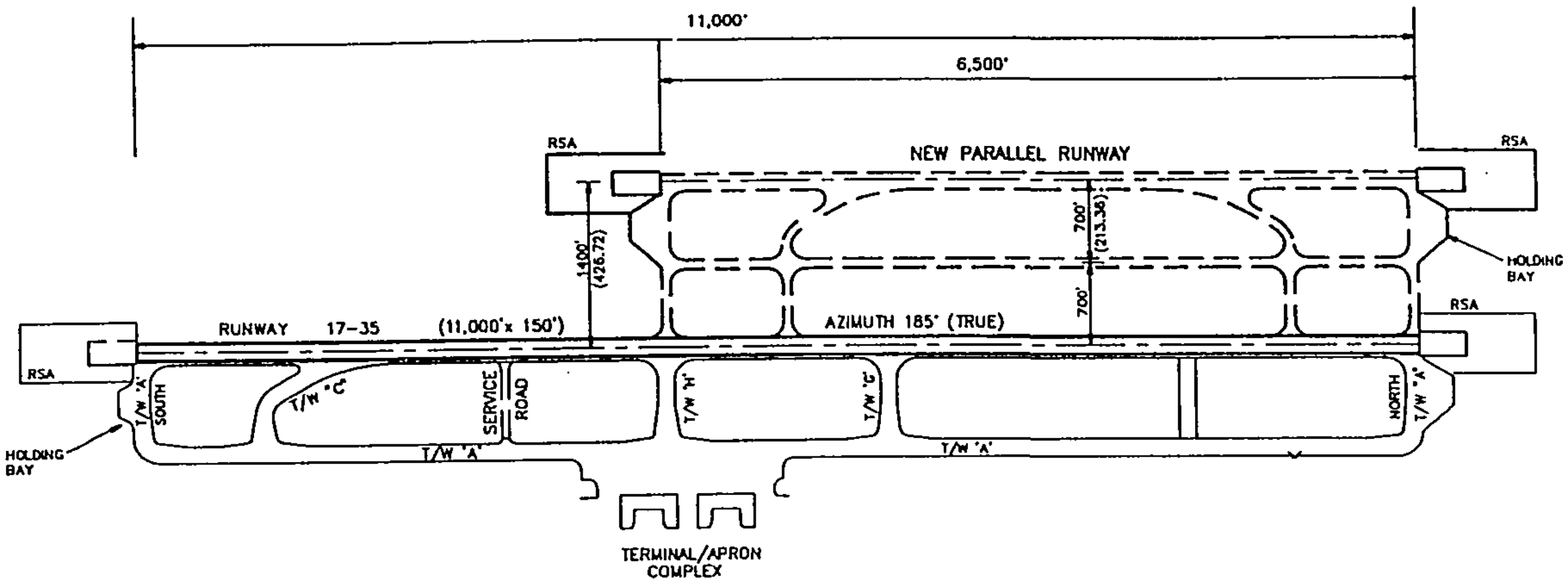

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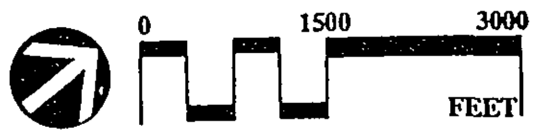

FIGURE 4-3
AIRFIELD LAYOUT PLAN
ALTERNATIVE 3
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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The prime objective of each plan is to meet present and future operational needs through the year 2015.

4.3.5.2 Runways

The runway consists of structural pavement designed to withstand load demands of the critical aircraft. Stabilized (paved) shoulders along the runway and blast pads at the runway ends reduce erosion from jet blast and lessens the possibility of engine ingestion of gravel and debris. Runway safety areas are provided in the event that airplanes undershoot, overrun, or veer off the runway. Safety areas also improve accessibility for firefighting and rescue vehicles. Clearways and obstacle free zones (OFZ) are designated over and around the runway in accordance with the Federal Aviation Regulations (FAR) Part 77.

A. Number of Runways - Demand forecasts and runway capacity analyses indicate the need for only one runway through the year 2020. Dual runway configurations presented in **Figures 4-1 through 4-3** are to enhance aircraft operations rather than accommodate demand forecasts. The development of a second runway is intended to increase user convenience by improving KOA's aircraft acceptance rate and reducing operational delays. In the event of an impaired runway, use of a dual runway may avoid inconvenient detours to other airports such as Hilo, Kahului, or Honolulu International.

B. Runway Length - Runway length is determined by several factors including: Aircraft types and operating weights; meteorological and geographical conditions; and the limitations surrounding the developments.

According to FAA design guidelines, a 6,500-foot long runway is inadequate to accommodate overseas aircraft at maximum certificated takeoff weights. Thus, the ideal condition for aircraft operations and airport management would be the construction of a second parallel 11,000 ft. runway, i.e. Alternative 1. The development of a second runway will also greatly increase level of service for overseas and interisland flights.

The 6,500 ft. parallel runways shown in Alternatives 2 and 3 would service the non-overseas aircraft, especially the interisland traffic. The rationale behind these alternatives is based on the aviation demand forecasts that, 2.51 million of the 3.78

million passengers projected by the year 2020, are interisland travelers. Thus by attenuating the interisland traffic through a dual runway configuration, a higher level of service will be achieved.

4.3.5.3 Aircraft Ground Circulation

A. Taxiways - The FAA prescribes design guidelines for taxiways by airplane design group. This criteria provides minimum aircraft dimensional requirements for use of a taxiway. Fillets at intersections and dimensional adjustments should be considered in the final design as necessary to facilitate efficient aircraft movement.

B. Holding Bays - Holding bays provide storage space for airplanes awaiting takeoff clearance, allowing bypass of other airplanes. They are useful in maintaining smooth operation of the airfield during peak periods. The location of holding bays in the alternative layouts were based on the assumed aircraft ground patterns and on clearance of the runway OFZ. All alternative plans feature holding bays along the end taxiways sized large enough to hold two wide body airplanes.

C. Pavement Strength - The critical design aircraft for pavement strength is determined on the basis of the greatest pavement load demand, regardless of the gear configuration type used. All alternative plans are based on the runway pavement able to carry the load of a B-747-400, with an approximate takeoff weight of 850,000 pounds.

D. Jet Blast Facilities - The existing facilities at KOA consist of 35-foot wide stabilized shoulders for all taxiways and runways in accordance with FAA Airplane Group V standards. These aircraft require shoulders at least 25 to 35 feet wide along the taxiways. Jet blast effects require stabilization (paving) of the shoulders to avoid erosion and possible engine ingestion of dust and loose gravel.

4.3.6 RECOMMENDATION

The KOA Master Plan provides flexibility to accommodate potential increases in air traffic beyond the 2015 master planning timeframe. Analysis of passenger forecasts for 2015 indicates the single runway would require an average use of up to 28 aircraft operations per hour, while the KOA airfield capacity is 60 aircraft operations per hour. For this reason, land areas within the easternmost portions of the KOA property should continue to be preserved and set aside for the future until such time that development of a second runway is warranted.

Although a dual runway is not now needed, future development beyond 2015 will be governed by need to address safety and demand concerns. Construction of a second runway would enhance airfield operations by: 1) permitting separation between larger commercial and lighter private commuter aircraft. A second runway would also facilitate operations in the event of an emergency or safety related mishap; and, 2) if passenger counts should greatly increase beyond forecasts, severe aircraft delays could result. Therefore, in some instances when future annual demand is expected to approach one half of the annual service volume, nominal construction costs for airfield improvements can be balanced or offset by savings in avoiding future aircraft delays.

4.4 LAND USE ALTERNATIVES

4.4.1 OVERVIEW

Three land use alternatives were prepared, each representing a variety of approaches to the allocation of land uses and vehicular circulation. All alternatives were derived based on the existing master plan and projects in progress. The concept behind each plan is discussed below, followed by a more detailed discussion of specific land use elements within each plan.

The land use alternatives were developed to provide a conceptual approach to the distribution and location of use and circulation elements. The final recommended Master Plan is based on an analysis of these alternatives.

4.4.2 CONCEPTS FOR ALTERNATIVE PLANS

The alternative concepts were developed to provide a consistent basis for creating and evaluating alternatives. All alternative plans use the following basic concepts:

- Separate passenger and terminal activities from airport operations/support facilities.
- Use the flightline for terminal/flight related activities only, i.e. move administrative activities to mauka locations away from the runway.

- Place the OST and parking immediately north of the Interisland Terminals and expand to the east (mauka), should terminal or apron requirements permit, and maintain the one-way loop access system in the terminal area.

- Converting the existing T-hangers to cargo or other uses, and locate and expand the GA hangers and tie-downs to the south and east.

- Study the relocation of the airport access road to the north to be more aligned with the central area of the present and future terminals. Provide for a secondary service access to Queen Kaahumanu Highway with limited movement, i.e., right-in/right-out.

- Utilize the south ramp area for GA and FBO.

- Provide a consolidation of 'back of the house' support facilities, i.e. administration, post office, flight kitchen, utilities site and fuel farm, all with secure, direct access to the apron area.

- Provide a long term parking lot, adjacent to the ground transportation area, so that access can be achieved via ground transportation shuttles.

- Provide areas of landscaping, reasonably contiguous and concentrated for the disposal of treated wastewater.

- Provide opportunities for future expansion of all facilities for development beyond the planning horizon.

- Preserve lands adjacent to Queen Kaahumanu Highway for possible future business and industrial uses. Consider the possibility of a frontage road and an interchange at the Airport Access Road and Queen Kaahumanu Highway in the distant future.

4.4.3 NEW FACILITIES TO BE INCLUDED

The alternatives also include specific facilities that are expected in the future, but do not presently exist at the airport.

4.4.3.1 Overseas Terminal

The OST is planned to provide service to mainland and international carriers. Presently, these flights use the Interisland Terminal for enplaning and deplaning of overseas passengers. The interim Federal Inspection Services (FIS) facility was built to serve arriving international passengers. The present level of flight activity is being accommodated by these facilities; however, improved facilities within the OST will be needed to properly serve the larger aircraft size and its typical number of passengers. The timing of the OST is uncertain, as is the size of the first phase of construction.

4.4.3.2 Flight Kitchen

With the advent of overseas flights originating at KOA, there is a need for food and beverage service. Presently a local hotel is providing this service; however, a facility will eventually be constructed at the airport. Approximately four acres is being reserved for this use. Access to the ramp is required.

4.4.3.3 Postal Facility

The U. S. Postal Service owns a four acre site at the airport and plans to utilize this facility as a distribution center. While this site is fixed, it is anticipated that it may be relocated if such a move can be justified.

4.4.3.4 Fuel Storage

Two types of fuel storage are required, both with separate storage needs. Overseas flights require 'Jet-A' fuel and GA generally requires 'AvGas.' The Hawaii Fueling Facilities Corporation (HFFC) is planning to install a fuel farm for overseas carriers. This facility is anticipated to require approximately 3.2 acres and will be served by large tanker trucks from Kawaihae Harbor and Hilo. Fuel will be piped from the farm to the ramp area. The AvGas facility will be much smaller and should be located proximate to the GA area.

4.4.3.5 Wastewater Treatment Plant (WWTP)
This facility is in the initial planning stages since the existing plant is at or near capacity during peak hour periods. The proposed location is at the intersection of Road "N" and the road serving the ARFF Training Facility. Since treated wastewater will not be injected into the ground, due to Department of Health requirements, it will be necessary to pipe the treated wastewater to landscaped areas where it may be reused for irrigation.

4.4.3.6 Heliport
Presently, helicopters are using space at the south end of the airport. It is acknowledged that this is a temporary facility and that a heliport will be provided in the future. The heliport will primarily serve tourist operations.

4.4.3.7 New Air Traffic Control Tower (ATCT)
It is anticipated that a new control tower will be needed to improve visibility, especially with the advent of the OST. FAA has completed a site selection study to recommend a new ATCT location. Once the recommended site is reviewed and finalized, financing will most likely be secured from special airport revenue funds and possibly, FAA reimbursement. Expectations are for construction sometime after CY2000.

4.4.3.8 Expanded GA Facilities
A permanent GA facility is needed, specifically with an increase in the tie-down area.

4.4.4 ALTERNATIVE PLANS

Three generalized alternatives were prepared to study various approaches to land use and vehicular circulation.

4.4.4.1 Alternative 'A' **(Figure 4-4)**
This option is most closely aligned with the 1987 master plan. In addition to the concepts itemized above, it contains the following features:

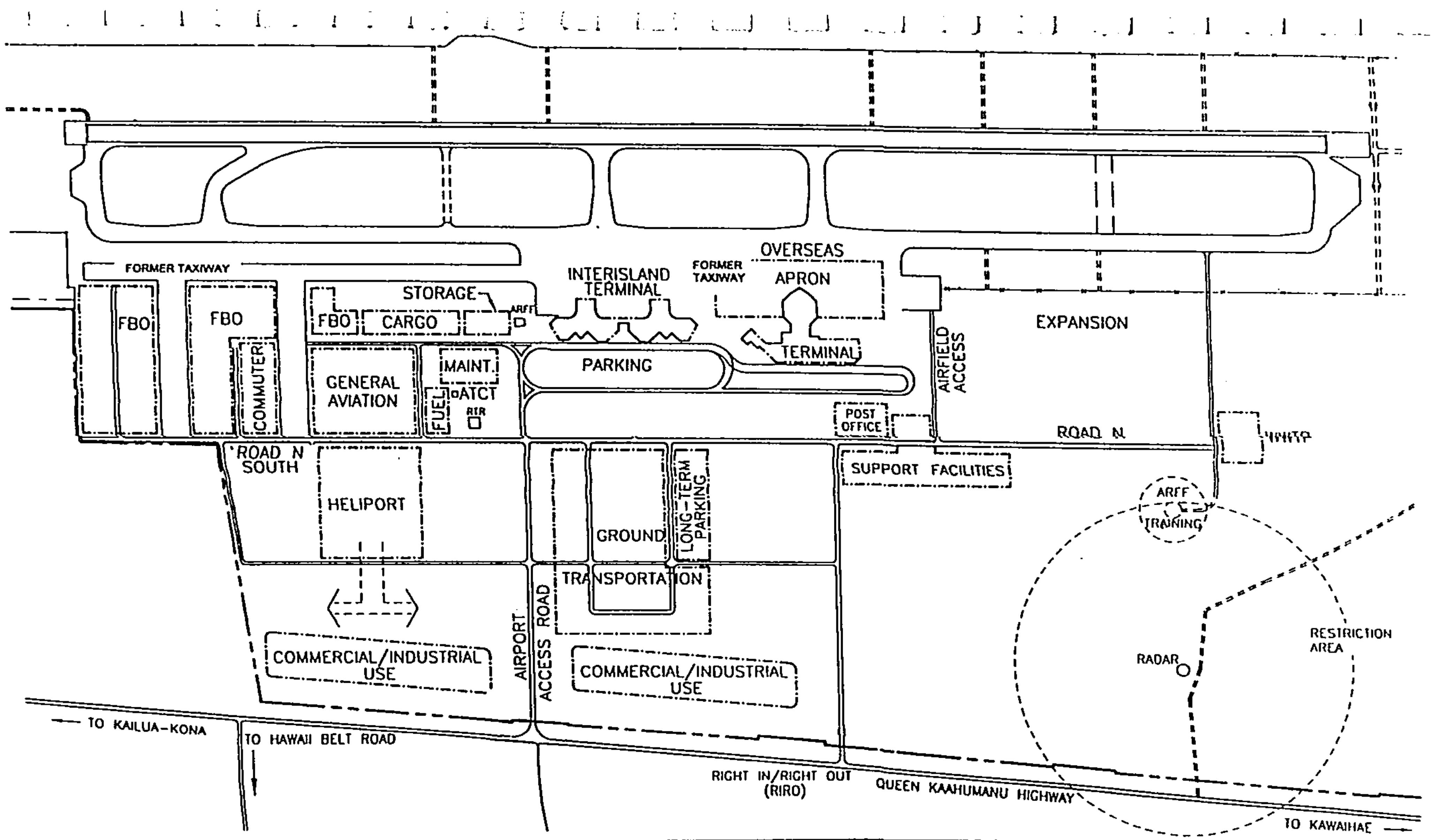

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FIGURE 4-4
AIRPORT LAND USE PLAN ALTERNATIVE A
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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- The alignment of the access road remains status quo.

- The loop road serving the terminals is expanded east of its present location and its alignment is consistent in front of all terminals. Across from the Overseas Terminal is a tour bus facility shown by the architects in terminal concept plans.

- Road "N" acts as a service road connecting public and restricted areas. Of some concern is the close proximity between Road "N" and the loop road, especially since the intersection of this road and access road is a critical junction within the airport traffic system.

- The Heliport, GA and FBO areas are as shown on the prior master plan.

4.4.4.2 <u>Alternative 'B'</u> **(Figure 4-5)**
This alternative maintains many of the same land use relationships as the others, with the following exceptions:

- The access road is located on the alignment of proposed Road "P", which aligns it with the OST.

- The terminal loop road is expanded to the east and offset mauka in front of the OST to allow for greater depth. This offset in the terminal road will allow for additional depth on the OST apron area for larger aircraft and additional spaces (as compared with the Interisland Terminal). Also, it allows greater aircraft push back room to eliminate possible conflicts with the existing taxiway. This loop configuration allows ground transportation to be directly accessed, thus relieving congestion at the north-south service road and access road.

- Only a portion of Road "N" will be used as a road, however, it will be retained as a utility corridor for its full length. A new parallel service road to the east links facilities from the north to the south. Security can be effectively provided for the airport support facilities to the north while providing direct access to the airfield.

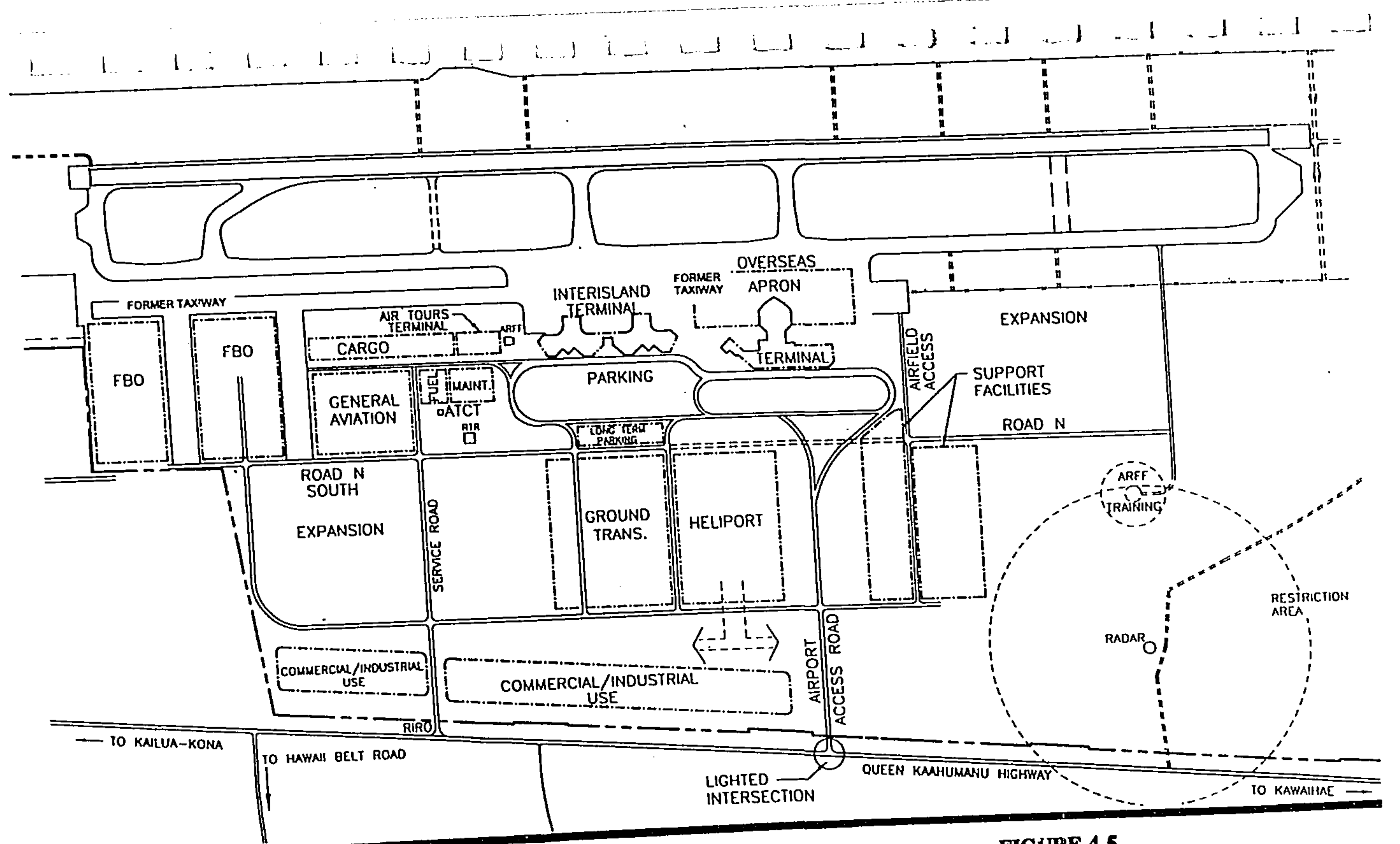

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FIGURE 4-5
AIRPORT LAND USE PLAN
ALTERNATIVE B
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North Kona, Hawaii

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- The heliport has been located immediately north of the ground transportation area. This position would be more favorable should a new ATCT be relocated north of its present location.

4.4.4.3 Alternative 'C' **(Figure 4-6)**
This option combines features of Alternatives A and B:

- The access road is centered on the terminal area.
- The terminal loop is expanded to the east to align with Road "N." As in Alternative B, the road fronting the OST is moved to the east. This configuration allows for a landscaped area between the east portion of the loop and the parking area. The effect of this and Alternative B would be similar to the access loop at Hilo International Airport.
- As in Alternative B, there is direct access off the loop to the Ground Transportation area.
- Portions of Road "N" have been abandoned as in Alternative B.
- The WWTP has been moved slightly to the south to reduce the piping distance to this facility.

4.4.5 ACCESS, CIRCULATION AND PARKING

The alternative plans show a variety of airport access road locations, with parking generally an extension of existing facilities. Access and parking issues are discussed in the following subsections.

4.4.5.1 Access Road
The location of the access road should provide ease of use and direct connection to the terminal area. Alternatives B and C which have the airport access road aligned with Road "P," reflect the installation of the OST to the north. However, even with the OST, the Interisland Terminal will remain the high traffic area of the airport, as Alternative A reflects. Alternatives A and B service opposite ends of the loop road which provides for even vehicular flows with fewer crossing conflicts. Alternative C is ideally located to serve both terminal areas; however, this alignment requires a completely new road alignment and increases the number of crossings, resulting in additional traffic conflicts and time delays.

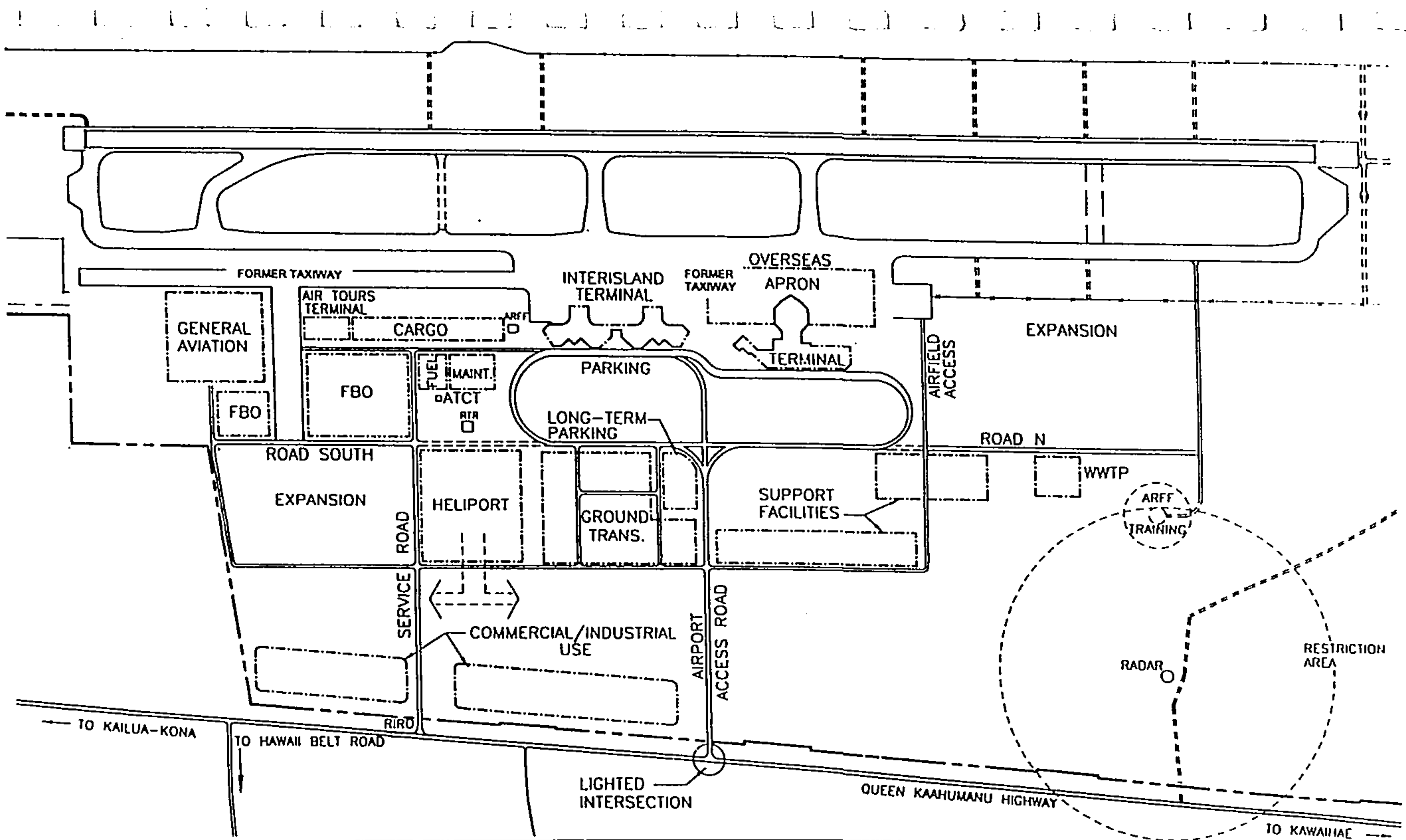

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FIGURE 4-6
AIRPORT LAND USE PLAN
ALTERNATIVE C
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North Kona, Hawaii

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The secondary access road is assumed to have limited access, right-in/right-out only. The location of this road is very important, for it will provide relief for traffic to other non-terminal areas of the airport. Service vehicles can also use this road to avoid passenger traffic. Alternatives A and B provide for the best distribution of the two access roads, with each secondary road serving different needs of the airport. The advantage of Alternative A is for the support facilities, such as the fuel farm, U.S. Postal Service facility and flight kitchen, to have truck service that can be easily separated from the main access road.

4.4.5.2 Service Access Roads

The north/south service road is critical in connecting all portions of the airport. Road "N" is scheduled for construction soon and will function as the primary north/south connector for the immediate future. The disadvantage of this alignment is its close proximity to the future expanded terminal service loop. The intersection of Road "N" and the Access Road will eventually become the most significant intersection within the airport, and will likely be signalized at some future time. To allow for smooth traffic flow and optimum driver reaction time this intersection would be better located to the east, as shown in Alternatives B and C.

Other access issues include connection to the ramp area for operational uses and ground transportation access. Access to the ramp is provided in all three alternatives, with Alternative B providing the most direct link and least possible intermixing with public traffic. Alternatives B and C provide for a direct connection between the ground transportation area and the terminal loop road. This allows more direct access and reduces the amount of conflict between the main Airport Access Road and rental car traffic.

4.4.5.3 Parking

Parking is easily expanded both to the north and east of the existing lot. In the long run, employee parking would be located to the east of public parking areas, within the expanded loop road system.

4.4.6 OVERSEAS TERMINAL ALTERNATIVES

The OST is shown in all alternative plans as immediately north of the Interisland Terminal area. Initial development would be a two gate terminal with loading bridges, hardstands with fuel hydrants, and extension of the terminal loop road and parking.

Architects are preparing concepts for the OST (**Figure 4-7**). Studies anticipate a village of single story structures along the terminal loop road and a two-story structure on the airfield side with loading bridges. The architectural expression should be compatible with the existing Interisland Terminals. Several concepts for terminal configuration are being considered.

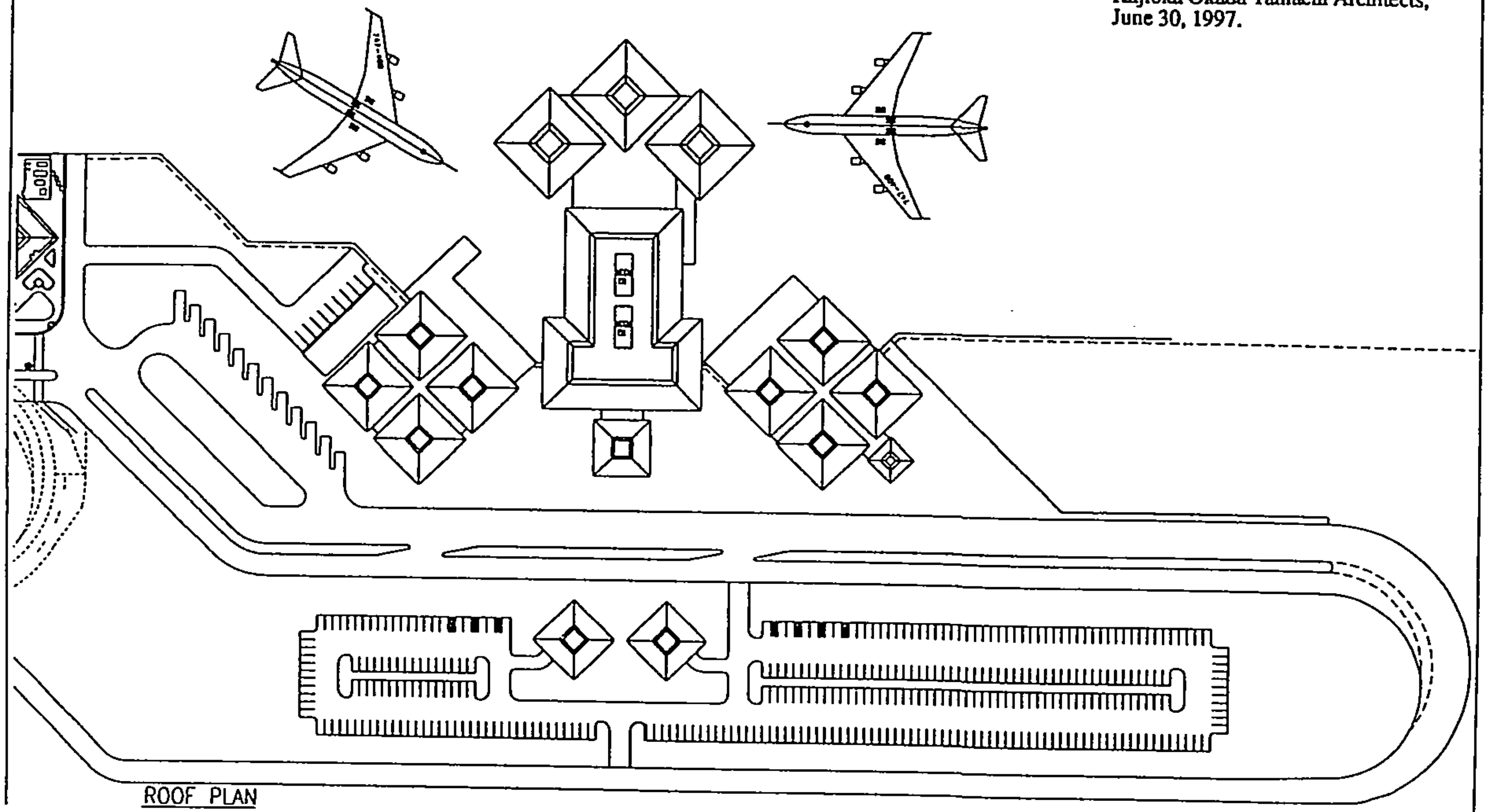
4.4.6.1 Linear Concept (**Figure 4-8**)
The linear plan provides for gates to be aligned in a north/south line, all reached via a central concourse area. Under this configuration the overall depth of the terminal facility would be minimized and visibility to the aircraft apron area would be optimal from the ATCT. The conceptual layout shows a tour bus facility located in the parking area across from the terminal, reached by an underground passageway.

4.4.6.2 Pier Concept (**Figure 4-9**)
This approach utilizes piers with waiting areas apart from the main concourse, connected by passageways. Each pier configuration would service a number of aircraft on three sides. By its very nature, this concept requires a ramp area with greater depth. It would require that the terminal loop road be offset to the east, as shown in Alternatives B and C. An offset that is not too extreme, can be easily accommodated.

The KOA master plan is flexible enough to accommodate a variety of approaches, so long as they fall within the overall use 'envelope' reserved for the OST.

4.4.7 INTERISLAND TERMINAL

The Interisland Terminal is undergoing a series of improvements to accommodate more passengers, especially for domestic and international overseas flights. The north baggage claim area and both the north and south passenger holding areas were enlarged. Ticketing and baggage make-up facilities are also being expanded. Ten gates (two sets of five) are available. The interisland flights usually do not use more than two gates at a time in each of the two areas. Interisland passengers are projected to grow by approximately 15% over the next twenty years to 2,121,000 annual passengers.



SOURCE: Draft Overseas Terminal III, Concept Study, DOT-Airports Division, Kajioka Okada Yamachi Architects, June 30, 1997.

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FIGURE 4-7
OST CONCEPT STUDY
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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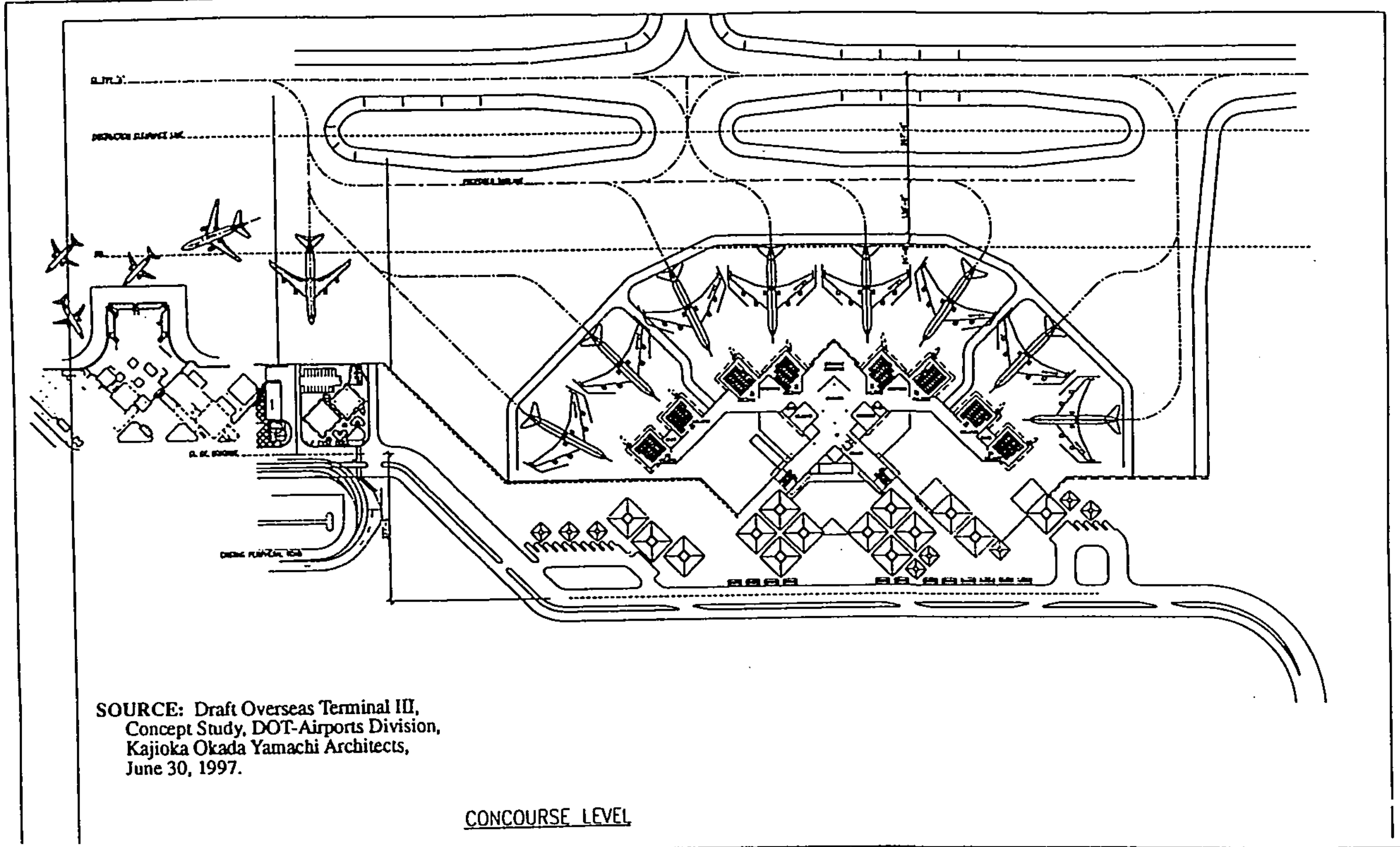

SOURCE: Draft Overseas Terminal III, Concept Study, DOT-Airports Division, Kajioka Okada Yamachi Architects, June 30, 1997.

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FIGURE 4-8
OST LINEAR CONCEPT
Kona International Airport at Keahole
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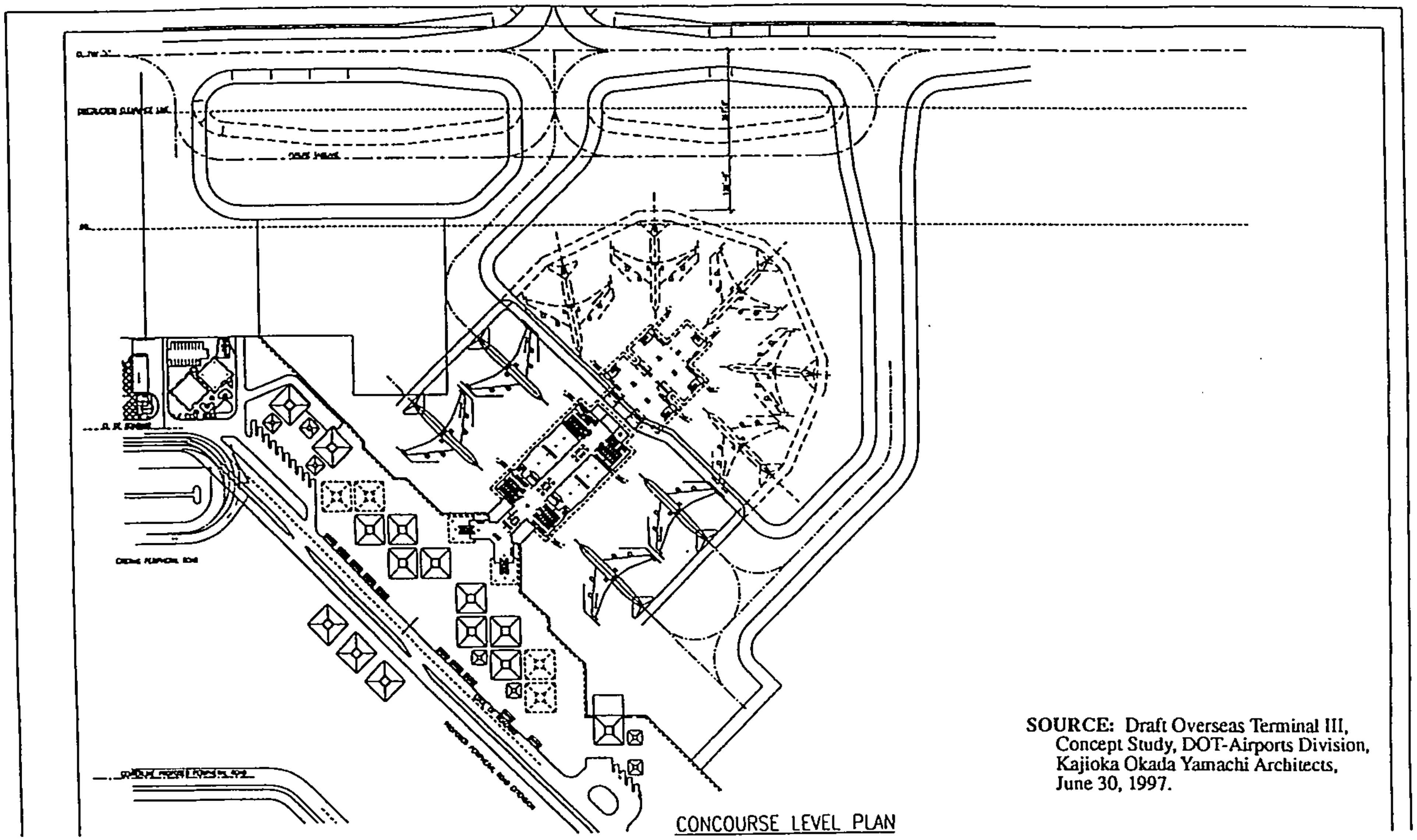

SOURCE: Draft Overseas Terminal III, Concept Study, DOT-Airports Division, Kajioka Okada Yamachi Architects, June 30, 1997.

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FIGURE 4-9
OST PIER CONCEPT
Kona International Airport at Keahole
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Alternatives for the Interisland Terminal relate primarily to use by overseas carriers. Most of the overseas flights utilizes the north terminal, and the overseas charter flights the south terminal. One option is to take "no action" and continue operations as they are now for an extended period of time. This would necessitate additional improvements in dealing with the larger numbers of passengers characteristic of overseas flights.

Should the decision be made to accelerate construction of the first phase of the OST, then incremental improvements to the Interisland Terminal could be kept to a minimum. In later portions of the planning period (2010-2015), consideration should be given to major remodeling or reconstruction due to the age of the facility.

4.4.8 OTHER ELEMENTS

4.4.8.1 Heliport

Alternatives A and C locate this facility toward the south end of the airport, generally east of the GA area, while Alternative B situates the heliport near the ground transportation lots. In all cases the helicopters would take-off and land along a north/south flight path. A primary concern is the amount of noise generated by this use; therefore adjacent use proximity must be considered.

4.4.8.2 Commuter Terminal

The use of the term "Commuter Terminal", from the prior master plan, is misleading; therefore it will be renamed "Air Tours Terminal", since this is the principal use. Several locations are shown on the alternative plans, ranging from the GA area to just south of the ARFF Facility. Proximity to the other terminals is not essential for tour purposes.

4.4.8.3 General Aviation (GA)

In all alternatives this is shown at the south end of the airport. Its configuration and specific location varies slightly between the plans. It would likely be served by Ramp K, perpendicular and east from the existing north-south ramp serving the helicopters and cargo areas. Room for expansion, especially of the tie down areas, should be available.

4.4.8.4 Fixed Base Operators (FBO)

The FBO area is sited at the airport's south end consisting of small subdivided lots with ramp access.

4.4.8.5 Commercial/Industrial Uses
Consideration should be given to other non-airport land uses in the areas between the airport (relocated Road "L") and Queen Kaahumanu Highway. Such uses could provide revenues to the State of Hawaii. Priority should be given to uses that compliment or supplement the airport. For example, a service station could support ground transportation facilities. Other uses could include industrial, offices, highway related commercial or other appropriate uses.

4.5 NO ACTION ALTERNATIVE

The No Action alternative would involve taking no further action to implement the KOA Master Plan Update. Proposed projects would not be developed to address existing and anticipated future needs.

The No Action alternative would result in failure to address anticipated safety, health, welfare, and convenience issues associated with operation of KOA. Facilities which are currently providing acceptable levels of service would eventually become deficient due to wear and/or increased demand. Facilities which are already operating at deficient levels can be expected to require increased maintenance and eventually, replacement. Continued operation of deficient facilities or their failure could also lead to safety and health hazards for both the operators of KOA and the traveling public.

Anticipated impacts associated with the "No Action" alternative include but are not limited to the following:

- Overseas Terminal (OST) - The current OST utilizes a temporary outdoor tent type of structure to house Federal Inspection Services (FIS). Although this facility is currently adequate, it is expected that with increasing growth of domestic and overseas arrivals that there will be a commensurate increase in delays and inconvenience for travelers. The resulting inefficiency of operations from the continued combining of OST operations within the terminal area shared with domestic and interisland air travelers is further expected to result in congestion, delays, inconvenience, and increased safety problems.

- Wastewater Treatment Plant - The existing Wastewater Treatment Plant is already operating beyond its design capacity. Further reliance on the existing facility would eventually result in decreased performance, breakdowns, and failure of the system to adequately treat effluent. It is expected that as passenger levels continue to increase in the future, that recurring breakdowns of the system would lead to an eventual shutdown due to health and safety concerns of the State Department of Health, and County of Hawaii. In addition, there will still be a need to provide the public with an interim portable toilet or wastewater treatment system. The cost of providing these services would likely be higher and for a greater period of time, than if a new wastewater treatment plant were to be developed.

- Air Traffic Control Tower (ATCT) - The existing ATCT will require replacement due to the need to maintain adequate sight distances for aircraft using the runway. The lengthening of the runway from 6,500 feet to 11,000 feet has allowed for an increase in the size of aircraft capable of using Kona International Airport at Keahole. The 4,500 foot runway and taxiway extension was added to the northern end of the existing runway and taxiway. This northward runway/taxiway extension, along with the increase in the size of aircraft using the airport, results in the existing ATCT being in a less than optimum location to maintain an adequate line of sight to the aircraft using the runway/ taxiway. Therefore, an ATCT in a location with better view planes, unobstructed by taxiing aircraft, is required to maintain safety and efficiency of operations. It can be expected that the no further action alternative would result in an eventual safety compromise with increasing use of larger overseas capable aircraft such as DC-10, L-1011, B-747, B-767, B-777, and comparable foreign type aircraft.

- Relocation of various airport facilities including: General Aviation (GA), Air Tour Terminal, Heliport - The KOA Master Plan Update proposes to relocate these facilities to increase efficiency of movement of aircraft, goods, services, and people. It is expected that with no further action there will continue to be both inefficient movement, as well as continued inadequate conditions in locations such as: 1) GA area, where there is a need to provide for 12 additional aircraft parking spaces and more hangar space by 2015; 2) Air Tour Terminal area which has inadequate conditions including limited plumbing and automobile parking only on gravel areas; and, 3) Heliport facility which is currently at the south end of the terminal complex, where there is greater potential for conflict with the nearby air tour facility as well as larger passenger aircraft. The no action alternative would maintain the current condition of these facilities.

- Airfield Improvements including Itinerant Aircraft Parking, Ramp "K", and Overseas Apron - Itinerant aircraft must currently park on the paved area north of the Aloha/United apron where there is increased possibility for congestion with limited maneuvering space for aircraft. The KOA Master Plan Update proposes to relocate this use on an area of approximately 6-acres adjacent to Ramp "K", south of the cargo area. Ramp "K" is proposed to help with consolidation and servicing of the FBO, Air Tour, GA and Itinerant Aircraft Parking area. The Overseas Apron will be similarly constructed in preparation for development of the Overseas Terminal.

  The No Action Alternative would negate development of these facilities to improve efficiency and improve use of space at KOA.

The net effect of the No Action Alternative could also indirectly affect the growth of the Kona district since no further improvements would lead to increased delays, loss of operational efficiency, and possible health, safety, and welfare problems for the general public. The existing facilities would not be able to accommodate the projected increase in population and growth of the tourist industry. Non-expansion would also limit the amount of people and goods traveling through Kona.

SECTION 5
ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION - PHYSICAL ENVIRONMENT

5.1 GEOGRAPHY AND CLIMATE

KOA is located on the western edge of Hualalai mountain and consists almost entirely of a'a and pahoehoe lava flows created during the eruption of 1801. Average slope at this site is less than 5 percent. Elevation at the Queen Kaahumanu Highway is approximately 130 feet above mean sea level. Elevation of the runway at its high point is 47.22 feet.

Regional and local climatology significantly affect air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout the State and most of the year, significant differences in these parameters may occur from one location to another. Most regional and local climate differences within the State are caused by mountainous topography.

The climate on the northwest side of the Island of Hawaii is influenced more by local heating and cooling of the ground than by the effect of tradewinds prevalent in the rest of the State. This is characteristic of the Kona area which experiences a diurnal, land/sea wind pattern. Normal tradewinds are blocked by the mountain masses of Mauna Kea (13,784 feet above MSL), Mauna Loa (13,680 feet above MSL), the Kohala Mountains, Kilauea, and Hualalai (8,251 feet above MSL). During the day, the land is warmer than the ocean and the resulting pressure gradient causes winds to blow from the ocean towards the land. In the evening the reverse occurs and as the land cools, the evening and night breezes blow from the land towards the warmer ocean.

Average annual rainfall in the area is less than 25 inches along the coastline and temperatures average about 75 degrees Fahrenheit. The heaviest rains are brought by winter storms during the October to April season (Atlas of Hawaii, 1983).

Evaporation rates are typically high, in the general range of 0.18 inches per day during winter and 0.36 inches during summer as measured at Anaehoomalu. There are no pan evaporation measurements for the Keahole area.

5.2 LAND OWNERSHIP AND LAND USE

Keahole Airport was constructed in 1970 at a considerable distance from existing commercial, resort, and residential developments. At that time, the surrounding land was designated in the State Conservation District and zoned by the County of Hawaii as Open or Unplanned. In recent years although residential, commercial, and industrial development has slowly occurred in the adjoining areas, the vicinity of the airport has largely remained in an undeveloped state.

5.2.1 LAND OWNERSHIP AND LEASES

The land on which KOA is located is owned by the State of Hawaii, DOT-A, and includes sections of the following ahupuaas west of Queen Kaahumanu Highway: Ooma, Kalaoa, Hamanamana, Haleohiu, Kau, Puukala, Awalua Ohiki, and portions of Kaulana, and Mahaiula. The gross area of airport land is 4,244.1 acres (less an exclusion area of 40 acres equals 4,204.1 acres, Survey of Keahole Airport, April 30, 1985). The total net area available for airport use is 3,407.18 acres: approximately 421.12 acres to the south have been leased to the Hawaii Ocean Science and Technology (HOST) Park; 321.80 acres to the west have been leased to the Natural Energy Laboratory of Hawaii (NELH); 50 acres have been set aside to Department of Land and Natural Resources (DLNR) by a 1984 Triparty Agreement between the State Department of Transportation (DOT), DLNR, and Department of Hawaiian Home Lands (DHHL); and 4 acres have been set aside for a U.S. Postal Service facility.

Table 5-1 identifies the net total acreage available for airport use. Land owners are identified in **Figure 5-1.**

Most of the land at KOA is ceded with the exception of the Puukala ahupuaa (**Figure 5-1**). Land in the Puukala ahupuaa is non-ceded.

TABLE 5-1

NET ACREAGE AVAILABLE FOR AIRPORT USE AT KOA

Description	Date of Execution	Acreage
DOT - Governor's Executive Order 3074 Airport and Energy Research Use	8/20/81	Gross DOT Area = 4,244.10 Net DOT Area = 4,204.10
General Lease S-5157-High Tech. Dev. Corp. Hawaii Ocean Sciences Tech. (HOST) Park	9/18/87	421.12 acres leased from DOT
General Lease S-4714 - Natural Energy Laboratory of Hawaii (NELH)	3/9/84	321.80 acres leased from DOT
1984 DLNR Triparty Agreement	Executing	Withdraw 50 acres from DOT to DLNR
Land Exchange Agreement with U.S. Postal Facility (USPS)	12/18/92	Withdraw 3 acres from DOT for U.S. Postal Facility
Quitclaim Deeds Doc. Nos. 95-070569 & 95-070571	5/24/95	Cancel USPS land exch. agreemt. for 3 ac. & permit withdrawal of 4 acres from DOT for U.S. Postal Facility

NET TOTAL ACREAGE AVAILABLE FOR AIRPORT USE = 3,407.18 Acres

5.2.2 EXISTING SURROUNDING LAND USES

According to the 1989 West Hawaii Regional Plan, there is a major cluster of resorts in the project area referred to as "Resort Destination Node" (**Figure 5-2**). This area is called the "Keahole-Keauhou Node" and includes the following places: Ooma II; Kohanaiki; Kailua-Kona; and, Keauhou. The Resort Destination Node concept is intended to cluster resort development to permit economies of scale in providing infrastructure and delivering public and private services to visitors and residents. Individual developments within this node, however, are still subject to applicable State and County guidelines.

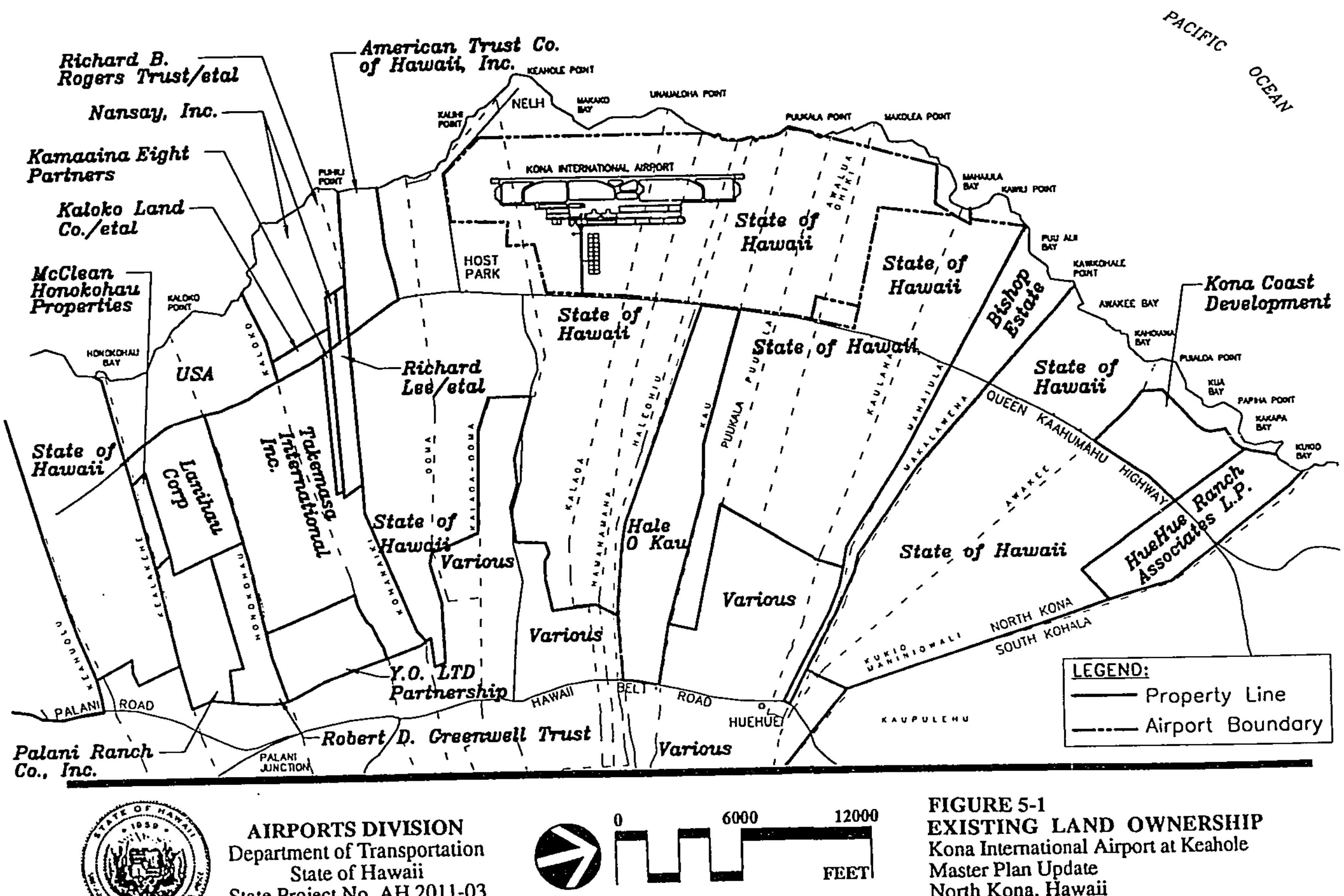

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FIGURE 5-1
EXISTING LAND OWNERSHIP
Kona International Airport at Keahole
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North Kona, Hawaii

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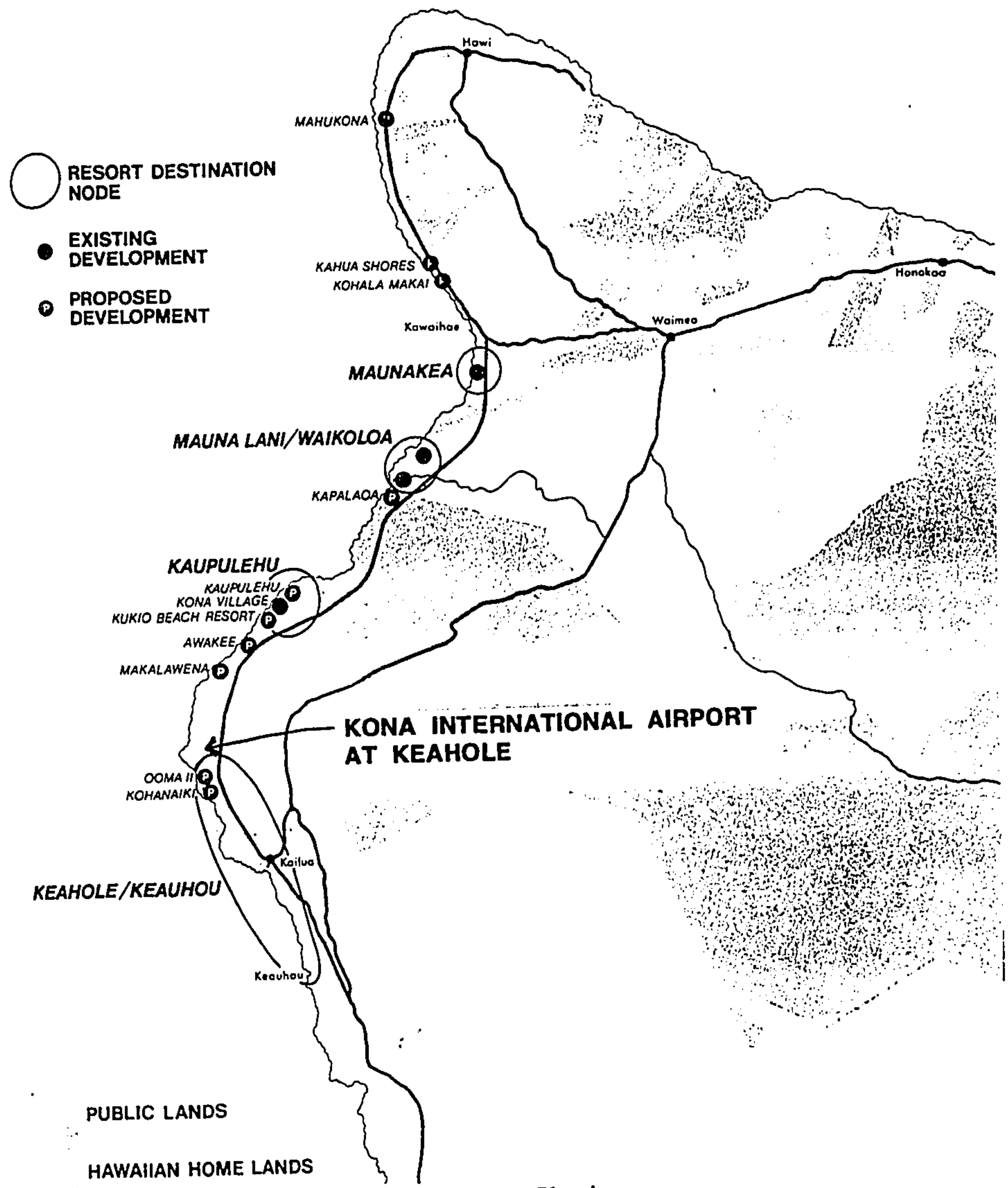

SOURCE: West Hawaii Regional Plan, 1989, Office of State Planning.

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FIGURE 5-2
RESORT DESTINATION NODES
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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Existing land uses surrounding KOA are shown in **Figure 5-3**. Three residences and part of the Keahole Agricultural Park lie within a one mile radius of the airport air traffic control tower. The next closest developed areas are the NELH facilities at Keahole Point and the HOST Park. The NELH facilities are 1.2 miles from the tower and approximately 4,000 feet west of the southern end of the runway.

NELH is a unique, internationally recognized facility. Research and commercial tenants from the corporate, academic and government sectors lease space at this site to investigate ocean and solar related technologies. The HOST Park provides an opportunity for research, development, and/or production in the following areas: astronomy, software development, renewable energy, oceanography, aquaculture, electronic design and assembly, biotechnology, telecommunications, pharmaceuticals and tropical agriculture.

The American Trust Company of Hawaii has applied for an Urban land use classification of its Ooma II lands southeast of the airport. The application was denied by the State Land Use Commission and is considered to be inactive at this time.

Nansay Incorporated received Urban classification of their Kohanaiki Resort lands southeast of the airport by State Land Use Commission Decision and Order for Docket No. A86-599 on January 30, 1987. One of the conditions imposed by the State Land Use Commission was the granting of a perpetual easement on portions of the resort lands. Currently, there are three easements that allow for aircraft noise levels ranging between 60 to 70 DNL on specified portions of the resort lands. The resort will also provide the necessary sound attenuation treatments to structures housing noise sensitive uses so as to not exceed 45 DNL.

Lands to the north of the airport boundary are primarily State-owned and administered by the Department of Land and Natural Resources (DLNR) with the exception of Makalawena, which is owned by the Bishop Estate. These areas are considered to be a recreational area. The park boundary extends in a northerly direction, west along the Queen Kaahumanu Highway and stretches from Mahaiula to Kiaua Point. The park does not extend east from the highway. Public access is available through Makalawena. DLNR eventually hopes to obtain this land in the future either by purchase or land exchange with Bishop Estate. A similar issue was just resolved between DLNR and Kona Coast Development.

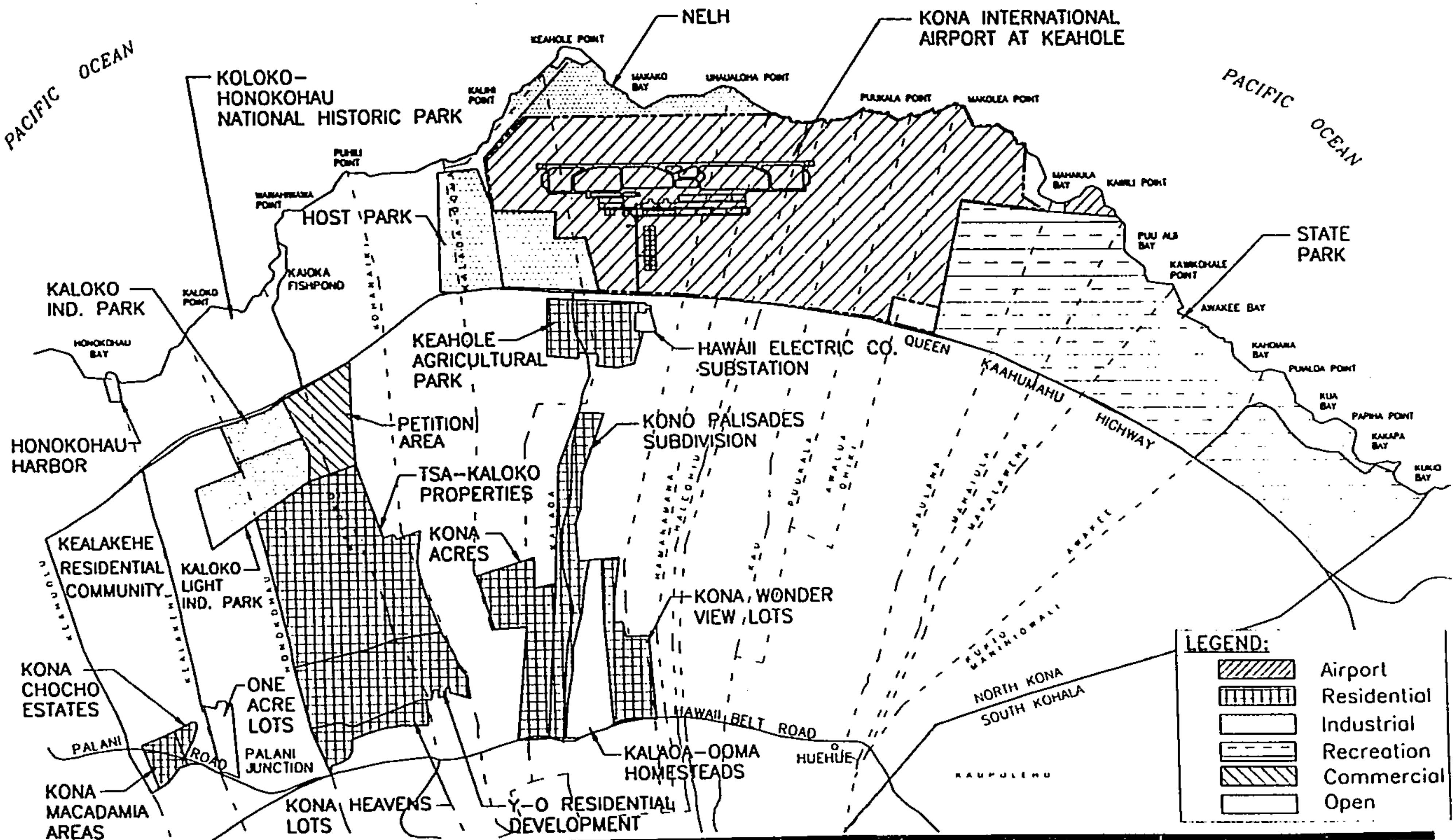

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FIGURE 5-3
EXISTING LAND USE
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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The closest subdivision is the Kona Palisades Subdivision which is approximately 1.8 miles east of the air traffic control tower. Other developed areas in the vicinity of the airport include the Kaloko Industrial Park and Honokohau Harbor, both located south of the airport at a distance of approximately 3.4 miles and 3.9 miles, respectively.

5.2.3 STATE LAND USE

The State Land Use classification for KOA and areas surrounding the airport are shown in **Figure 5-4.** The airport property is divided into two State land use classifications: Urban District and Conservation District. The airport roadways, terminal area, and runways are classified as State Urban and encompasses approximately 548 acres. NELH and the HOST Park are also in the State Urban classification.

Lands to the north of the airport and to the east and west of the runway and terminal area are State Conservation land. Lands to the east of Queen Kaahumanu Highway and the site of the Keahole Agricultural Park, are in the State Agricultural classification. Although not now required, future development of a parallel runway west of the existing runway will eventually require an amendment to the State Land Use District designation as well as a change in County zoning.

A. Impacts

No adverse impacts are anticipated since a change in the State Land Use district designation will not be required.

The proposed future development of a parallel runway and the resulting change in State land use classification is similarly not expected to result in potential for adverse environmental impacts. KOA is well established as the major land use in the region since the airport was constructed in 1970. Large land areas surrounding KOA have remained in open space to fulfill FAA regulatory requirements, maintain safety, and provide for future airport expansion. Should construction of a second parallel runway be required, the proposed use will be in an open area that has already been set aside for safety and regulatory purposes. Use of this land for a second runway, therefore, would remain consistent with airport activities in the urban district.

B. Mitigation

Mitigation measures are not required.

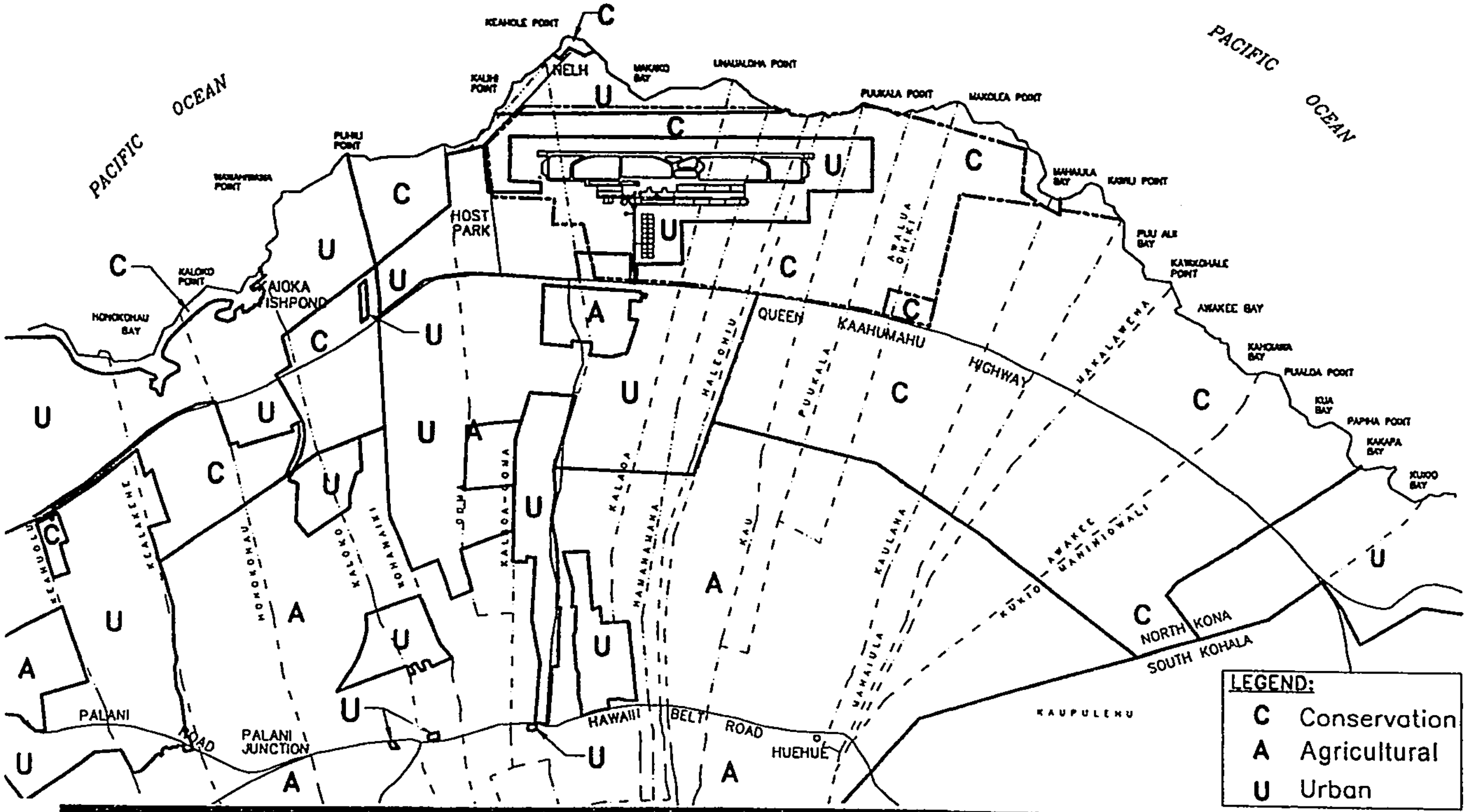

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FIGURE 5-4
STATE LAND USE CLASSIFICATION
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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AUG 2000

5.2.4 COUNTY ZONING

The 1989 runway extension initiated a change of County zoning from Open (O) to General Industrial (MG-1a). County zoning for the area surrounding the airport is shown in **Figure 5-5.** None of the land surrounding the airport had been zoned for resort or residential uses, however, a few small areas south of the airport have recently become zoned for a variety of multi-family residential, commercial, industrial and resort uses.

Although not now required, future development of a parallel runway will require a change of zone from O to MG-1a. This change will require a corresponding State Land Use amendment from Conservation to Urban.

A. Impacts
No adverse impacts are anticipated since a change of zone will not be required.

B. Mitigation
Although mitigation measures are not required, it is recommended that State and County government officials be advised that land uses affected by aircraft noise continue to be limited to those which are compatible with an airport facility. This will facilitate the long term preservation of lands surrounding KOA for airport planning purposes.

5.3 NATURAL HAZARDS

The potential natural hazards to which the airport vicinity could be subjected include earthquakes and volcanic eruptions. The Island of Hawaii is classified as Seismic Risk Zone 3, based on a scale of 1 to 4, four being higher; therefore, risks to life and property are present at the airport site. According to the Atlas of Hawaii, 1983, "Since 1925, seven earthquakes with magnitude greater than 5.3 have occurred on the Big Island. In 1951 a magnitude 6.8 earthquake originated on the Kealakekua fault, just off the Kona Coast of Hawaii. The greatest Hawaiian earthquake of historic time occurred in April 1868. It was estimated to have had a magnitude of 7.25 to 7.75 on the Richter scale at its epicenter along the Kau District Coast".

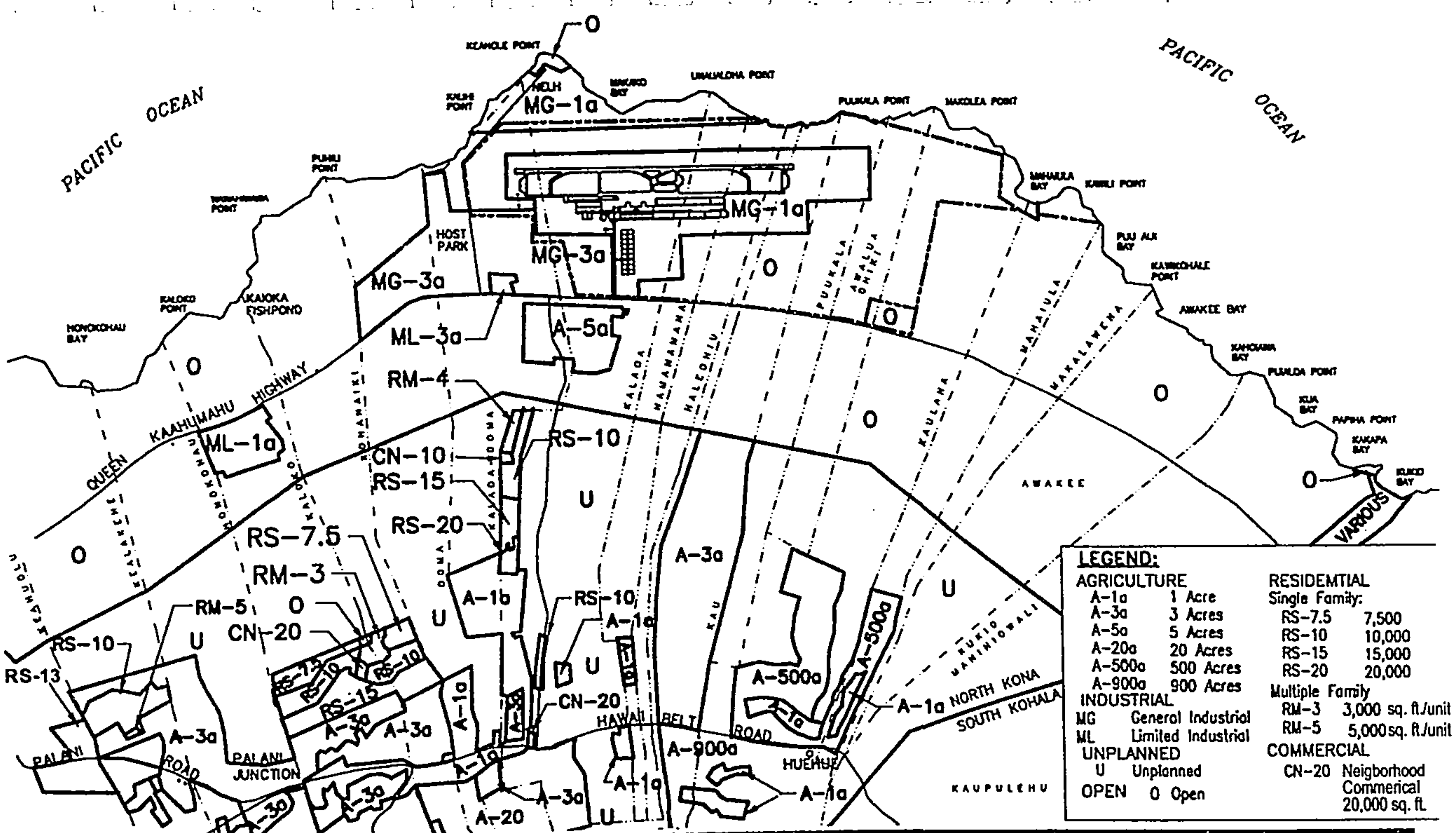

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FIGURE 5-5
COUNTY ZONING
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

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JAN 1999

Volcanic hazards in the area have also been studied in detail (Mullineaux et. al., 1987). The last volcanic eruption of Hualalai that affected the area surrounding the airport occurred in 1800-1801. Lava emerged from the northwest volcanic rift zone at about the 1,600-foot elevation, in the vicinity of Puhi o Pele Cinder Cone, just makai of Mamalahoa Highway, creating a flow that entered the ocean north of Keahole Point.

The airport is located outside of any floodway or flood fringe zones as described by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). The terminal buildings at the airport are outside the evacuation zone for tsunami hazards. The limits of the evacuation zone are west of the existing runway.

A. Impacts

Risks to life and property caused by a natural disaster such as an earthquake are present at this site.

B. Mitigation

Structures built in this earthquake zone are subject to seismic provisions of the Uniform Building Code of the County of Hawaii. Structures shall be designed and constructed to resist stresses produced by lateral seismic forces. For example, masonry or concrete structures shall have the principal reinforcement spaced not more than 2 feet on center using frames designed to carry all vertical loads. The frames will have joints capable of resisting forces by bending.

5.4 GEOLOGY AND SOILS

The U.S. Department of Agriculture Soil Conservation Service has classified the soil type at KOA as a'a (rLV) and pahoehoe (rLW) lava flows. A'a lava is found at elevations ranging from near sea level to 13,000 feet and receives from 10 to 250 inches of rainfall annually. It is associated with pahoehoe lava flows and many soils. A'a is rough and broken with the consistency of clinkery, hard, glassy pieces piled in tumbled heaps (Soil Conservation Service, 1973).

Pahoehoe lava is also found at elevations ranging from sea level to 13,000 feet. The annual rainfall ranges from 10 to more than 140 inches. This lava type has a billowy, glassy surface that is relatively smooth. In some areas the surface is rough and broken, with hummocks and pressure domes.

Pahoehoe lava has no soil covering and is typically bare of vegetation. In areas of higher rainfall, however, scattered plant types including ohia trees, ohelo berry, and alii will gain a foothold in the cracks and crevices. Some flat slabs of pahoehoe are used on building facings and fireplaces (Soil Conservation Service, 1973).

Both a'a and pahoehoe lava flows have little to no soil covering and are virtually devoid of vegetation except for mosses, lichens, ferns, and a few small ohia trees. Lavas in the KOA airport environs are generally devoid of mosses and lichens, although some sprouting of ohia and ferns were discovered in various locations including lava tubes.

The Land Study Bureau Detailed Land Classification Report for the Island of Hawaii has designated the land at the airport as Class E; lands that are very poor and least suited for agriculture.

A. Impacts
There is a possibility of encountering lava tubes within the rLV and rLW soil types. Existing lava tubes pose a threat to life and property in the event the tubes collapse during excavation and construction.

B. Mitigation
Development within the airport boundaries should not be hindered by any significant construction constraints. Soil testing and borings should be made prior to design and precautions should be taken while grading in the event that lava tubes are discovered.

5.5 FLORA

A botanical survey of the undeveloped portions of the Urban designated lands at KOA was undertaken on November 20 and 21, 1999. Fountain grass and scrub vegetation was found to cover large parts of the airport property, while ruderal or weedy vegetation occurs on areas which have been graded or disturbed (Botanical Survey, Kona International Airport at Keahole, North Kona, Hawaii, February 2000, see Appendix A).

"A total of 67 plant species were found. Of these, 52 (78%) are introduced; 2 (3%) are originally of Polynesian introduction; and 13 (19%) are native. Ten of the native species are indigenous (native to the Hawaiian Islands and elsewhere), while three are endemic (native only to the Hawaiian Islands). None of the plants is a threatened and endangered species. Two of the endemic plants, the maiapilo or native caper (*Capparis sandwichiana*) and *Fimbristylis hawaiiensis*, are considered species of concern, but these are not high priority species of concern and the populations number in the thousands" (Ibid, February 2000).

Native and endemic species identified on site include the following:

Native Hawaiian or Indigenous Species

Moa (*Psilotum nudum*)
Koali 'awa (*Ipomoea indica*)
Naupaka (*Scaevola sericea*)
Spurflower or 'ala'ala wai nui pua ki (*Plectranthus parviflorus*)
'Ilima (*Sida fallax*)
'A'ali'i (*Dodonaea viscosa*)
Naio (*Myoporum sandwicense*)
'Uhaloa (*Waltheria indica*)
Fimbristylis cymosa
Pili grass (*Heteropogon contortus*)

Native Only to Hawaii or Endemic Species

Nehe (*Lipochaeta lavarum*)
Maiapilo (*Capparis sandwichiana*)
Fimbristylis hawaiiensis

"The proposed uses for the undeveloped portions of the Urban designated lands are not expected to have a significant negative impact on the botanical resources as the majority of the plants which occur on the site are introduced species. There are no sensitive, native plant-dominated vegetation types or threatened and endangered species on the project site. All of the native plants can be found in similar dry lowland areas on Hawai'i island and the other islands" (Ibid, February 2000).

"It is recommended that whenever and wherever possible, native plants be used for landscaping the new facilities. Plants native to the West Hawai'i region are adapted to the lava substrate and low rainfall; they would require less water, soil, and maintenance. An anchialine pond bordering the

Urban designated lands, just outside the runway fence line on the south end of the runway, should be avoided if any future use is planned for this area" (Ibid, February 2000).

A. Impacts

None of the plant species identified during the botanical survey are listed as threatened or endangered. While most of the plant species found at KOA are introduced, native species which occur on the site can be found in similar lowland environments elsewhere on the Big Island and the other Hawaiian Islands. The proposed use of the undeveloped portions of the State Urban district lands therefore, should not have a significant negative impact on botanical resources.

B. Cumulative Impacts

The proposed project will result in additional new landscaping with introduced, exotic species. This will expand and diversify the existing flora. Use of native plant materials to supplement the existing landscaping effort will be considered.

C. Mitigation

No further mitigation measures are expected or required, the February 1999 botanical study, however, recommends that native plants be used for landscaping wherever possible. Native plant species specifically adapted to the low rainfall and volcanic substrate conditions at Keahole include:

Maiapilo (*Capparis sandwichiana*) - a bushy shrub with attractive and fragrant flowers.

Nehe (*Lipochaeta lavarum*) - a small, sprawling shrub with silver gray leaves and large, yellow, daisy-type flowers.

naio (*Myoporum sandwicense*) - a large shrub to small tree with glossy green, almost succulent leaves and white to pinkish, fragrant flowers. Also known as false sandalwood because of its fragrant wood.

'A'ali'i (*Dodonaea viscosa*) - a rounded shrub with glossy yellowgreen leaves; the fruit is a showy, reddish-brown, papery capsule often used in lei making.

Other plants found within the region which should also be considered include:

Loulu palm (*Pritchardia affinis*)
Hala pepe (*Pleomele hawaiiensis*)
'Ohe (*Reynoldsia sandwicensis*)

5.6 FAUNA

A faunal survey of the project site was conducted on December 7 and 8, 1999 (Faunal Survey of Avian and Mammalian Species, Kona International Airport at Keahole, February 2000, see Appendix B). The purpose of the survey was to determine presence of any federally listed endangered, threatened, proposed, or candidate avian or mammalian species on, or in the immediate vicinity of the KOA facility. The probability of use of the site by listed species was also assessed given the habitat available.

The study encompassed the area within KOA and within an elevation range between ±6 m to ±43 m relative to mean sea level (MSL).

The results of the survey indicated only one mammalian species which included several small Indian mongooses (*Herpestes a. auropunctatus*). The survey also encountered skeletal remains of two feral goat (*Capra h. hircus*) and one domestic cow (*Bos taurus*). Scat of domestic dog (*Canis f. familiaris*), cat (*Felis catus*), donkey (*Equus a. asinus*) as well as that of goat was encountered in numerous places within the site. No live rodents were detected during the survey; however, it is likely that roof rats (*Rattus r. rattus*), Norwegian rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) utilize various habitats within the site. Without a trapping program, it was difficult to assess population densities of these often hard-to-see mammals. All of these introduced mammalian species are deleterious to avian populations. Hawaii's sole endemic terrestrial mammalian species, the endangered Hawaiian hoary bat, or `Ope'ape'a, was not detected. (Ibid, February 2000).

A total of 14 avian species were detected. The only native species recorded was the Pacific Golden-Plover (*Pluvialis fulva*), a common indigenous migratory species which was seen close to the south ramp area. All of the other 13 species recorded are considered to be alien to the Hawaiian Islands.

The most common species recorded was the House Sparrow (*Passer domesticus*). This commensal alien species nests and feeds within the airport structures.

All avifauna detected are common species found throughout the leeward lowland areas of the Big Island. No endangered or threatened avian species were detected within the KOA site. The findings of both the avian and mammalian surveys were consistent with the present habitat available within the KOA boundary. The findings of the mammalian survey are also consistent with other surveys conducted within the lowland areas of North Kona within the recent past (David 1995a, 1995b, 1999, 2000). It is likely that Hawaiian hoary bats overfly the airport facilities upon occasion, as they have been seen in numerous lowland areas in North Kona on a seasonal basis (David 1993, Jacobs 1994, R. David unpublished field notes 1975-1999).

There is a small anchialine wetland system (26 x 19 meters) located approximately 48 meters east of the southwest fence corner at the southern end of the runway (see Appendix B for figure). Brackish water is located in an extensive crack system around the edge of a pahoehoe depression, which shows signs that it holds water following either very high tides or extensive rains. The vegetation at the edges of this wetland was made up mainly of a wetland facultative (F+) indigenous (native to, but also found elsewhere) sedge species *Fimbristylis dichotoma*.

According to the faunal survey a one time survey cannot provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations combined with usage and availability of resources will cause different use patterns throughout the year or, over a number of years. The airport site and most of North Kona is also experiencing drought conditions which have persisted for the last 3 years. This condition has severely affected many of the lowland alien avian species normally present in the area.

Habitat found on the site and within fountain grass dominated lowland areas in North Kona do not provide the resources necessary for the sustenance or nesting of native avian species. In a wetter year it is expected that additional resident avian alien species will utilize the existing habitat within the project site. It is likely that following further development, and the installation of irrigated landscaping that many of the commonly occurring alien species currently found in North Kona will be recorded. If lawns, parking lots and other open areas are created it is likely that these features will also attract a number of migratory shorebirds between the months of September and May each year. Many of the more than 80 species of migratory and extralimital avian species which have been recorded from Hawaii have been recorded from coastal areas in North Kona (Pyle et al. 1988, David 1991b, Pyle 1992, 1997).

A. Impacts

No Federal or State of Hawaii listed threatened or endangered vertebrate species were observed on the KOA property. The anchialine pond located at the south end of the runway fence will remain in an undisturbed condition to ensure no potential for negative adverse impacts associated with development.

A number of avifauna species could be negatively affected by future development of both airport facilities as well as the surrounding Natural Energy Laboratory of Hawaii (NELH)/Hawaii Ocean Science and Technology (HOST) park facility.

Although not detected during this survey, the endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*) has been recorded within the existing airport boundaries. Given that aquaculture operations are continuing to expand within the NELH facility, and Cyanotech Corporation is being required to continue managing habitat to increase the production of stilts, there will continue to be potential for bird air strike hazard (BASH) incidents involving endangered Hawaiian Stilt, endangered Hawaiian Coot (*Fulica alai*), and any number of migratory waterfowl and shorebird species which are being attracted to the NELH/Cyanotech mitigation ponds. The small wetland (anchialine pond) located outside the existing perimeter fence supports at least one species of Hawaiian anchialine shrimp, (*Halocardina rubra*), or `opae'ula. This is one prey items that Hawaiian Stilt travel distances to exploit. It is probable that as the population of stilt increase within the aquaculture farms that they will "discover" this food resource, putting more birds in the direct path of aircraft approaching or climbing away from the southern end of the main runway.

It is also possible that the endangered endemic Hawaiian subspecies of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), or Ua'u over-fly the airport facilities between the months of May and October (Banko 1980, Harrison 1990). This pelagic nocturnal seabird species was formerly common on the Island of Hawaii (Wilson & Evans 18901899), and reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea

(Henshaw 1902), as well as the mid to high elevations of Mount Hualalai. It has within recent historic times been reduced to relictual breeding colonies located at high elevations on Mauna Loa and possibly Mount Hualalai (Banko 1980, Harrison 1990, Cooper & David 1995, Cooper et al. 1995, R David Unpublished Field Notes 1986-1995, 1999).

The primary cause of mortality in Dark-rumped Petrels is thought to be predation by alien mammalian species at the nesting colonies (Day and Cooper 1998, Cooper and Day 1994). Collision with utility structures is considered to be the second most significant cause of mortality in Hawaii. Nocturnally flying seabirds, especially fledgling birds, can become disoriented by exterior lighting on their way to sea in the Summer and Fall. When disoriented, seabirds often collide with manmade structures and, if not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Ainley and Podosky 1993, Ainley et al. 1994, Cooper and Day 1994, Day and Cooper 1997, Cooper and Day 1998, Podolsky et al. 1998). There is no suitable nesting habitat within the project site for this species.

The principal potential impact that further development of airport facilities poses to Dark-rumped Petrels is the increased threat of the downing of birds disoriented by exterior lighting which may be required in conjunction with further expansion of the airport.

B. <u>Cumulative Impacts</u>

Foreign avian, mammal, and reptile species associated with urbanization are expected to increase in numbers with the development and landscaping of the airport property. While State and federally listed threatened and/or endangered species are not currently found within KOA development of both the airport and adjacent facilities including NELH are expected to contribute to the incidence and frequency of visits by Hawaiian Stilt and Coots. Further development of the terminal area may also result in potential for increased downing of nocturnal seabirds by increased use of exterior lighting at KOA.

C. Mitigation

It is anticipated that with increased landscaping of the terminal and surrounding airport area that there will be a commensurate increase in the avifaunal population. While no adverse impacts are anticipated to foreign exotic or introduced species, state and federally listed threatened and endangered species such as the Hawaiian Stilt and Hawaiian Coot may be affected. Continued use of adjacent facilities including NELH are expected to increase the frequency of visits by such species. Mitigation measures to reduce the potential for adverse impacts include the following:

1. Mitigation ponds were earlier constructed by NELH/Cyanotech Corporation to reduce the incidence of avifauna foraging at commercial ponds. Construction of the mitigation ponds have since encouraged use by both introduced as well as threatened and endangered species. It is recommended that NELH/Cyanotech Corporation consider relocation of the mitigation pond to an alternative location such as within the Kona Sewage Treatment Plant facility or within the Kaloko-Honokohau National Historical Park, at Aimakapa Pond. As noted in the Faunal Survey, the development of new alternatives to fulfill responsibilities in accordance with the Endangered Species Act of 1973, as amended, should involve the U.S. Fish and Wildlife Service (USFWS) and an objective non-agency biologist. As required, DOT-A would assist with the coordination of this effort.

2. Even with removal of the mitigation ponds the existing NELH/ Cyanotech Corporation commercial ponds are expected to continue to be a source of attraction to passing avifauna. DOT-A will coordinate with NELH to encourage the development of hazing protocols to make the existing aquaculture ponds less attractive to passing wetland associated avifauna.

3. Because there is the potential for bird/aircraft collisions mitigation that will continue to be carried out by DOT-A will include use of the FAA, Wildlife Hazard Management Plan for KOA (see Appendix) (Federal Aviation Regulations, Part 139.337). The Wildlife Hazard Management Plan provides for FAA to arrange for an ecological study whenever any of the following

conditions occur: (1) Any aircraft experiences a multiple bird strike or engine ingestion on the airport or on final approach or departure; (2) Any aircraft experiences a damaging collision with wildlife other than birds; and, (3) Wildlife of a size and in number capable of causing an event such as No. 1 or No. 2, and is observed to have access to any airport flight pattern or movement area.

The FAA Administrator will consider a number of factors including the completed ecological study, views of airport users, and regulatory agencies, prior to determining an appropriate course of action.

Unwanted interactions between the airport facility and nocturnal avian species overflying the facility will continue to be addressed through use of shielded exterior lighting. The purpose of shielded lighting will be to protect overflights of nocturnal species such as the Dark-rumped Petrel and to reduce unwanted glare which would affect the operations of the Mauna Kea observatories.

5.7 NOISE

A FAR Part 150 Noise Compatibility Program Report (NCPR) was prepared by Y. Ebisu & Associates (Final Report, December 1997. According to the NCPR, there are no existing incompatible land uses within the 5-year Noise Exposure Map for the Kona International Airport at Keahole. Corrective noise measures, therefore, are not required. However, because of potential for increased noise in the airport sideline areas, the NCPR recommends: 1) 68% of all night departures should use Runway 35, and 32% use Runway 17 (Option T5); and, 2) all nightime departures should use the Golf intersection as the starting point for aircraft takeoff (Option T6). At this time DOT-A is considering further emphasis on limiting land development in the airport environs as a means of addressing the above voluntary restrictions on aircraft operations. This would include imposing further limitations on potential noise sensitive uses on industrial and commercial leased, and undeveloped lands surrounding the airport. This would be in addition to following an existing NCPR recommendation to discourage uses including residences, hospitals, day care centers, churches and schools, from locating within the airport environs.

A. Impacts

According to the NCPR there are no existing incompatible land uses within the DNL 60+ contours. Proposed expansion of facilities at KOA, therefore, should not cause significant aircraft noise impacts to existing land uses or the community.

The proposed Ooma II Resort development to the south has a significant amount of land within the DNL 60+ contours. Should any portion of this land be used for residential development, it will be an incompatible land use due to aircraft generated noise.

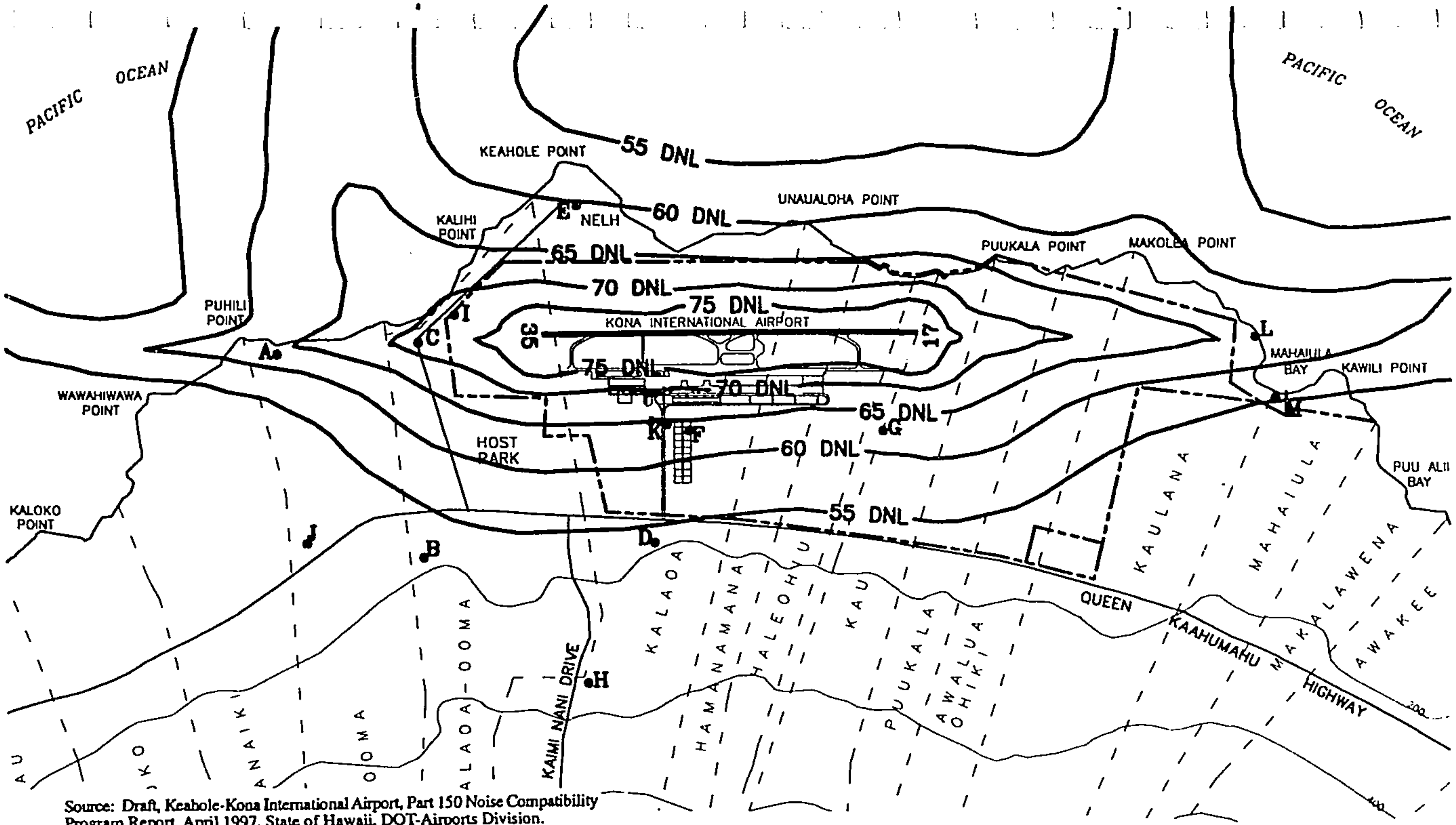
Noise generated from single event overflights of nearby residential developments are likely. Noise generated during construction of the proposed KOA expansion, however, is not likely to adversely affect noise sensitive facilities. This is because of the distance of the airport from any noise sensitive facilities which could be disturbed during construction.

B. Cumulative Impacts

The purpose of the FAR Part 150 Noise Compatibility Program is to disclose airport noise levels, confine the 75 DNL contour to the airport boundaries, and establish and maintain compatible land uses within the airport noise contours. According to the Base Year and Five-Year Noise Exposure Maps (**Figure 5-6 and Figure 5-7**), confinement of the 75 DNL contour and maintenance of compatible land uses are either being met or will not be difficult to achieve by 2001.

C. Mitigation Measures

There are four noise abatement measures that have been recommended as part of the Noise Compatibility Program prepared in conjunction with the 1987 Master Plan. Only the following three recommendations have been approved by FAA on a voluntary basis:



Source: Draft, Keahole-Kona International Airport, Part 150 Noise Compatibility Program Report, April 1997, State of Hawaii, DOT-Airports Division.

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FIGURE 5-6
BASE YEAR NOISE MAP (1996)
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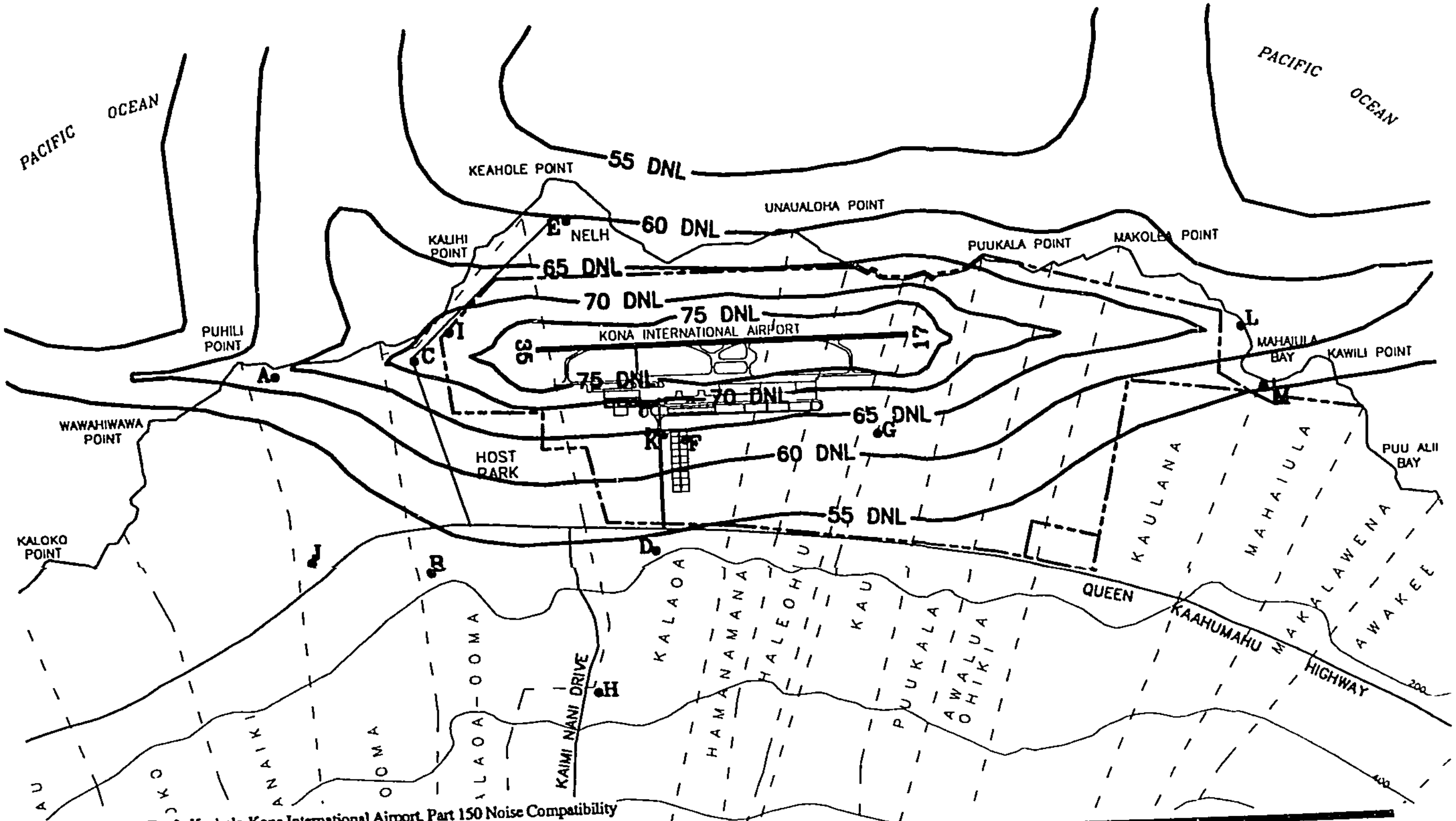

Source: Draft, Keahole-Kona International Airport, Part 150 Noise Compatibility Program Report, April 1997, State of Hawaii, DOT-Airports Division.

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FIGURE 5-7
5-YEAR NOISE EXPOSURE MAP
(2001) NO MITIGATION SCENARIO
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Master Plan Update
North Kona, Hawaii

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- Changing flight patterns by routing aircraft over less sensitive areas can reduce the noise exposure. Air carrier flights from Hilo are sometimes routed between the Kona Palisades and KOA. Aircraft which generally follow the informal noise abatement procedures, however, do occasionally fly too close to the subdivision. The airlines should recommend their pilots use the downwind approach over the ocean, weather permitting and provided that flight patterns do not affect the FAA's ability to properly sequence aircraft in and out of KOA.

- Enforce prescribed flight track use. Adherence to the prevalent flight tracks would result in the least number of people being exposed to high levels of aircraft noise. Some deviations occur on departure of air tour aircraft and result in noise complaints. The State, FAA and aircraft operators have developed informal procedures for air tour aircraft. The aircraft will have a runway heading long enough to reach an altitude of 1,500 feet by the time they are abeam of the Air Traffic Control Tower.

- Limit aircraft types to Stage 3 which are quiet technology aircraft.

Additional voluntary measures have also been identified by the NCPR and include the following:

- Implement and publish an Informal Preferential Runway Use System which favors use of Runway 35 for nighttime departures under calm wind conditions. When nighttime winds and traffic conditions dictate use of Runway 17 for nighttime departures, designate Golf Intersection as the preferential start to roll location.

- Designate current flight tracks as the preferential ingress/egress routes at the airport.

- Publish the Preferential Runway Use System in the State Airport Directory and Flying Safety Manual as well as in the Pacific Chart Supplement. Include a map of the locations of noise sensitive avoidance areas in the publications.

- Continue monitoring of land development proposals in the Kona International Airport at Keahole environs. The State DOT should continue to discourage noise sensitive uses, such as residences, resorts, hospitals, day care centers, churches, and schools from locating within the 60 DNL noise contour of the 1996 Base Year Map, as well as those maps representing forecasted conditions. The DOT would advocate this position through their recommendations during land use deliberations.

- Non-noise sensitive uses, such as commercial and industrial development, should not be discouraged from locating within the 60 DNL noise contour.

- Disclose the Base Year and 5-Year Noise Exposure Maps to the local community by providing overlays of the noise contours on applicable Tax Maps. Also provide the necessary information and tax map overlays in support of the mandatory airport noise disclosure requirements of State Law (Chapter 508D-15, Hawaii Revised Statutes) in all real estate transfers of lands within the airport noise contours.

- Annually monitor aircraft noise levels and operations at the Kona International Airport at Keahole, and conduct Public Informational Meetings on the progress of the FAR Part 150 Noise Compatibility Program.

According to the NCPR, the above recommendations would result in reductions in single event noise levels at various KOA noise monitoring locations (**Table 5-2**). It should be noted that for Calendar Year 2001, no further increases in noise levels are anticipated even under the no mitigation scenario.

TABLE 5-2
CHANGES IN DNL AT MONITORING STATIONS UNDER
SELECTED MITIGATION OPTIONS T5 AND T6: 1996 AND 2001

Noise	Noise Monitoring Locations at KOA												
Time frame	A	B	C	D	E	F	G	H	I	J	K	L	M
Calendar Year 1996 (Base Year)	63.2	51.5	71.8	53.9	60.3	63.2	62.3	45.9	71.7	49.0	64.2	64.5	55.4
Calendar Year 2001 (no mitigation)	63.2	51.4	71.2	53.8	60.2	63.1	62.3	45.9	71.5	48.9	64.1	64.4	55.2
Change from 1996 Base Year	**0.0**	**-0.1**	**-0.6**	**-0.1**	**-0.1**	**-0.1**	**0.0**	**0.0**	**-0.2**	**-0.1**	**-0.1**	**-0.1**	**-0.2**
Option T5	63.2	51.1	70.9	53.5	59.7	62.7	62.8	45.6	70.7	48.6	63.6	64.7	55.8
Option T5 minus Calendar Year 2001 (no mitigation)	**0.0**	**-0.3**	**-0.3**	**-0.3**	**-0.5**	**-0.4**	**0.5**	**-0.3**	**-0.8**	**-0.3**	**-0.5**	**0.3**	**0.6**
Option T6	63.3	51.0	71.4	52.8	59.2	61.8	62.7	45.2	72.3	48.7	62.6	64.7	55.8
Option T6 minus Calendar Year 2001 (no mitigation)	**0.1**	**-0.4**	**0.2**	**-1.0**	**-1.0**	**-1.3**	**0.4**	**-0.7**	**0.8**	**-0.2**	**-1.5**	**0.3**	**0.6**

NOTE: Refer to **Figures 5-6 and 5-7** for locations of noise monitoring stations.

5.8 HAZARDOUS MATERIALS

An Environmental Compliance Audit (ECA) for KOA was completed by Kimura International, in June 1999, and updates the prior ECA completed by Ogden Environmental and Energy Services, 1994.

Administration of the ECA is by DOT-A for the purpose of identifying and determining the regulatory status of DOT-A and airport tenant facilities, and to evaluate the potential for contamination due to past, present, and future activities on airport property. Although tenants are required to comply with State law concerning use, storage, and disposal of hazardous materials in accordance with the terms and conditions of tenant leases, overall responsibility for containment and regulatory compliance is under jurisdiction of DOT-A.

The following is a summary of the major findings of the 1994 ECA. The following facilities are identified as potential generators of hazardous wastes: automobile rental companies, air carriers, aircraft rental and flight instruction, helicopter tours, aircraft fueling operations, ground transportation companies, DOT-A support services including baseyard and operations facility, and the Aircraft Rescue and Fire Fighting (ARFF) Facility.

Each identified facility was evaluated for its compliance with Federal, State, and local regulations under the six listed compliance areas:

- Underground Storage Tanks (USTs) and Above Ground Storage Tanks (ASTs)
- Hazardous Wastes and Used Oil
- Hazardous Materials (e.g. Polychlorinated Biphenyls - PCBs)
- Wastewater
- Spill Control
- Air Emissions

The following is a summary of facilities where tenant education and remedial action are required. Appropriate modifications have been made:

1. USTs and ASTs: **Figure 5-8** identifies current locations with USTs. According to **Figure 5-8,** there are approximately 9 locations with existing USTs.

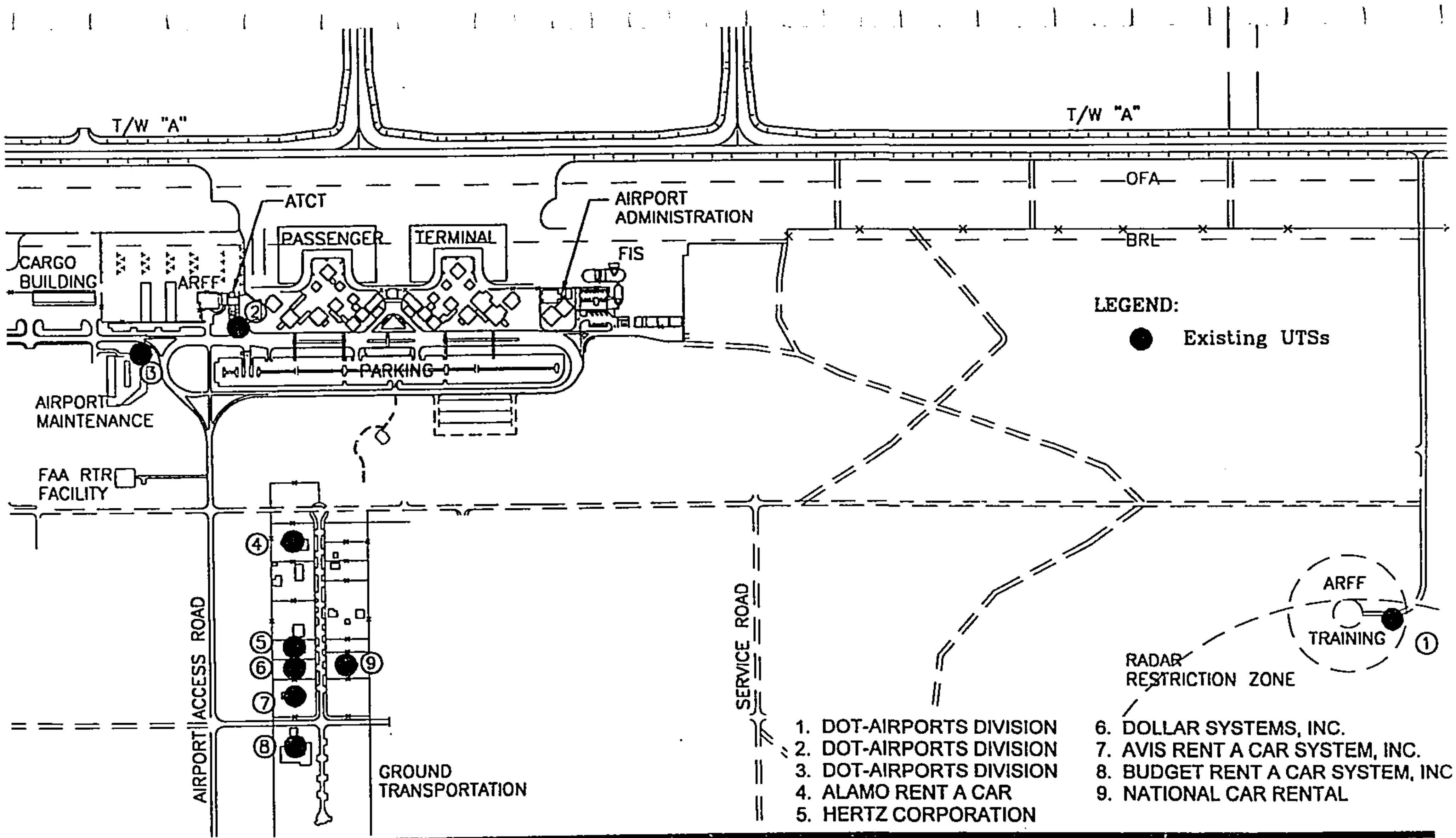

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FIGURE 5-8
EXISTING UNDERGROUND STORAGE TANKS (USTs)
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2. Hazardous Wastes and Used Oil: Typically, facilities at the airport generate only small quantities of hazardous waste. Areas of non-compliance include improper marking, placarding, and accumulation times. Three tenants were identified as not properly disposing of oil or petroleum wastes properly. As noted, the ECA recommendations provided for development of appropriate modifications to ensure proper recordkeeping and disposal practices.

3. Hazardous Materials: Most facilities at the airport store and/or use small amounts of hazardous materials. All tenants who store hazardous materials on-site must submit Material Safety Data Sheets (MSDS) to the airport manager and show proof of employee training in hazardous materials handling and use of required protective measures and equipment. To date, no evidence of manufacturing operations, transformers, or waste materials containing PCBs have been found.

4. Wastewater: According to a representative of the Wastewater Division of the Hawaii County Department of Public Works, the airport is served by private lines and none of the tenants at KOA require or possess National Pollution Discharge Elimination System (NPDES) permits; however, the presence of grease traps, recordkeeping procedures and the likelihood of oil and fuel discharge to the Publicly Owned Treatment Works (POTW) were noted during the facility audits.

5. Spill Control: Secondary containment structures and the preparation of a Spill Prevention Control and Countermeasure (SPCC) plan are specified for bulk storage tanks, such as those at the fuel farm, per 40 CFR 112.7 and 112.3, respectively. Historically, the greatest problem encountered at smaller tenant locations was improper containment and control of oil, especially oily wastes.

6. Air Emissions: None of the tenants are subject to air emission regulations at KOA.

In addition to the items outlined above, asbestos abatement has been completed at several locations within the terminal area. The work primarily involved removal of insulating material below the roof tiles and some floor tiles at various locations. The buildings and areas affected included **(Figure 5-9)**:

Building Nos.
309 - Restaurant
311 - Airline Ticketing
312 - Airline Ticketing
321 - Airline Office
323 - Airline Ticketing
325 - Restaurant
327 - Concessions Area
329 - Baggage Claim
330 - Seating/Telephones

Additional areas including covered walkways and lobbies were also scheduled for asbestos removal depending on whether asbestos containing materials were used in previous construction projects. Once the asbestos containing material was removed, it was bagged and sealed for disposal at an approved facility. The current project was started in November 1998 and has since been completed.

The findings of the 1999 ECA by Kimura International are contained in Appendix D. The findings of the 1999 ECA primarily updates current conditions involving storage, use, and disposal of potentially hazardous materials. As required, appropriate operational practices and measures were implemented to ensure no potential for adverse impacts to the environment.

A. Impacts

No adverse impacts are anticipated from development of the proposed airport improvements. The Environmental Compliance Audit program is intended to provide sufficient information necessary for compliance with existing Federal, state, and local regulations regarding hazardous wastes. Where appropriate, mitigative measures have been proposed and were implemented to ensure no adverse impacts to the environment.

B. Mitigation Measures

Appropriate mitigation measures were developed as part of the prior 1994 ECA. The findings and recommendations of the current 1999 Environmental Compliance Audit has similarly been directed toward each of the six (6) listed compliance areas noted above.

Other projects involving treatment of hazardous materials, such as asbestos or lead abatement, will continue to be provided as required by applicable state and federal regulations governing disposal of demolition wastes from buildings and structures.

5.9 WATER QUALITY

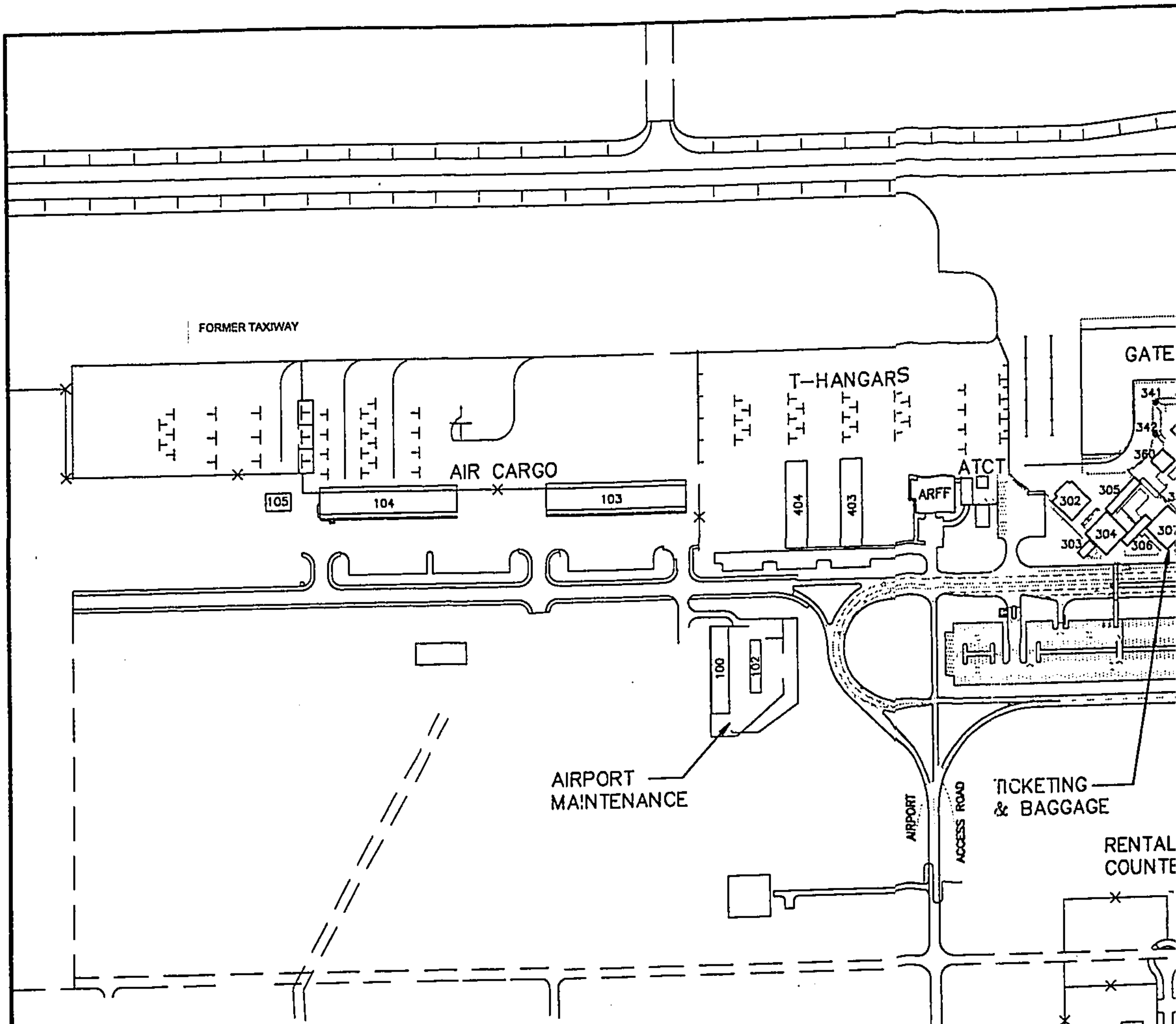
5.9.1 SURFACE AND GROUNDWATER RESOURCES

There are no fresh water perennial or intermittent streams located within or within the immediate vicinity of KOA. This can be readily explained by the location of the airport over a large lava flow. Stormwater runoff generated from the airport is subject to rapid percolation through the a'a and broken portions of pahoehoe lava flows. The area is not classified as a groundwater recharge area.

The results of a Water Quality Monitoring Program for the Keahole Airport Expansion, December 1998, have been included in Appendix E. The study provides further discussion and includes sampling from ground based monitoring wells and coastal waters offshore of the airport to ascertain potential for adverse impacts to both groundwater quality and coastal/marine benthic biota. According to results from the study, "There are no significant unexpected features of the data. All values fall within expected norms."

A. Impacts

No impacts to surface or groundwater resources are expected. Surface or groundwater resources which could be impacted are neither present nor located within proximity to the KOA environs.



100	Maintenance Building
102	Vehicle Shed
103	Air Cargo Building
104	Air Cargo Building
105	Air Taxi Building
302	Baggage Claim
303	Seating/Telephones
304	Baggage Claim
305	Airline Maintenance Shed
307	Concessions
309	Restaurant
311	Airline Ticketing
312	Airline Ticketing
313	Airline Office
314	Airline Office
315	Baggage Make-Up
316	Baggage Make-Up
317	Airline Ticketing
318	Baggage Make-Up
319	Baggage Make-Up
320	Airline Ticketing
321	Airline Office
322	Airline Office
323	Airline Ticketing
325	Restaurant
327	Concessions
329	Baggage Claim
330	Seating/Telephones
331	Offices
343	Offices/Storage
344	Ground Transportation
348	Holding Area
349	Holding Area
355	Security Check
356	Security Check
358	Security Check
359	Restrooms
360	Lounge/Newsstand
361	Concession
362	Concession
363	Lounge/Newsstand
370	Baggage Claim
403	T-Hanger
404	T-Hanger

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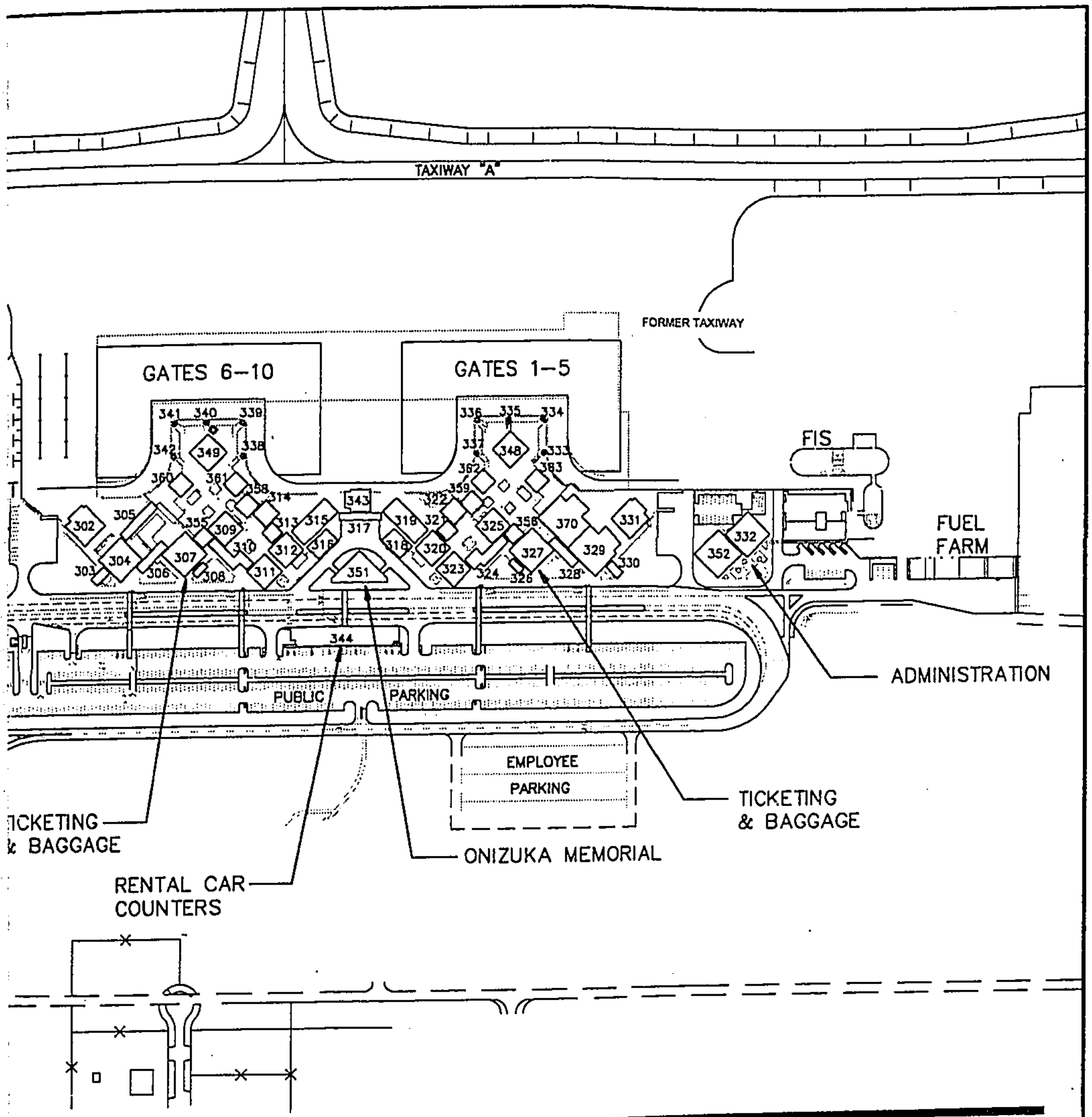

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FIGURE 5-9
EXISTING TERMINAL AREA LAYOUT
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B. Mitigation

Mitigation measures are not required nor recommended. Continued adherence to applicable Federal, State, and County of Hawaii rules and regulations governing operation of facilities will continue to be implemented.

5.9.2 SHORELINE AND NEARSHORE WATERS

The coastal nearshore waters are classified "AA" according to the Water Quality Standards Map of the Island of Hawaii, October 1987, by the Office of Environmental Planning and State Department of Health (DOH). Class "AA" waters are one of two designations of open coastal waters by the State DOH. Class "AA" waters are intended to remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human caused source or actions. Class "AA" waters are the most stringently regulated of open coastal water classifications. The designation of Class "A" waters provides for a broader range of uses, "... as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters" (Chapter 11-54-03, Water Quality Standards, Classification of Water Uses, Hawaii Administrative Rules).

The airport lies adjacent to the HOST Park and NELH with an ocean water pipe corridor about 10,300 feet wide extending 12,000 to 14,000 feet out from the shoreline. There are an estimated 79 anchialine ponds, including 27 ponds of exceptional natural value south of the airport near Wawahiwa Point in Kohanaiki. Other "significant" anchialine ponds are present at Honokohau and Kaloko. There is one anchialine pond located at the southwest end of the runway.

A. Impacts

The proposed KOA Master Plan Update is not expected to result in adverse environmental impacts to the Class "AA" ocean waters along the Keahole coastline. Construction will be limited to areas immediately surrounding the airport runway and terminal and therefore, should not result in discharges to State waters.

B. Mitigation

Although the KOA Master Plan is not expected to result in potential for adverse impacts requiring mitigation, future projects beyond the Master Plan, such as a second parallel runway, will need to be carefully managed to ensure protection of the "AA" waters off the Keahole coastline. The NPDES permit program requires that an Individual NPDES permit be filed if there is potential for discharges to "AA" waters during and after construction. A major permit requirement is for the preparation of Best Management Practices (BMPs) and a water quality monitoring plan to maintain State and Federal standards for water quality.

5.10 AIR QUALITY

The Federal Clean Air Act does not view a commercial airport such as KOA as a direct source of air pollution. However, it is defined as an indirect source of air pollution because it will attract and concentrate aircraft and motor vehicles. At the same time, volcanic activity on the Big Island is a major contributing source of air pollution throughout the State. On days when there is increased volcanic activity and there are Kona winds present, there is a noticeable haze which sometimes extends from the Big Island and Kona region, to major areas of the Hawaiian Island chain. The contribution of volcanic activity to air pollution levels are not directly discussed in the two air quality studies that have been conducted for the KOA expansion. Instead, the studies focused on air quality impacts to the surrounding area due to anticipated increases in airport activities.

5.10.1 AIR QUALITY IMPACT REPORT - 1988

Impact analysis conducted in 1985 and 1986, based on the Airport Vicinity Air Pollution (AVAP) Model (Argonne National Laboratory, 1974) indicates that despite the projected increase in air and ground operations, air quality in the airport vicinity will be minimally affected. Concentration estimates for carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and total suspended particulates (TSP) were well below applicable State and Federal standards. Total and non-methane hydrocarbon concentrations were also estimated, although there are no longer standards for the latter. The results indicated levels well below the previous State standard of 100 micrograms per cubic meter ($\mu g/m^3$).

The blockage of the normal northeasterly tradewinds by Mauna Loa and Mauna Kea and the resulting reduced ventilation in the Kona area can result in a buildup of pollutant concentrations. Close monitoring and periodic reevaluation of pollutant levels should be done as future developments expand in the area. To date, there have been no adverse impacts due to air pollution loading activities at KOA.

Table 5-3 provides a comparison of State standards for ambient air quality to the modeling results at KOA including projections to the year 2005 (Air Quality Impact Report, Keahole Airport, North Kona, Hawaii, March 1988). Comparison was made with State standards because they are more stringent that Federal standards; therefore, compliance with State standards infers compliance with Federal standards. Concentration values also include a "background level" for each pollutant based on either compliance with standards. While there are no longer State or Federal standards for hydrocarbons, they were included because airports are usually significant contributors of hydrocarbon emissions. In the case of KOA, subtracting the background methane level from the total hydrocarbon estimate indicates the ambient concentration of non-methane hydrocarbon would still meet the previous State standard of 100 micrograms per cubic meter.

A review of the contribution of emissions by source, indicates that aircraft will continue to be the primary emissions source in all categories of constituents that were measured in the Air Quality Impact Report. This is indicated in **Table 5-4**. As noted in the air quality report:

- The airport and its environs are a significant source of carbon monoxide, nitrogen oxides, hydrocarbons, and to a much lesser extent, particulate matter and sulfur dioxide. Emissions of these pollutants are projected to increase over the 1985 - 2005 period as a result of increases in aircraft operations and the ground vehicle activity that is generated by those operations;

- Despite the significant emissions, ambient concentrations of these pollutants are projected to remain in compliance with federal and state air quality standards; and,

- Because of its unique terrain and meteorological characteristics, Kona is more susceptible to buildup of pollutant concentrations and will have to be monitored closely, and periodically reevaluated as industrial, commercial, and residential/resort development proceeds in the future.

TABLE 5-3
AIR QUALITY COMPARISON TO STATE OF HAWAII STANDARDS
KOA

	Averaging Period	Concentration ($\mu g/m^3$)
Carbon Monoxide (CO)		
State Standard	1 hour	10,000
KOA (1990)		131 - 505
KOA (2005)		134 - 472
State Standard	1 hour	5,000
KOA (1990)		218 - 272
KOA (2005)		262 - 346
Nitrogen Dioxide (NO_2)		
State Standard	Annual Arithmetic Mean	70
KOA (1990)	24 hours	30 - 35
KOA (2005)		31 - 37
Sulfur Dioxide (SO_2)		
State Standard	24 hours	365
KOA (1990)		12 - 14
KOA (2005)		12 - 14
Total Suspended Particulate Matter (TSP)		
State Standard	24 hours	150
KOA (1990)		28 - 30
KOA (2005)		28 - 30
Total Hydrocarbons (THC, as methane)		
State Standard	3 hours	No State Std.
KOA (1990)		1,650 - 1,662
KOA (2005)		1,652 - 1,662

BACKGROUND LEVELS

CO	-	100 $\mu g/m^3$	
NO_2	-	29 $\mu g/m^3$	(1975 DOH Monitoring at Hilo)
SO_2	-	12 $\mu g/m^3$	(1985 - 1986 DOH Monitoring at Kona)
TSP	-	28 $\mu g/m^3$	(1985 - 1986 DOH Monitoring at Kona)
THC	-	1,648 $\mu g/m^3$	(methane, 1979 - 1980 Monitoring at Honolulu International Airport)

SOURCE: Air Quality Impact Report, Keahole Airport, March 1988, State Department of Transportation, J.W. Morrow

TABLE 5-4
PROJECTED ANNUAL EMISSIONS BY SOURCE CATEGORY
KOA 1985 - 2005

	Emissions (Tons/Year)				
Source	CO	NOx	HC	SO_2	PM
1985					
Roads	269	30	43	2	5
Parking	8	<1	1	<1	<1
Ground Service Vehicles	91	11	14	1	1
Fuel Storage/Handling	0	0	4	0	0
Aircraft	716	128	140	14	21
1985 TOTAL	**1,085**	**169**	**202**	**17**	**26**
1990					
Roads	274	39	37	3	7
Parking	9	1	1	<1	<1
Ground Service Vehicles	95	12	15	1	1
Fuel Storage/Handling	0	0	6	0	0
Aircraft	839	192	170	19	26
1990 TOTAL	**1,217**	**243**	**228**	**23**	**34**
2005					
Roads	233	53	27	6	13
Parking	5	<1	<1	<1	<1
Ground Service Vehicles	121	15	19	1	1
Fuel Storage/Handling	0	0	10	0	0
Aircraft	1,192	320	239	27	34
2005 TOTAL	**1,551**	**388**	**295**	**34**	**48**

NOTES: CO - carbon monoxide
NOx - nitrogen oxides
THC - total hydrocarbons
SO_2 - sulfur dioxide
PM - particulate matter

SOURCE: Air Quality Impact Report, Keahole Airport, March 1988, State Department of Transportation, J.W. Morrow

5.10.2 AMBIENT AIR QUALITY MONITORING PROGRAM - 1997

Monitoring of airborne particulate matter at KOA was completed in July, 1997 (Appendix F). The purpose of the particulate monitoring was to fulfill the requirements of the KOA Special Management Area (SMA) Use Permit No. 325. The following is a monitoring summary of particulate material with an aerodynamic diameter of less than 10 microns (**Table 5-5**):

TABLE 5-5
PM 10 MONITORING SUMMARY
KOA 1997

Date	24-Hour Average PM 10 Concentration (ug/m^3)
5/04/97	11.0
5/10/97	10.2
5/16/97	13.2
5/22/97	11.7
5/28/97	10.5
6/03/97	10.9
6/09/97	11.6
6/15/97	11.7
6/21/97	12.8
6/27/97	12.1
7/03/97	N/A
7/09/97	13.7
7/15/97	10.7
7/21/97	17.3
7/27/97	13.5

SOURCE: Keahole International Airport PM 10 Monitoring Report For May - July 1997, B.D. Neal & Associates, August 1997.

Followup with State Department of Health, Clean Air Branch, indicated the particulate material levels were well within State standards for the period May - July 1997. Based on the no adverse impact result of the study and the conditions of SMA Use Permit No. 325, the air monitoring station was removed.

A. Impacts

The blockage of normal tradewinds by the two large mountain masses east of Kona reduces natural ventilation and can result in a build-up of air pollutants in the area.

KOA is a significant contributor of carbon monoxide, nitrogen oxides, and hydrocarbons, and to a lesser extent, particulate matter and sulfur dioxide. The planned increase in airport activity will result in further increase in air pollutants. Impact on the surrounding environment, however, is not expected to be significant based on modeling results which indicated no present or future violations of State or Federal standards.

B. Mitigation

As the Kona region continues to develop, close monitoring and periodic reevaluation of pollutant build-up resulting from reduced natural ventilation should be conducted. If there is an increase in allowable levels of air pollutants, DOH, Clean Air Branch, should be notified for appropriate action.

5.11 VISUAL RESOURCES

The airport facilities stand out in stark contrast to the a'a and pahoehoe lava fields due to the open nature of the surrounding landscape. The airport facilities are located to the west of the Queen Kaahumanu Highway. Views from the highway present a panoramic view of the North Kona coastline, while views from the airport to the east present a panoramic view of Hualalai.

A. Impacts

The natural state of the lava fields will be replaced by the construction of new buildings, roadways and pavement surfaces. Some of the these facilities will result in expansion onto undeveloped portions of the lava field surrounding KOA.

B. Mitigation

A pleasing visual environment will be created by use of landscaping to enhance the area and screen unattractive facilities. Formal gardens within the terminal complex will provide visual relief from the immediate airport surroundings. Some of the existing architectural design themes will be incorporated into the design of new buildings to maintain the "tropical village" design character of the airport.

5.12 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Future development activities at KOA are not expected to result in major adverse impacts to historic or archaeological resources. This is based on results of a prior 1987 archaeological survey and Archaeological Update and Public Access Shoreline Hawaii (PASH) Rights Interviews for Kona International Airport at Keahole, study which was completed in April 2000 (see Appendix H).

Prior development activities including construction of the Keahole Airport in 1970, NELH/HOST facility, and Queen Kaahumanu Highway have already resulted in major alteration and removal or destruction of sites which may have been of historic or cultural value. A review of prior archaeological reports and studies indicate that while there has been no comprehensive inventory or historic sites on airport lands, that studies completed to date include an early large scale archaeological survey, and various small scale surveys with limited information on site locations referenced to standard base maps (e.g., USGS topographic quads).

The April 2000 archaeological survey was carried out to validate the findings of prior archaeological site work; identify potential new sites which were not previously studied; and, to collect information on traditional native Hawaiian use of the KOA site. According to results of the study, nine areas were surveyed with the goal of confirming earlier findings of no sites. In each case no significant sites were found.

The following summarizes the results of the April 2000, archaeological survey. See Appendix H for the survey area and archaeological site locations.

5.12.1 CONFIRMATION OF NO SITES

Nine areas were surveyed with the goal of confirming earlier findings of no sites. In each of these areas no sites were found.

5.12.1.1 Phase I - Overseas Apron, and Phase II - Parking and Overseas Terminal

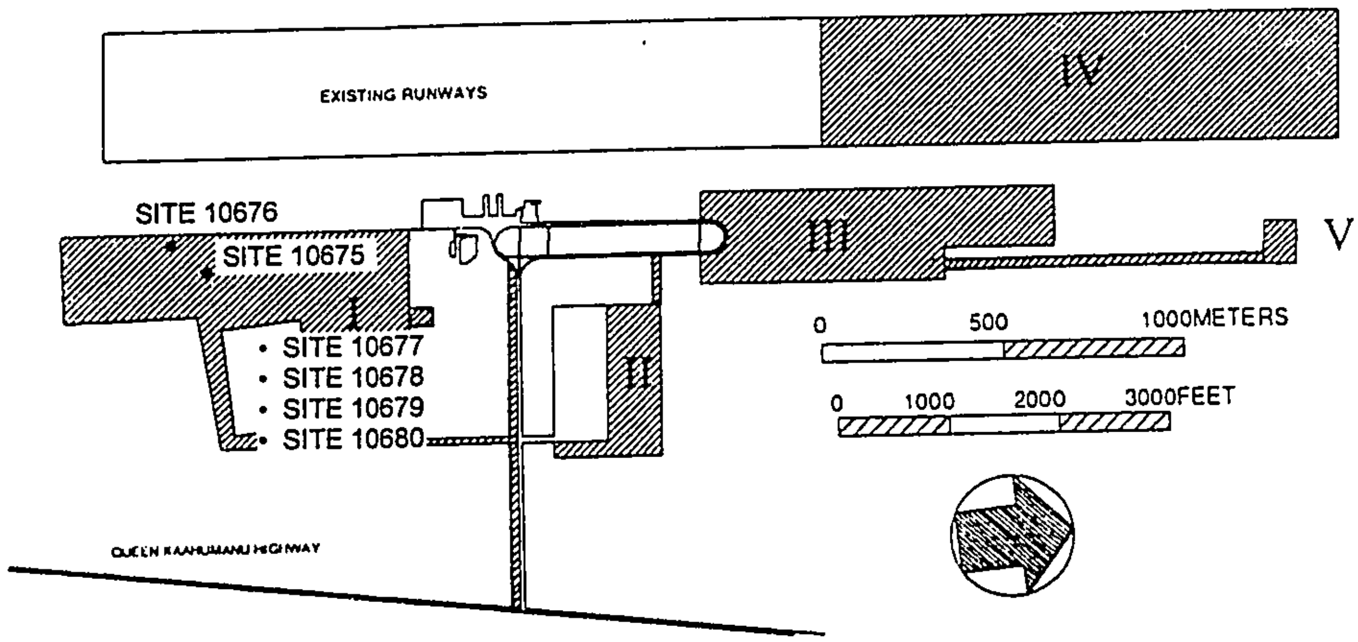
Each of these facilities is located north of the airport passenger facilities. "Barrera described this area, which he called Survey Area III (**Figure 5-10**), as having been previously excavated as a borrow pit (1987a:1). His survey recorded no sites. Today these areas are graded and used primarily for construction lay-down, although the portion of the Overseas Apron inside the airport security fence is paved with asphalt and the northern end of the Overseas Apron might include a bit of the 1801 lava flow."

"The 1801 lava flow at the northern end of this area was surveyed for sites as part of the current project. Precise boundaries of the area could not be determined in the field, so the survey extended north to a point definitely outside of the area. The 1801 lava flow supports very little vegetation and surface visibility during the survey was excellent. The archaeologists traversed the lava flow on irregular transects, paying special attention to possible caves and overhangs. The level of survey was sufficient to find any historic sites that might be present, but no sites were found. This finding of no sites is consistent with previous work elsewhere on the 1801 lava flow" (Archaeological Update and Public Access Shoreline Hawaii (PASH) Rights Interviews for Kona International Airport at Keahole, April 2000).

The results of the survey indicate no historic sites are present within the above areas. Therefore, there will be "no effect" on historic sites.

5.12.1.2 Phase I - Postal Facility Site Preparation

The Postal Facility Site Preparation area is located mauka of the Parking Phase II area. "The area is today mostly graded and was probably part of the borrow pit reported by Barrera in his Survey Area III (Barrera 1987a:1). A small area of old pahoehoe with fountain grass, part of an extensive *Hipuka* located mostly *mauka* of Road "N"." (Ibid, April 2000).



Source: Keahole Airport, Hawaii: Archaeological Survey of Five Areas Proposed for Airport Expansion, Chiniago, Inc., 1987

AIRPORTS DIVISION
Department of Transportation
State of Hawaii
State Project No. AH 2011-03

SCALE AS NOTED

FIGURE 5-10
LOCATION OF SURVEY AREAS
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

R. M. Towill Corporation

JAN 1999

The Postal Facility site area was surveyed to determine presence of any potential middens, remains, or other artifacts which might indicate prior prehistoric or modern day use. No sites were found. Based on results of the survey, development of the Postal Facility Site Preparation Area will have "no effect" on historic sites because no historic sites are present.

5.12.1.3 Phase II - Ground Transportation Lease Lots

The Ground Transportation Lease Lot area is located north of the existing car rental facilities. This area was previously surveyed by Barrera in a 1987 survey, and was identified as Survey Area II, a previously excavated borrow pit. Barrera's survey located no sites and the area has since been graded and filled. Recent survey investigation of the area mauka of the site indicated no sites present.

Based on results of the survey of the Ground Transportation Lease Lots, there will be "no effect" to historic sites because no historic sites are present.

5.12.1.4 Phase I - Air Cargo Building III, GA Fuel Storage Site Preparation, and Phase II - General Aviation Site and Air Taxi Terminal

Each of the General Aviation (GA) fuel storage, GA site, and Air Taxi Terminal areas have been partially graded, but have expanses of undisturbed pahoehoe lava. Barrera found no sites present in 1987 and the current April 2000 survey confirmed the absence of any sites.

Based on results of the survey of areas for the Phase I - Air Cargo Building III, GA Fuel Storage Site Preparation area, and Phase II - General Aviation Site and Air Taxi Terminal, there will be "no effect" on historic sites because no historic sites are present.

5.12.2 PREVIOUSLY IDENTIFIED SITES

Four areas which were previously surveyed as either part of the 1987 Barrera survey or earlier surveys were resurveyed to reassess level of significance. One of the four sites remains largely intact, while remaining sites that were previously identified as "no longer significant" were demolished as part of previous work for the 1987 KOA Master Plan/1988 KOA Master Plan Environmental Impact Statement.

5.12.2.1 Phase I - Ramp "K", Itinerant Aircraft Parking, and Phase II - Ramp "L"

Ramp "K," Itinerant Aircraft Parking and Ramp "L" are located at the south end of the airport. " This area was partially surveyed by Barrera (1993), who made a photographic record of a portion of Mamalahoa Trail (State Site 50-10-27-2) (see also ALP and Appendix B, Faunal Survey of Avian and Mammalian Species, February 2000, for location), which either passed over or very near the west end of Ramp "L." Barrera (1987b) surveyed the Itinerant Aircraft Parking, Air Cargo Building III, and the *makai* ends of Ramps "K" and "L" outside the security fence, finding one site, 50-10-27-10306, consisting of 11 features interpreted as habitation shelters and associated functions. Site -10306 was located in the vicinity of Ramp "K" according to the schematic site location map (Barrera 1987b). Barrera (1987a) surveyed the mauka ends of Ramps "K" and "L," finding two sites in the vicinity of Ramp "L." Site 50-10-27-10675 was described as "a hole excavated into the pahoehoe bedrock" (Barrera 1987a:2). Site 50-10-27-10676 was a "rock mound" (Barrera 1987a:2). These sites were evaluated as containing information important for Hawaiian prehistory." (Ibid, April 2000). These sites were determined to be "no longer significant" after they were recorded by Barrera.

Today, the portion of this area outside the airport security fence is completely graded and the portion of Ramp "K" inside the security fence is paved with asphalt. The historic sites once located there, including Sites -10306, -10675, and -10676 are now destroyed, as is a portion of the Mamalahoa Trail. (Ibid, April 2000).

Development of Ramp "K," Itinerant Aircraft Parking, and Ramp "L" will have "no effect" on historic sites because no historic sites are present. (Ibid, April 2000).

5.12.2.2 Phase II - Heliport

"Barrera (1987a:6 ff.) recorded four sites in the vicinity of the Phase II Heliport. They include: Site 50-10-27-10677, a habitation cave; Site 50-10-27-10678, a cave; Site 50-10-27-10679, a lava tube; and Site 50-10-27-10680, two excavations into the pahoehoe bedrock. Barrera appears to have been unaware that Site 10677 was previously recorded by Ching and Rosendahl (1968) as Site Kalaoa T2, and that Site 10679 was recorded by them as Sites Kalaoa T3 and T4. All four of the sites were evaluated as significant for the information on Hawaiian prehistory and history that they have yielded and are likely to yield (Barrera 1987a:11) and later underwent data recovery (Barrera 1990). The data recovery excavations were successfully completed (Hibbard to Koga 1990) according to an approved data recovery plan (Nagata to Miyamoto 1989). The sites were then technically "no longer significant." (Ibid, April 2000).

5.12.3 INVENTORY SURVEY

The April 2000 archaeological survey was further extended to include four previously unsurveyed areas to ensure sufficient investigation of areas subject to potential impact by the KOA Master Plan Update. Two of the areas yielded historic data while the remaining two areas indicated no historic sites.

5.12.3.1 Phase I - Fuel Farm Site Preparation and Wastewater Treatment Plant Site

The archaeological survey included the area for the Fuel Farm Site Preparation and an area which previously included the proposed Wastewater Treatment Plant site. The former Wastewater Treatment Plant Site will continue to be reserved and set aside as needed for future airport uses.

The current location of the Wastewater Treatment Plant is immediately adjacent to the prior site, south of the Air Rescue and Fire Fighting Access Road. This location overlaps the prior site and also has been subject to extensive modification and demolition associated with earlier development of the Keahole Airport. This included the quarrying of boulders and rocks for construction purposes.

According to the survey, "The Fuel Farm Site Preparation area is on a portion of an a'a lava flow that is today completely graded. There are no historic sites present at the Fuel Farm Site Preparation area. The [note former] Wastewater Treatment Plant Site is located on a former quarry, and is today a massive hole in the ground. Survey around the mauka edge of the quarry revealed evidence of heavy machinery activity and no trace of historic sites" (Ibid, April 2000).

It is expected that development of the Fuel Farm Site Preparation area and current Wastewater Treatment Plant areas will have "no effect" on historic sites because no historic sites are present.

5.12.3.2 Phase II - Emergency Generator and Flight Kitchen Site Preparation

"The Emergency Generator and Flight Kitchen Site Preparation areas are located in a *kipuka* area of old pahoehoe lava with common fountain grass and small shrubs, *mauka* of Road "N". The pahoehoe lava surface here is irregular and broken, with large up-thrust sections. Fountain grass growth obscured the ground surface in many areas, especially low spots in the topography. In some places, where fountain grass growth was especially thick, it was not possible to gain a clear view of the ground surface. Two archaeologists spent approximately 8 person hours surveying for sites in the vicinity of the Emergency Generator and Flight Kitchen Site Preparation area. Because it wasn't possible to determine the precise boundaries of these areas in the field, an effort was made to survey a larger area that included them both." (Ibid, April 2000).

"The archaeologists walked eight irregular north-south transects through the area, at approximately 25 m intervals, varying their paths according to the topography to include all likely site locations. Sites were described and photographed and their locations were later established with differentially-corrected GPS." (Ibid, April 2000).

A total of 10 sites were recorded in the area and assigned consecutive field numbers from 1 to 10 (See Appendix H for figure). The sites were plotted on a map of airport facilities to ascertain the location of the sites in relation to the proposed KOA Master Plan Update projects. Most of the sites fall outside of the two project areas, however; Site 7 and Site 8 are within the boundaries of the Emergency Flight Kitchen Site Preparation Area; and, Site 1 falls within the boundaries of the Emergency Generator.

"Sites 1-9 can be described as circular or near-circular plan alignments of angular pahoehoe cobbles and boulders, generally a single course high but in places two or exceptionally three courses high, with outside diameters between 1.2 and 2 m. In some of the sites, one or more pahoehoe slabs are set on end, giving a portion of the alignment a height of ca. 20 cm, but in the usual situation the cobbles and boulders rest on their larger surfaces and rise only ca. 10 cm above the surrounding ground surface. In all cases the alignments are constructed on an expanse of unbroken pahoehoe that is level or gently sloping. No cultural materials were found associated with any of these sites" (Ibid, April 2000).

Site 10 is a C-shape structure of pahoehoe cobbles and boulders up to two courses high that augments a natural depression in the pahoehoe. No cultural materials were observed at this site.

Sites 1, 7, and 8 are significant for the information on Hawaii prehistory that they have yielded. All three of the sites represent minimal labor investments in terms of type and level of construction, and have no associated cultural materials. Their locations have been accurately recorded and they have been described in appropriate detail. According to the archaeological survey these three sites are "no longer significant" because they have yielded the information that made them significant.

A. Impacts

All archaeological sites within the area identified for master plan expansion of the airport have been identified and properly documented. No further impacts associated with the KOA Master Plan Update are anticipated.

B. Mitigation

No further archaeological mitigation measures will be required to construct the KOA Master Plan Update facilities. Three basic recommendations, however, are proposed to improve future archaeological data collection and management. These recommendations include:

Recommendation No. 1 - Update the existing State Historic Preservation Division GIS - An update of the State's GIS system would assist with the future management of archaeological resources not only at KOA, but statewide. It may be possible that as KOA continues to be improved and upgraded that future archaeological data collection efforts would include GIS based data that can be included as part of the State's system.

Recommendation No. 2 - Update the GIS database for Keahole to facilitate the future inventory of archaeological sites on airport property - This item would also facilitate future management of historic and cultural resources at KOA and may be implemented with future projects and improvements.

Recommendation No. 3 - An attempt should be made to locate collections made during data recovery at airport sites. "It is believed that some of the collections held by Chiniago Inc. were taken over by the contract archaeological firm on Hawaii Island headed by Lloyd Soehren. This lead should be followed up with a telephone call to Mr. Soehren and possibly a trip to Hawaii Island to review any Chiniago Inc. collections that he might hold. Once the Kona International Airport at Keahole collections are identified, arrangements should be made to curate them in a State approved repository" (Ibid, April 2000).

5.13 PUBLIC ACCESS SHORELINE HAWAII (PASH ACT 50 SESSION LAWS OF HAWAII 2000) RIGHTS

A series of interviews with informants familiar with the history and use of the Keahole area were conducted in conjunction with the April 2000 archaeological survey. Eight formal interviews were completed between December 3, 1999 and February 9, 2000. In addition to formal interviews, discussions were also held to obtain general background information on Keahole and to identify other possible informants that could contribute historical background information to the KOA site.

The interviews identified 7 PASH rights issues. A summary of these issues involve the following:

1. Limited Access to Shoreline Within the Vicinity of Existing Airport Properties

   Limited access to the shoreline is a concern and problem for residents in the Kona area, and for those wishing to use the shoreline for fishing and recreation. Although access has been limited somewhat since construction of the airport, access has more recently been denied due to the boundaries and restrictions created by NELH. Most informants agree that the three major uses of the area, (a) vehicle access, (b) camping, and (c) fishing, were not compromised by construction of the airport. The change in vehicular access as a result of realignment and partial construction of a new road around the airport property was acceptable. Although a little more inconvenient, most individuals wanting to use the shoreline could still do so. Since construction of NELH facilities, however, access to the area has become restricted. Road access, camping and fishing are seen as either inaccessible or so limited that people can rarely use the shoreline area. The fishing supply is also believed to have dwindled.

2. Compromising of Archaeological and Historical Sites

   Archaeological and historical sites, both known and unidentified, are believed to exist within and surrounding KOA. Sites that carry the greatest degree of cultural significance for descendants of Keahole lands are human (ancestral) burials. Although burials have not been identified by previous archaeological surveys in the area (Tom Dye, Archaeologist), nearly every informant stated that ancestral burials exist around the airport. Locations for burials are known to some kupuna living in the area.

The second group of sites includes known features that have very specific boundaries/localities. Informants have recalled that there were once various trails leading from Keahole to Hualalai. Among the known trails are the Mamalahoa and the Kahakai ala Kalakai trails. The primary concern is that these trails be maintained (restored if necessary), and made accessible as footpaths.

Although no detailed or specific information was gathered about the existence of a former fishpond in the airport area, a few people recall that this pond was covered during construction of the airport. The fishpond was not raised as an area of concern but was referenced in discussions emphasizing historical significance of the area. Also, most people referenced the salt ponds in the area. Though rarely used now, these ponds were known to be a valued resource prior to development of the airport.

3. Access to Prime Fishing Grounds

Several informants and interviewees have recalled the once abundant fishing grounds that lie along the Kona Airport shoreline. This area extended south towards Kailua, and north towards Kawaihae. In recent years, not necessarily corresponding with development of the airport, the fish supply has declined. The need to access fishing grounds raise two levels of concern: 1) the actual supply of the resource, and; 2) physical access to shoreline areas known previously as prime fishing grounds.

Along with the fish supply, there are related concerns of noise, lights and jet exhaust traveling from the airport to the ocean. These factors are believed to adversely impact fishing in the area.

4. Loss of Native (Traditional) Plants

   Plants along the shoreline were once used to make leis. According to one informant the area was very likely used for the gathering of traditional plants since this was a practice of most areas settled by Hawaiians. Some of these plants however, are no longer available because they have been pulled out by development of the airport area.

   Another informant emphasized the importance and use of the shoreline by hula halau for ritual and gathering purposes. This included going to the shoreline to gather plants, participate in spiritual cleansing, and for related activities.

5. Observation of Traditional Boundaries (Need to Treat Ahupuaa as One Unit)

   In addressing PASH issues, it is clear that application of physical boundaries (as in the current project area) needs to be clarified. A major question is how to take into consideration the notion of an ahupuaa, while also working within designated, site-specific boundaries. Traditional and cultural customs and practices involve addressing the entire ahupuaa. The airport spans over several ahupuaa. Therefore, the area on which the airport is located cannot be restricted to only its designated boundaries. A clarification of traditional Hawaiian land divisions is needed if traditional land use and issues are being addressed.

   According to one informant, the more appropriate question that needs to be addressed by this project is, "Is anything happening here that is going to preclude the exercise of one's kuleana." According to the informant, kuleana means responsibility, and it is the responsibility of every generation of Hawaiian to care for, as much as to live in and off the land. Kuleana also allows the individual to request that they be allowed to exercise their rights to the land. (It should be noted that PASH rights in general, and the issues identified in the PASH interviews, are a questioning of the ability to properly or fully exercise one's kuleana).

6. Impacts to Aquifers and Seabeds

   Two concerns were raised with regard to PASH issues at KOA: 1) impacts to aquifers; and, 2) impacts to seabeds. Further research evaluating impacts to water quality, including the quality of salt and the extent of pollutants mixing in deep water. Also, salt collections that are sometimes owned [regularly used] by families should be evaluated for quality. Salt collection is seasonal but may be impacted by activities associated with nearby developments.

7. Boundaries Compromised and/or Seen and Inseparable from NELH

   According to the PASH interviews, PASH rights to KOA are nearly inseparable from concerns associated with NELH. The present location of NELH, at the southeastern edge of the airport boundary, is within the same ahupuaa as KOA. With the exception of the Airport District Manager and public officials, most informants and area residents do not separate the two facilities, or the lands on which they are located. There are several areas of contention with NELH, including it (a) being a private enterprise using ceded lands, (b) possibly polluting the nearby shoreline, and (c) not being community oriented or cooperating with the community. Although these issues are beyond the scope and purpose of the current project, they are related to KOA in the minds of the informants.

The proposed KOA Master Plan Update provides for the development of facilities necessary to meet air travel capacity demands as well as for the continued safety and comfort of both the traveling public and airport tenants. The PASH rights interviews have identified seven issue areas which could require community dialog or public informational meetings as future portions of the KOA facility are developed. This will be to ensure airport development sensitive to shoreline access requirements.

The PASH rights interviews indicate that shoreline access is a problem and concern for residents although the major uses including vehicular access, camping and fishing, were not compromised by construction of KOA. This has been due to the existing provision of a shoreline access road (**Figure 2-3 - Airport Layout Plan**) by DOT-A to maintain the public right to visit and use the shoreline. At the same time, land uses surrounding the KOA facility have resulted in some loss of access. The primary land use surrounding KOA, NELH, is not subject to development associated with the KOA Master Plan Update.

The continuing use of archaeological surveys to assess potential for negative adverse impacts to archaeological and historic sites (especially burials) will continue to be utilized whenever necessary. Proposed development sites for the KOA Master Plan Update were reviewed and evaluated by archaeologists and the State Historic Preservation Division to ensure "no effect" to significant sites.

Access to prime fishing grounds and the apparent decline in abundance of species previously found along the airport shoreline may be somewhat explained by increased fishing pressure over the past several decades throughout coastal waters of Hawaii. The decline in fish stocks may therefore be a phenomenon common not only to Keahole, but to coastal areas throughout the state. At the same time, coastal as well as ground water quality at Keahole has been evaluated in the report Water Quality Monitoring Program for the Keahole Airport Expansion, December 1998. The primary finding of the report was that water quality for the area continues to be within expected parameters with no deviant or abnormal levels of deleterious constituents detected. The water quality monitoring program therefore, demonstrates that with continued adherence to health and safety regulations for the operation of KOA, that there should continue to be no anticipated adverse impacts to the environment.

There has been loss of some plant species immediately within the developed portions of the KOA facility, however, major portions of KOA remain undeveloped and contain many of the same plant species associated with the Keahole dry lowland environment. As noted in the Botanical Survey, Kona International Airport at Keahole, North Kona, Hawaii, February 2000, there are no sensitive, native plant-dominated vegetation types or threatened and endangered species on the project site. All of the native plants can be found in similar dry lowland areas elsewhere on the Island of Hawaii. It is possible that the combination of both the on-going three year old drought and limited access south of KOA may have heightened the perception of loss of native plant species. Access to areas along the public shoreline access right of way, however, are available to the public.

The establishment of fences and restricted access surrounding portions of KOA are intended to maintain public and airport tenant safety. Public access, therefore, cannot be granted to the airfield and surrounding zones comprising the flight line, clear zones, aviation use support areas, and various locations surrounding the terminal. DOT-A will continue to maintain restrictions to these areas in accordance with FAA and various other Federal, State, and County of Hawaii regulations governing operation and use of an active public airport.

Because of issues raised concerning the NELH facility, DOT-A will provide a copy of the Archaeological Update and Public Access Shoreline Hawaii (PASH) Rights Interviews for Kona International Airport at Keahole, April 2000, to NELH to advise them of public concerns raised in the report.

A. Impacts

It is expected that with continued development of KOA that there will be continuing need to maintain public shoreline access rights. The current provision of public shoreline access at KOA will continue to be provided in accordance with State law. No further adverse impacts associated with the provision of public shoreline access, therefore, are anticipated. At the same time multiple concerns involving future development must be addressed on a case by case basis as required.

B. Mitigation

No further mitigation concerning the provision of public shoreline access at KOA are expected to be required. However, a copy of the archaeological update will be provided to NELH to advise them of potential public concerns.

SECTION 6
ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION - SOCIOECONOMIC ENVIRONMENT

6.1 HUMAN SETTLEMENT PATTERNS AND PROPOSED LAND USE

Construction of the Keahole Airport in 1970 has contributed to the maintenance of open space and land uses that are generally compatible with operations of the current KOA facility. This has been primarily due to FAA regulations requiring sufficient airspace and obstruction free areas to ensure safety of aircraft operations. The recent downturn in Hawaii's visitor industry, however, has probably also contributed to limited residential development in the Keahole Region and elsewhere throughout the State.

Existing residential developments surrounding KOA include the following (**Figure 5-3**):

- Keahole Agricultural Park - The west boundary of this park is located approximately 1 mile east of the KOA air traffic control tower. The site comprises approximately 2,608 acres divided into 5 to 15 acre lots. One single family residence is permitted in each agricultural lot. To date, approximately 10 residences have been built.

- Kona Palisades Subdivision - This residential subdivision is located further east, and beyond (above) the Keahole Agriculture Park. It is located approximately 1.8 miles east of the KOA air traffic control tower.

- Kona Wonder View Lots and Kona Acres - These residential subdivisions are located further east and above Kona Palisades. The western boundaries of these subdivisions are approximately 3.4 miles from the airport air traffic control tower.

Other commercial/industrial areas that have been developed to the south include Kaloko Industrial Park, 3.4 miles south, and Honokohau Harbor, 3.9 miles south, from the airport. As noted in Section 5, NELH and HOST Park are situated on leased airport lands and primarily serve as research facilities. Lands to the north are primarily in recreational uses.

A. Impacts

Development of the proposed KOA Master Plan is not expected to result in adverse impacts to the area population. The current KOA site was selected in the 1960s to replace the old Kona Airport which has since been redeveloped to serve park and recreational uses. The current KOA facility was dedicated in 1970 and encompasses a sufficiently large land area that, according to the KOA Part 150 Noise Compatibility Report (NCPR), 1997, there are no existing incompatible land uses within the 5-year Noise Exposure Map. Corrective measures that would normally be applied to areas of population settlement, therefore, will not be required.

Discussion of other potential sources of population impact would include the following:

- The proposed location of KOA facilities will not require displacement of the area population due to a new land use plan. The proposed location of facilities largely follows the prior 1987 KOA Master Plan which is based on need to ensure safety and efficiency of airport operations. According to the current KOA Master Plan Update, the location of KOA facilities will not result in displacement of the area population.

- No major new roadway facility changes which would impact the area population will need to be made. The potential for future regional traffic impacts due to development of facilities at KOA and adjoining residential and commercial developments were assessed in the Queen Kaahumanu Highway Widening Environmental Assessment, which was completed by DOT in May 1996. The project EA indicated that due to forecast traffic from KOA as well as surrounding developments, it will be necessary to eventually upgrade the Queen Kaahumanu Highway from a two to four lane facility. The intersection connecting the airport access road with the highway will require a three legged intersection. Internal traffic circulation within KOA will be handled by the existing network of KOA access roads and proposed new roads as represented in the KOA Master Plan Update DEA.

Direct population impacts may result from new employment opportunities associated with either the construction or operation of Master Plan Update related facilities, or indirectly through new businesses providing support services to the airport. It is expected that while some employment will be from the population surrounding the North Kona region, other forms of both short and long term employment may need to be imported. Additional discussion concerning potential for population related economic impacts is provided in the following sections.

B. Mitigation Measures

The KOA Master Plan Update is not anticipated to require mitigation measures to address direct impacts to the area population. Displacement of residents or businesses due to need for acquisition of new land is not necessary. The existing airport property will continue to be set aside in open space for future airport needs, thus reducing the long term potential for conflicts with adjoining land uses. This would supplement an existing NCPR recommendation to discourage uses including residences, hospitals, day care facilities, and churches and schools, from locating within the airport vicinity (per Section 5.7-Noise).

6.2 POPULATION CHARACTERISTICS

The State of Hawaii has experienced a steady increase in population over the last two decades. The most dramatic population change of the four counties occurred on Maui, followed by the Island of Hawaii. Oahu still has the largest number of people, however, the percentage change in population has been greater on the neighbor islands. Changes in population by decade, from 1970 to 1990, are shown in **Table 6-1**. The North Hilo district had declines in population which were due in part, to the decline of the sugar industry and closing of sugar mills.

Population changes within the various districts on the Island of Hawaii are shown in **Table 6-2**. Of the eight districts identified, all but one showed an increase in population. The district with the most significant change was the North Kona district which had a 361.18 percent increase in population since 1970. The most dramatic rise in population was between 1970 and 1980.

The future population of the State and individual counties was estimated by the State Department of Business, Economic Development, and Tourism. These projections are shown in **Table 6-3**. According to **Table 6-3**, the State defacto population will increase by approximately 73.5 percent between 1985 and 2005. The population of the Island of Hawaii over this same period is expected to grow by approximately 56.1 percent.

TABLE 6-1
PERCENT CHANGE IN STATE OF HAWAII POPULATION
1970, 1980, AND 1990

YEAR	STATE	MAUI	KAUAI	OAHU	HAWAII
1970	769,913	46,156	29,761	630,528	63,468
1980	964,961	70,991	39,082	762,565	92,053
1990	1,108,229	100,504	51,177	836,231	120,317
% Change 1970-90	43.94%	117.75%	71.96%	32.62%	89.57%

SOURCE: Hawaii State Data Book, 1993-94, A Statistical Abstract State of Hawaii, Department of Business, Economic Development & Tourism.

TABLE 6-2
POPULATION BY DISTRICT, HAWAII COUNTY
1970, 1980, AND 1990

				PERCENT CHANGE		
DISTRICT	1970	1980	1990	1970-80	1980-90	1970-90
PUNA	5,154	11,751	20,781	45.0	76.84	303.20
SOUTH HILO	33,915	42,278	44,639	24.7	5.58	31.62
NORTH HILO	1,881	1,679	1,541	-10.7	-8.22	-18.08
HAMAKUA	4,648	5,128	5,545	10.3	8.13	19.30
N. KOHALA	3,326	3,249	4,291	-2.3	32.07	29.01
S. KOHALA	2,310	4,607	9,140	99.4	98.39	295.67
NORTH KONA	4,832	13,748	22,284	184.5	62.09	361.18
SOUTH KONA	3,398	3,699	4,438	8.9	19.98	30.61

SOURCE: Hawaii State Data Book, 1993-94, State of Hawaii, Department of Business, Economic Development & Tourism.

TABLE 6-3
POPULATION PROJECTION
RESIDENT AND DE FACTO BY COUNTIES - 1985-2010*

YEAR	STATE	OAHU	HAWAII	KAUAI	MAUI
Resident Population†					
1985	1,039.7	804.3	105.9	44.4	85.1
1990	1,112.9	838.2	121.5	51.6	101.6
1995	1,179.2	870.9	137.2	56.0	115.2
2000	1,238.5	904.0	149.6	60.9	124.0
2005	1,304.0	944.0	160.6	66.6	132.8
2010	1,366.7	980.0	173.9	72.0	140.9
De Facto Population‡					
1985	1,138.0	855.0	112.5	55.3	115.1
1990	1,257.0	912.1	136.5	69.0	139.5
1995	1,287.1	915.4	149.7	69.3	152.8
2000	1,372.8	959.2	165.9	78.8	169.0
2005	1,463.0	1,007.0	181.9	89.5	184.8
2010	1,548.6	1,048.9	200.4	100.1	199.5

*Thousands. Series 2000 Projections, DBED&T.

† The resident population is defined as the number of persons whose usual place of residence is in area, regardless of physical location on the estimate or census date. It includes military personnel stationed or homeported in the area but excludes persons of local origin attending school or in military service outside the area.

‡ The de facto population is defined as the number of persons physically present in an area, regardless of military status or usual place or residence; it includes visitors present but excludes residents temporarily absent.

SOURCE: Population and Economic Projections for the State of Hawaii to 2020, State of Hawaii, Department of Business, Economic Development & Tourism, May 1997.

Population projections for the County of Hawaii, Kona and Kohala districts, are provided in **Table 6-4**. These projections are based on three development scenarios ranging from limited development in the district, to significant expansion of visitor accommodations which is expected to spur population growth in the districts.

A comparison between **Table 6-4** and 1995 actual data indicates: 1) the Kona District Alternative I projection of 30,200 was underestimated from the actual 1995 Kona population of 34,066; and, 2) the Kohala District Alternative I projection of 30,400, was overestimated from the actual 1995 Kohala population of 16,924 (Hawaii State Data Book, 1997). Although the reduced population for the Kohala District is consistent with the downturn in Hawaii's overall economy during the mid- to late 1990s, the population projection for Kona indicates moderate growth between the Alternative I (30,200) and Alternative II (35,000) projections for 1995.

A. Impacts

Development of the proposed KOA Master Plan is not expected to result in adverse impacts to the area population. The current KOA site was selected in the 1960s to replace the old Kona Airport which has since been redeveloped to serve park and recreational uses. The current KOA location is relatively distant from urbanized Kona, and since 1970, has supported land uses which are generally consistent with ongoing operation of an airport facility.

Direct and indirect population impacts may result due to new employment opportunities that will either help support tourism or provide services that are required by the airport. Area businesses may also create indirect employment opportunities as new residential growth away from the airport generates the need for additional goods and services.

B. Mitigation Measures

The KOA Master Plan will generate new employment opportunities which in turn, may generate need for additional housing. This housing need will involve short as well as long term requirements, some of which can be fulfilled through the existing housing inventory. If new housing is required it is expected that new construction will be fulfilled in accordance with existing State and county rules and regulations governing development.

TABLE 6-4
ALTERNATIVE KONA-KOHALA POPULATION PROJECTIONS
1990 - 2000

	ALTERNATIVE I *		ALTERNATIVE II **		ALTERNATIVE III ***	
YEAR	Kona	Kohala	Kona	Kohala	Kona	Kohala
1980	20,000	8,000	20,000	8,000	20,000	8,000
1985	23,800	12,900	24,900	11,700	26,200	10,400
1990	27,100	20,700	30,100	17,600	32,900	15,300
1995	30,200	30,400	35,000	25,900	39,900	22,200
2000	33,200	39,400	39,400	32,000	46,300	28,200

* Assumes no additional Kona hotels, additional Kona resort condos, and existing planned development projects.

** Assumes complete Keauhou hotel development, additional Kona resort condos.

*** Assumes significant expansion of visitor accommodations in Kona.

SOURCE: Kona Regional Plan (Draft), Hawaii County, Planning Department, Table IX-19, 1982 (Revised).

6.3 ECONOMIC CHARACTERISTICS

6.3.1 BUSINESS AND EMPLOYMENT

The two mainstays of Hawaii's economy are tourism and Federal spending. The prime driver is tourism, which has been a major force for decades. High tourist counts serve as the primary driver for the retail trade as well. Tourism is well documented by the Hawaii Visitors Bureau (HVB) and some of the materials used in this section are derived from various HVB annual reports.

Business and employment trends in the Kona area can be characterized as having moved from a principally agriculturally based employment center to one where the visitor industry is the largest employer. In 1950, 52 percent of the employed persons listed their primary employment as being in agriculturally related operations. By 1970, the employment characteristics of the area had changed dramatically. Service related employment, primarily the visitor industry, had increased from 8.2 percent of the work force to 17 percent. The agricultural industry declined from 52 percent to 8.6 percent.

Changes in employment are shown in **Table 6-5**. Growth in the visitor industry has contributed to the growth in the construction industry and wholesale/retail trades.

Based on comparative figures for the entire State (with the exception of Kalawao), residents of Hawaii County have median incomes below the other counties (**Table 6-6**).

Unemployment figures for 1997 also indicate that the rate for the County of Hawaii is the second highest in the State followed by the County of Kauai. Overall unemployment rates as reported in the State of Hawaii Data Book, 1997, indicate the following: Oahu - 5.3%; Hawaii County - 10.2%; Maui County - 7.5%; and, Kauai County - 11.3%.

TABLE 6-5
JOB COUNT BY INDUSTRY, COUNTY OF HAWAII
ANNUAL AVERAGES, 1994 - 1997

INDUSTRY	1994*	1995*	1996*	1997
TOTAL JOBCOUNT	50,250	49,550	50,700	51,900
TOTAL NON-AGRICULTURAL WAGE AND SALARY	47,300	47,100	48,150	49,450
Contract Construction	2,600	2,550	2,300	2,100
Manufacturing	2,050	1,750	1,650	1,650
Durable Goods	250	250	200	200
Non-durable Goods	1,850	1,500	1,450	1,450
Food Processing	1,450	1,150	1,050	1,000
Transportation/ Communication/Utilities	2,650	2,600	2,600	2,650
Trade	12,450	12,650	12,550	12,850
Wholesale	1,700	1,700	1,650	1,700
Retail	10,750	10,950	10,900	11,150
Finance/Insurance/ Real Estate	2,450	2,400	2,600	2,600
Services & Misc.	14,950	15,050	16,250	17,400
Hotels	5,600	5,500	6,000	6,750
Health Services	2,100	2,200	2,400	2,750
Other Services & Misc.	3,900	3,950	4,500	4,850
Government	10,200	10,100	10,150	10,250
Federal	850	900	950	900
State	7,200	7,100	7,050	7,150
Local	2,100	2,100	2,150	2,200
TOTAL AGRICULTURE: WAGE & SALARY	2,950	2,450	2,550	2,450

SOURCE: 1997, County of Hawaii Data Book. Department of Research and Development, County of Hawaii. July 1998. *Revised.
NOTE: Data rounded to nearest 50; totals may not add due to rounding.

TABLE 6-6
PER CAPITA, MEDIAN INCOME, AND
POVERTY STATUS, STATE OF HAWAII AND COUNTIES
1993

Location	Per Capita Income	Median Income Households	Persons in Poverty** Number	Percent
STATE	$23,842	$39,890	110,972	9.6%
HAWAII	$17,398	$31,150	20,329	15.0%
HONOLULU	$25,358	$43,596	75,992	8.9%
KALAWAO	-	$10,000	-	-
KAUAI	$19,966	$37,002	4,930	8.8%
MAUI	$21,766*	$38,521	9,722	8.6%

* Includes Kalawao.

** Based on Mainland poverty thresholds. Official Hawaiian thresholds are about 15 percent higher. These data accordingly understate the number and percent of persons below the poverty level in Hawaii.

SOURCE: Hawaii State Data Book, 1997. State of Hawaii, Department of Business, Economic Development & Tourism

6.3.2 TOURISM

Until recent times the primary economic activity in the Kona area was agriculture where more than 50 percent of the work force was employed. By the 1970s the importance of agriculture and the visitor industry had reversed. This section describes the major features of the visitor industry and its impacts on the Kona area.

6.3.2.1 Visitor Accommodations

During the period between 1990 and 1994, the number of visitor accommodations in the State fluctuated in both directions. While this period experienced an overall decline in the State, accommodations on the Island of Hawaii increased by approximately 7.18 percent in 1994 (e.g., increase of 643 units in 1994 divided by 8,952 units in 1990, **Table 6-7**). This number represents an increase of 643 units from 1990 to 1994 (HVB 1994). Maui had the second highest increase in hotel and condominium units at 4.5 percent. Both Kauai and Oahu experienced a decline in the number of accommodations available.

From 1994 to 1998, there has been an overall stabilization in the number of visitor units available. The statewide average annual rate of increase has been approximately 1.1 percent, compared to the Big Island with an average annual rate of 0.06 percent. This is consistent with the overall statewide trend in the mid to late 1990s, for fewer visitor arrivals. It is anticipated that as current visitor plant inventory data becomes available, it will reflect the on-going increase of visitor arrivals both statewide and at KOA.

TABLE 6-7
STATE OF HAWAII VISITOR PLANT INVENTORY
1990 - 1998

YEAR	State Total	Oahu	Hawaii	Kauai	Maui
1990	71,266	36,899	8,952	7,546	18,169
1991	72,575	36,623	9,383	7,567	19,002
1992A	73,799	37,729	9,170	7,778	19,552
1993A,B	70,542	37,032	9,490	4,631	19,389
1994	70,683	36,194	9,595	5,870	19,024
1995	N/A	N/A	N/A	N/A	N/A
1996	70,288	36,146	9,558	6,760	17,824
1997	71,025	35,971	9,913	6,589	18,552
1998	71,480	36,206	9,655	6,969	18,650

* Total Available Units = Hotels and Condominiums.

A. Oahu figure includes 428 units in the Villa at Eaton Square that were not available for visitor use in 1992 or 1993.

B. Hawaii County figure includes 350 units in the Hapuna Beach Prince Hotel that were not available for visitor use in 1993.

SOURCE: Visitor Plant Inventory, Hawaii Visitors Bureau, 1994, and Visitor Plant Inventory, (annual), Hawaii Visitors & Convention Bureau, 1998.

In terms of visitor accommodations on the Island of Hawaii, as of 1994, the Kona area has the greatest concentration of units, representing 45.1 percent of all the island's units (e.g., 4,331 Kona units divided by 9,595 total Big Island units, **Table 6-8**) and is followed by the Waimea-Kohala area with 39.4 percent. These two areas combined represent approximately 85 percent of the 9,595 units for visitor accommodations on the Island of Hawaii (HVB 1994).

TABLE 6-8
VISITOR ACCOMMODATIONS UNIT TYPE BY AREA
HAWAII COUNTY

DISTRICT	Number of Units	% Hotels	% Condominiums	% Island
Hilo-Honokaa	1,246	94.5	5.5	13.0
Naalehu-Kau	52	21.2	78.8	0.5
Volcano	190	57.4	42.6	2.0
Waimea-Kohala	3,776	93.4	6.6	39.4
Kona	4,331	59.3	40.7	45.1
TOTAL	9,595	77.0	23.0	100.0

SOURCE: Visitor Plant Inventory, Hawaii Visitor's Bureau,1994.

The average occupancy rate for the island was 58.18 percent for calendar year 1993. By comparison, the hotels in Waikiki posted average annual occupancy rates of 76.71 percent for the same period. Kauai averaged 76.66 percent, with Maui showing 67.56 percent. While the visitor accommodations on the Island of Hawaii have increased, it appears that the Island of Hawaii is not yet a competitive alternative to Waikiki or West Maui (Hawaii State Data Book, 1993-94, DBED&T).

6.3.2.2 Visitors (Past and Projected)

The following is excerpted from a report prepared by Aries Consultants Ltd., entitled "Update of Hawaii Aviation Demand Forecasts, October 1994."

"The most current visitor industry projections were prepared by the State of Hawaii, DBED&T in their *Population and Economic Projections for the State of Hawaii to 2010 (Series M-K)*. However, these forecasts were made during the 1980s when visitor growth was expanding and the State had not updated the 1988 M-K Series to reflect the impacts the decrease in visitor arrivals in 1991, 1992, and 1993 would have on the State's official long-range projections."

The most recent projections done by DBED&T indicate that statewide tourism will continue to grow through the year 2010. The projections shown in **Table 6-9**, indicate growth from an estimated 4.9 million visitors in 1985 to 11.5 million in the year 2010 (DBED&T, 1990).

TABLE 6-9
STATE OF HAWAII
VISITOR PROJECTIONS, 1985 - 2010

	HISTORICAL		FORECAST			
VISITORS	1985	1990	1995*	2000	2005	2010
VISITOR ARRIVALS	4,884,000	6,521,000	6,629,180	8,979,000	10,159,000	11,494,000
NON-JAPANESE	4,029,000	5,087,000	4,709,240	6,734,000	7,619,000	8,620,000
JAPANESE	855,000	1,435,000	1,919,940	2,245,000	2,540,000	2,874,000

AVERAGE ANNUAL INCREASE (PERCENTAGE)

	1985-1990	1990-1995*	1995*-2000	2000-2005	2005-2010
ALL VISITORS	6.0	0.3	7.1	2.5	2.5
NON-JAPANESE	4.8	-1.5	8.6	2.5	2.5
JAPANESE	10.9	5.1	3.4	2.5	2.5

SOURCE: Update of Hawaii Aviation Demand Forecasts, Aries Consultants Ltd., 1994, and State of Hawaii, DOT, 1999.
*Historical Data, State of Hawaii, DOT, 1999.

According to Aries Consultants, Ltd., statewide visitor arrivals exceed the M-K Series projections by an estimated 450,000 visitors in 1990 with total arrivals of 6,971,180 visitors. Since 1990, visitor arrivals decreased by an estimated 13 percent to a total of 6,115,300 visitor arrivals in 1993.

In order to update aviation forecasts for the State, Aries Consultants Ltd., prepared their own projections based on historical visitor trends according to HVB. Visitor trends from 1970 through 1992 were used to develop a least squares trend extrapolation of visitors through the year 2020. The analysis assumes that the same factors which influenced past visitor growth will continue to affect visitor arrivals in the future. Although this is rather broad, the technique provides a reliable benchmark for comparing the results of other analyses (Aries Consultants, Ltd., 1994).

These projections were compared with recent unpublished Statewide visitor arrivals prepared by the Department of Transportation, Statewide Transportation Planning Office, and the City and County of Honolulu Planning Department. In addition, unpublished visitor arrival updates were provided by Hawaiian Electric Company, Inc. for review and the assumptions were reviewed with several government agencies. A comparison of projected visitor arrivals expressed as average annual percentage increases are elaborated in **Table 6-10.**

According to **Table 6-10,** the projected Statewide visitor arrivals between 2000 and 2010 prepared for the 1988 M-K Series indicate an average annual increase of 2.5 percent to 11,494,000 visitor arrivals in 2010. More recent projections of visitor arrivals, prepared by the City and County of Honolulu, average 3.0 percent annual increase between 2000 and 2010 and are slightly higher than those forecast for the M-K Series. The projections by the Hawaiian Electric Company, Inc. show an average increase of 4.4% from 8,676,0000 visitor arrivals in 2000 to 13,409,000 visitor arrivals by 2010. Aries Consultants, Ltd. forecast average increases of 2.4% per year to 10,855,000 visitor arrivals and these are slightly lower than the M-K Series forecasts (Aries Consultants, Ltd., 1994).

The 1988 M-K Series forecasts were prepared during a period of high growth rate in visitor arrivals, particularly substantial increases in eastbound visitor arrivals in the late 1980s. More recent forecasts prepared by the City & County Planning Department estimate 11,276,360 visitor arrivals compared to M-K Series projections of 11,494,000 visitor arrivals. Visitor projections of 10,855,000 visitor arrivals (Aries Consultants Ltd.) in 2010 are more conservative than the other two forecasts.

Visitor projections prepared by Aries Consultants, Ltd. for aviation activity indicate visitor arrivals will increase to 2020 but at a slower rate of increase than what has been recognized in the past. The total enplaned plus deplaned passenger volume at KOA is forecasted to increase approximately 33% from the actual 1997 Airport Activity Statistics of 2,628,157, to 3,489,000 in 2015, for an average rate of 1.7% per year (Aries Consultants, Ltd., October 1994) (**Table 6-11**).

TABLE 6-10

PROJECTED VISITOR ARRIVALS, 2000-2020

	Visitors 2000	Annual Percent	Visitors 2010	Annual Percent	Visitors 2020	Annual Percent
1988 M-K SERIES	8,979,000	3.3	11,494,000	2.5	n.a.	n.a.
1994 CITY & COUNTY OF HONOLULU	8,358,000	1.8	11,276,000	3.0	14,279,000	2.4
1994 HAWAIIAN ELECTRIC CO.	8,676,000	12.2	13,409,000	4.4	n.a.	n.a.
1994 ARIES	8,528,000	2.0	10,855,000	2.4	13,183,000	2.0

n.a. = not available

SOURCE: Update of Hawaii Aviation Demand Forecasts, Aries Consultants Ltd., 1994.

TABLE 6-11

AIR PASSENGER FORECASTS FOR KOA

(Enplaned and Deplaned)

ANNUAL FORECASTS	ACTUAL 1992	1997	FORECAST 2000	2005	2010	2015	2020
Overseas							
Mainland	278,995	310,681	445,000	619,000	816,000	1,034,000	1,270,00
International	0	60,258	131,000	182,000	246,000	334,000	429,000
Interisland	1,882,941	2,257,218	2,078,000	2,122,000	2,139,000	2,121,000	2,081,000
TOTALS	2,161,936	2,628,157	2,654,000	2,923,000	3,201,000	3,489,000	3,780,000

SOURCE: Update of Hawaii Aviation Demand Forecasts, Aries Consultants Ltd., 1994, and State of Hawaii, DOT, 1997.

The development market in Hawaii, despite more recent projections for a slower rate of visitor growth, have already initiated development activity. According to the "Visitor Plant Inventory, 1994," 30 existing properties had planned to construct an additional 204 visitor units. According to county planning departments, a total of 32 new visitor accommodation projects were planned for the State, with a total of 15,751 rooms. Of the 15,751 units, 55% were to occur on Oahu, 38 percent on Hawaii, 6 percent on Kauai, and 1 percent on Maui (HVB 1994).

The expected increase in visitor plant inventory along with planned residential developments will result in major increased demands on many services and facilities, KOA being one of them.

ECONOMIC CHARACTERISTICS - IMPACTS AND MITIGATION

A. Impacts

Development of projects identified in the KOA Master Plan will result in creation of new employment. Job categories required will include both short-term construction and longer term operational employment related to the support of new KOA facilities. An estimated 2,053 direct and 3,592 indirect construction associated jobs will be generated. Estimates of longer term employment generated by KOA business and support businesses serving the airport are more difficult to determine but will primarily be dependent on level of demand placed on use of KOA facilities.

It is expected that increased employment opportunities will benefit the area economy. Short term construction, however, may involve use of skilled and semi-skilled workers brought in from other parts of the Big Island and State. Upon completion of construction activities transient workers are expected to depart the region. Longer term employment will provide greater opportunity for economic benefit to the region since resident employees will provide multiplier benefits based on spending of disposable income and payment of local (County) taxes and user fees.

U.S. Census Bureau data for the State of Hawaii provides information on housing vacancies which are an indication of the ability of an area to support any increase in short or longer term population due to in-migration of workers to help with construction of KOA Master Plan Update facilities. According to the 1990 Census, the last available census for which County of Hawaii, district housing data is readily available, the overall housing vacancy rate for the State was 0.84 percent for homeowner units and 5.44 percent for renters. A comparative review of vacancy rates indicates that statewide, the County of Hawaii has the second highest vacancy rate (1.5 percent) for homeowner units and the highest vacancy rate (10.3 percent) for rentals (**Table 6-12**). The North Kona region in comparison to the overall Big Island similarly maintains relatively high vacancy rates of 1.4 percent for homeowner units and 11.6 percent for rentals.

TABLE 6-12

HOUSING VACANCY RATES FOR STATE, COUNTIES AND NORTH KONA DISTRICT, ISLAND OF HAWAII

	Vacancy Rate (Percent)	
LOCATION	Homeowner	Renter
Statewide	0.8	5.4
Kauai	0.7	3.7
Honolulu	0.6	4.3
Maui	1.6	7.8
Hawaii	1.5	10.3
North Kona*	1.4	11.6

Note: Vacancy rate based on mean average of census tracts: 214, 215 & 216

SOURCE: U.S. Bureau of the Census, 1990 Census STF 1A, produced by the Hawaii State Data Center.

B. Mitigation

Mitigation measures are not expected to be required. The employment opportunities provided from Master Plan Update expansion of the airport will provide both public revenues, in the form of taxable income and payment of user fees, and private benefits, in the form of compensation and profit.

The KOA Master Plan will generate new employment opportunities which in turn, may generate need for additional housing. This housing need will involve short as well as long term requirements. Although the above housing vacancy rate does not provide the number of units available for use by new employees, it does indicate that among all

Counties, that the Big Island has the second highest vacancy rate for homeowner units, and the highest vacancy rate for rentals. Should new housing be required, it is expected that new construction will be provided as needed to supplement the North Kona housing inventory which as of 1990 amounted to 10,993 units compared to a Big Island total of 48,253 units, and a statewide unit count of 389,810 units (U.S. Census Bureau, 1990 census).

SECTION 7
ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION
PUBLIC FACILITIES, SERVICES, AND AIRPORT SUPPORT UTILITIES

7.1 ACCESS, CIRCULATION AND PARKING

7.1.1 ACCESS

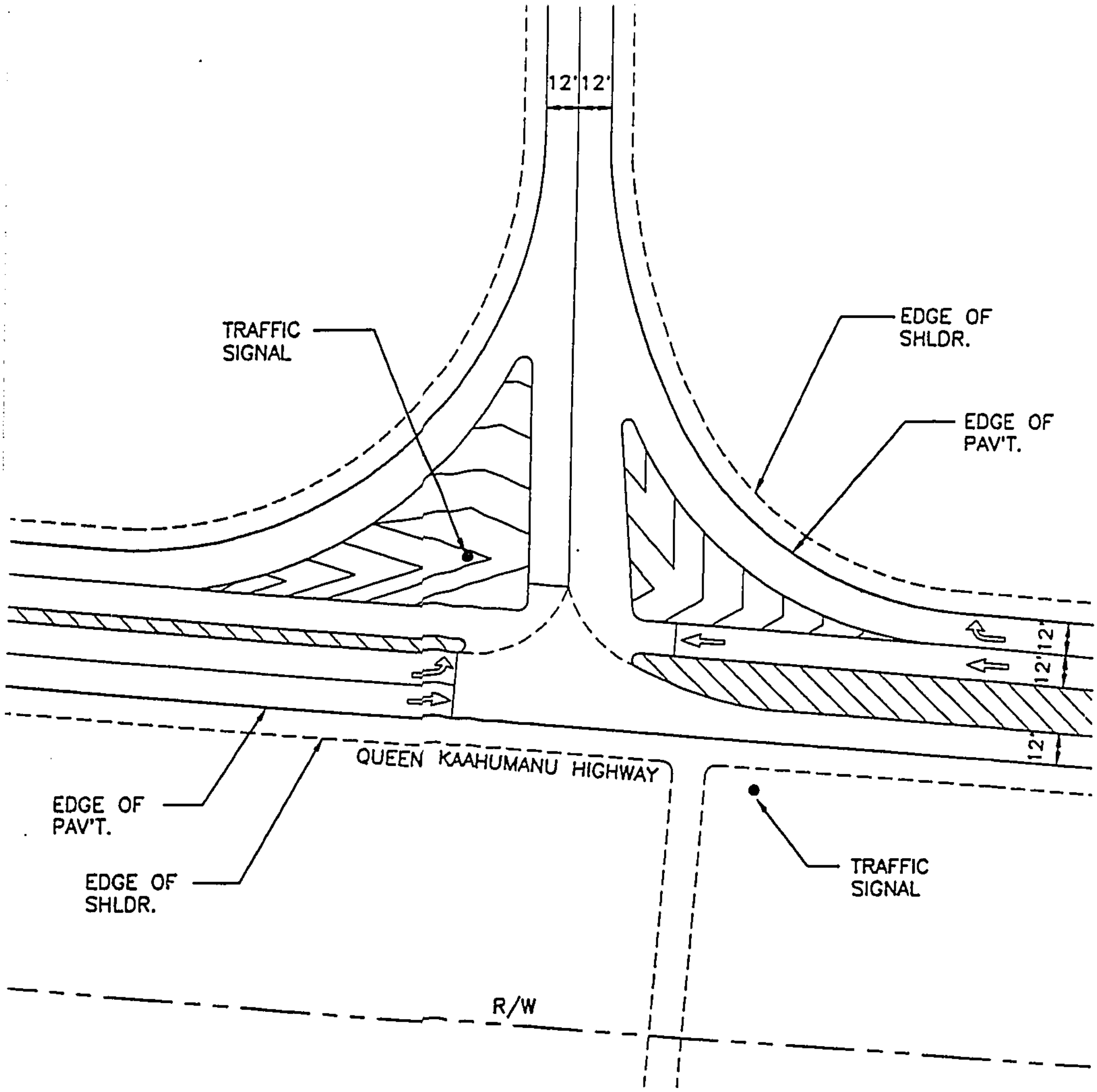
7.1.1.1 Queen Kaahumanu Highway Intersection

Access to KOA is through the Queen Kaahumanu Highway which is the primary State highway serving the area. Queen Kaahumanu Highway extends from Kailua-Kona to Kawaihae and is 24 feet wide, with 12-foot lanes in each direction, and with a 300-foot right-of-way near the Airport Access Road (**Figure 7-1**).

An analysis of traffic conditions on the highway were prepared as part of the, "Environmental Assessment for Queen Kaahumanu Highway Widening, Kailua to Keahole," County of Hawaii, by R. M. Towill Corporation, in May 1996. The EA provides an assessment of the level of highway service provided as well as potential future requirements. Information from the EA is provided in the following discussion.

Existing traffic volumes on the highway were collected to establish a baseline for projected traffic volumes. Existing average daily traffic (ADT) volumes were collected in two ways, compilation of 1992 Traffic Survey Data (State DOT) and filed surveys. This data was used to calibrate a computer model called Tranplan. Tranplan, a mathematical analysis tool, was used to produce traffic volume data based upon quantitative relationships among variables. The average base year daily traffic volumes are shown in **Figure 7-2.**

Projected traffic volumes were based on the State of Hawaii M-K population projection series. The M-K projections were also used to establish facilities needed in the 1991 Island of Hawaii Long-Range Highway Plan (LRHP). Based on the data at that time, the LRHP noted that the Queen Kaahumanu Highway between KOA and Palani Road would require upgrading to either a four-lane controlled freeway or a six-lane divided arterial with dedicated turn lanes provided at major intersections.



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NOT TO SCALE

FIGURE 7-1
ACCESS ROAD INTERSECTION
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

R. M. Towill Corporation

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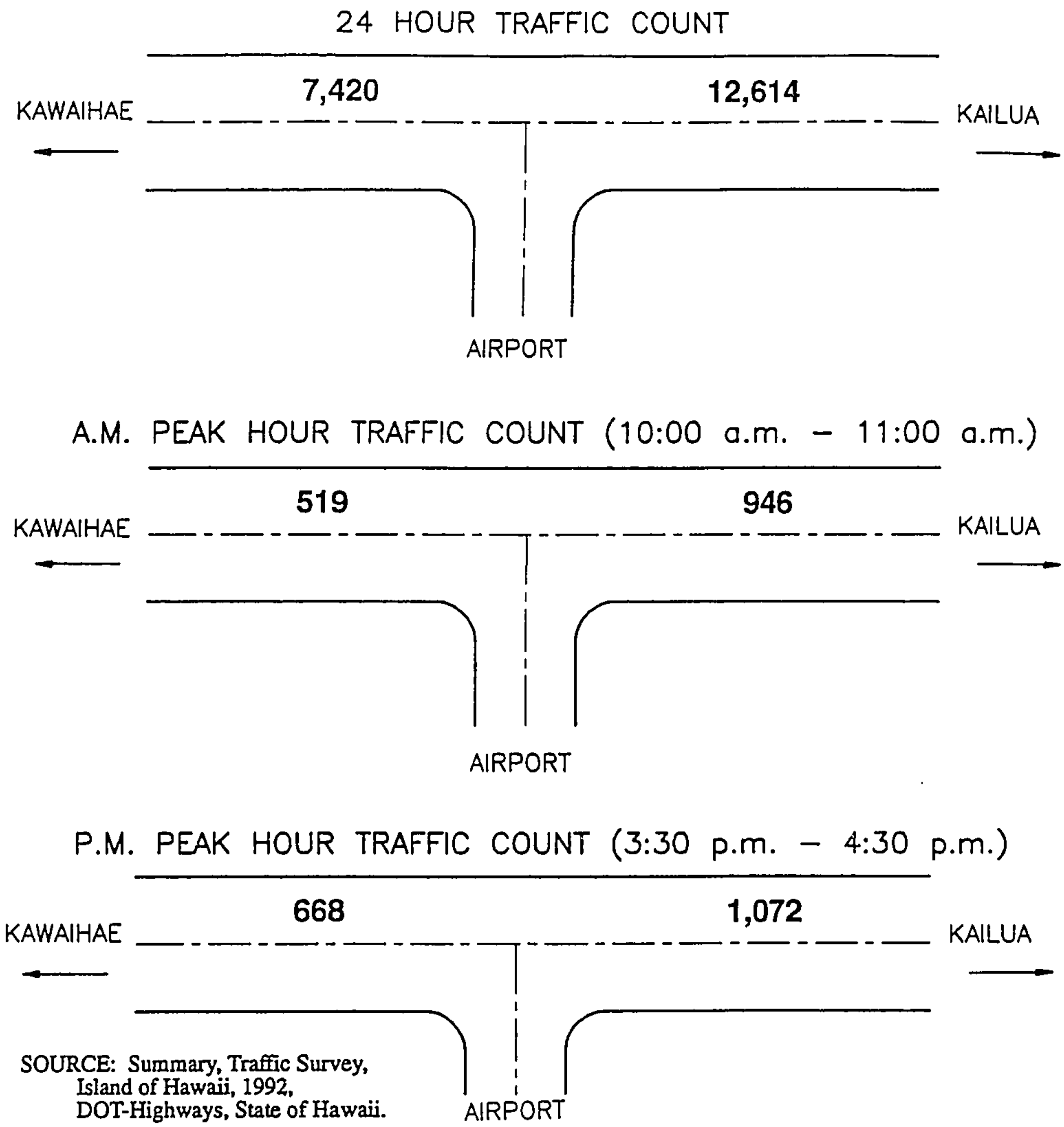

SOURCE: Summary, Traffic Survey,
Island of Hawaii, 1992,
DOT-Highways, State of Hawaii.

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FIGURE 7-2
BASE YEAR TRAFFIC VOLUMES
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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A Level of Service (LOS) analysis was performed for the peak period to examine the necessity for roadway improvements along the highway corridor between the airport and Palani Road. Based on the LOS analysis, both the AM and PM peaks would degrade to LOS E from LOS D between the airport access road and Kaiminani Road by the year 1996 given the current growth projections. At LOS E, it is assumed that the highway is operating at capacity and improvements will be required. LOS is a qualitative measure used by traffic engineers to describe traffic operational conditions. Six levels have been defined, from LOS-A (best operating conditions) to LOS -F (worst). The current forecast study confirmed the need to upgrade Queen Kaahumanu Highway to a four-lane divided facility.

From the analyses, the Federal Highway Administration (FHWA) determined that the Queen Kaahumanu Highway requires an upgrade from a two-lane highway to a four lane divided highway from Henry Street in Kailua-Kona to the Airport Access Road. The tentative schedule for this project is as follows (DOT-H, January 8, 1999):

Design: Mid-1997 - Late 1999
Right-of-Way Acquisition: Mid-1997 - +2000
Construction: Undetermined, pending construction funding

The portion of proposed new highway located at the intersection of the airport entrance had a recent installation of a 3-legged signal intersection prior to the overall highway improvements. The signalization of this intersection was completed in October 1996. This present configuration will be redesigned and improved as the highway is enlarged to 4-lanes.

7.1.1.2 Access Road

The airport access road was constructed with 2 inches of asphaltic concrete pavement over a 6-inch base course. The pavement width is 24 feet with two, 12-foot lanes with a 10 foot wide shoulder which extends along both sides of the roadway. The access road has a design speed limit of 45 miles per hour and stretches 3,050 feet from the Queen Kaahumanu Highway intersection to the airport site with maximum slopes near the intersection of roughly 6 percent. There are no facilities for exclusive pedestrian use, although a bicycle route is designated along Queen Kaahumanu Highway, from Kailua-Kona to the KOA facility.

7.1.1.3 Access Evaluation

The existing airport access road is adequate to support the current volume of traffic at the airport. During emergencies, service roads at both ends of the runway or unpaved roads, which are used during construction, from Queen Kaahumanu Highway may be used for airport access.

Additional improvements to accommodate future traffic increases include construction, widening, or realignment of various airport utility access roads. These road systems will not generally be used by the public but will facilitate business and operations uses at the airport.

7.1.2 TRAFFIC CIRCULATION

The existing automobile circulation pattern is retained in the proposed Master Plan. The airport access road from Queen Kaahumanu Highway will continue to have two-way traffic flow, and the peripheral road around the airport parking lot will continue to have only one-way traffic. A proposed cutoff loop to directly service the interisland terminals will eliminate the need for all traffic to go to the OST. The direction of these flows are illustrated in **Figure 7-3.**

The traffic pattern appears to be satisfactory with smooth vehicular movement during average concentrations. Queuing occurs at loading areas and intersections during periods of aircraft arrivals and departures.

7.1.3 PARKING FACILITIES

In 1995, 508 parking spaces were available for short-term public parking, and 92 spaces were available for long-term (monthly) parking.. The existing parking area is also being used for 75 car rental parking spaces. By the year 2015, approximately 840 or more public parking spaces will be required to accommodate the projected needs of airport users. New public parking facilities are in the area east of the interisland parking spaces and future OST.

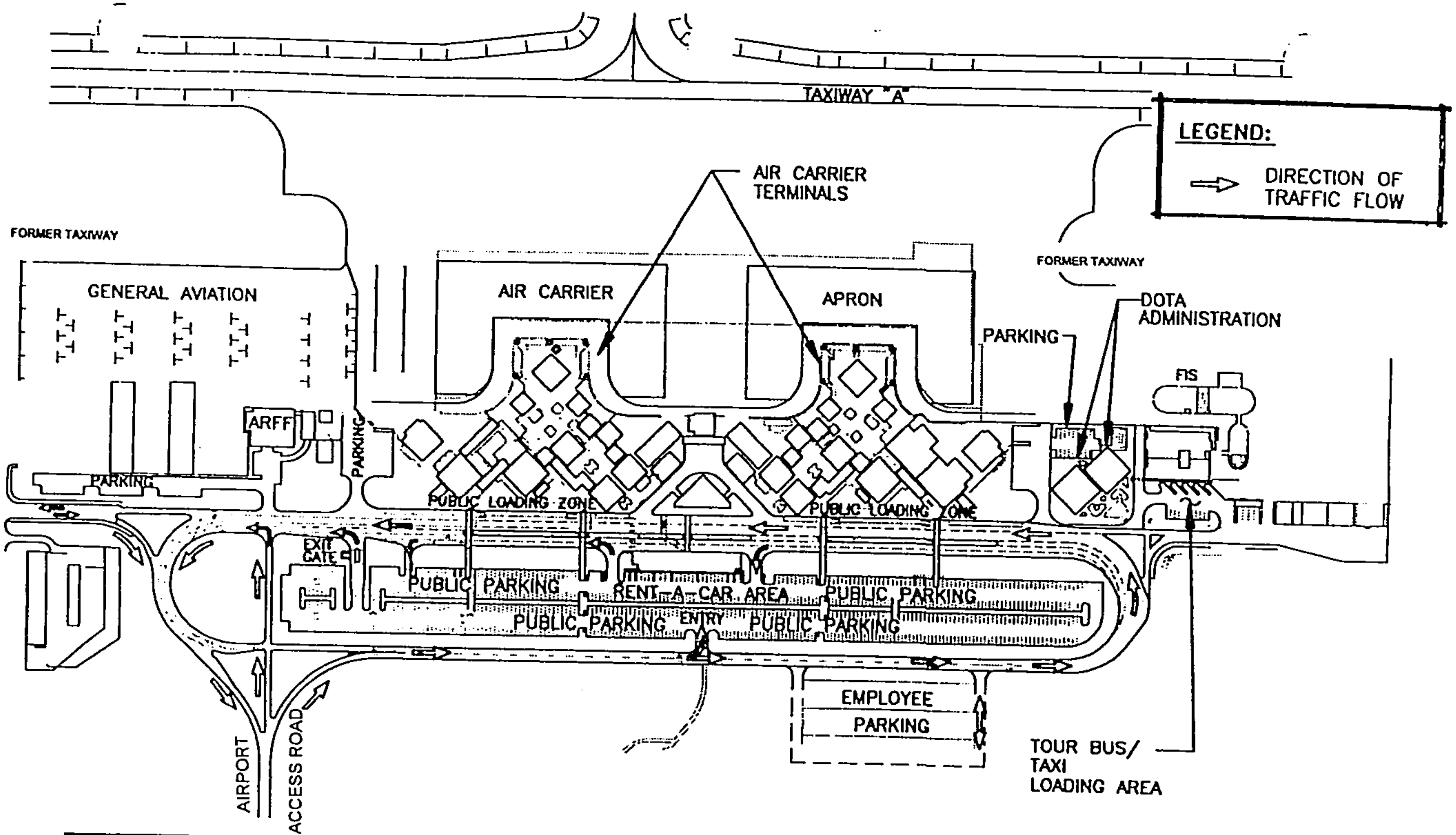

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FIGURE 7-3
TERMINAL AREA TRAFFIC PATTERNS & PARKING LOCATIONS
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

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7.1.3.1 Employee Parking

Employee parking is at a premium, especially since monthly rentals also use the employee lot. To accommodate the planned growth in employment, additional employee parking stalls will be required. While there are approximately 300 employees in 1995, the number of stalls available is uncertain, since they are not marked and the area is shared with monthly rentals. The ultimate facility will be properly marked and sized to service approximately 400 vehicles. The proposed employee parking facility will be located east of the public parking area within the peripheral loop road. A separate parking facility for long-term users is also proposed within the ground transportation area and can easily be serviced by car rental shuttle busses.

7.1.3.2 Buses and Limousines

There are a total of four areas for bus and limousine parking, one each at both ends of the terminal adjacent to the baggage claim areas. Bus parking is limited to a total of 12 stalls while limousine parking is limited to 8 stalls.

7.1.3.3 Taxi Parking

At this time, taxi company operations at KOA are on the increase. Taxi parking is designated towards the north end of the public parking area and adjacent to the baggage claim areas.

7.1.3.4 Public Parking

Public parking is provided via an airport concessionaire and is located east of the terminal area. The lot can accommodate 508 public parking spaces, according to the facility manager. Public parking ranges from short-term parking, which is considered less than 3 hours, to long-term, overnight parking. Approximately 75 spaces west of the public parking lot, adjacent to Building No. 344, are designated for rental cars. There are an additional 70 monthly parking rentals by private and commercial users. These spaces are within the employee parking lot.

ACCESS, CIRCULATION AND PARKING IMPACTS AND MITIGATION

A. Impacts

The existing access road, circulation roadways and parking facilities are expected to be inadequate to service the projected demands for expansion of the airport. The resulting congestion can be expected to further increase delays in providing access to travelers and users of the airport.

B. Mitigation Measures

The airport access road will be increased from a two-lane roadway to a four-lane roadway divided by a median strip before the year 2004.

The peripheral road between the public parking area and the proposed employee parking area will be increased from two lanes to four lanes. The peripheral road fronting the terminal will be widened to five lanes. The five lanes will be separated by an island into three and two-lane roadways. The two lane segment adjacent to the public parking will be designated for bus, taxi and limousine parking, and baggage truck loading zone. Through traffic will be accommodated past this area.

By the year 2015, approximately 840 public parking spaces will be required to accommodate the projected needs of airport users. New public parking facilities will be proposed in the east area of the interisland parking and future Overseas Terminal. A new employee parking area with approximately 400 stalls will be sited to the east of the public parking area.

7.2 POTABLE WATER SUPPLY

Water usage at the airport follows aircraft arrival and departure patterns. Most demands are due to passenger usage in the terminal area and from landscaping irrigation. On-site water will be supplied by a new 1 million gallon tank serving the airport and NELH area. The water will be supplied through a 12-inch pipeline fed by a 12-inch municipal water main running along the Queen Kaahumanu Highway. The pipeline follows the airport access road and along the periphery road where it connects to the water distribution network (**Figure 7-4**).

There will be continued use of existing off-site transmission and storage facilities, maintained by the Hawaii County Department of Water Supply (DWS). Source water is obtained from four wells and an underground shaft south in the Kahaluu area.

A 0.5 million gallon off-site water storage reservoir at elevation 280 feet above mean sea level (MSL) is linked with the 12-inch line above Queen Kaahumanu Highway to provide for fire flows.

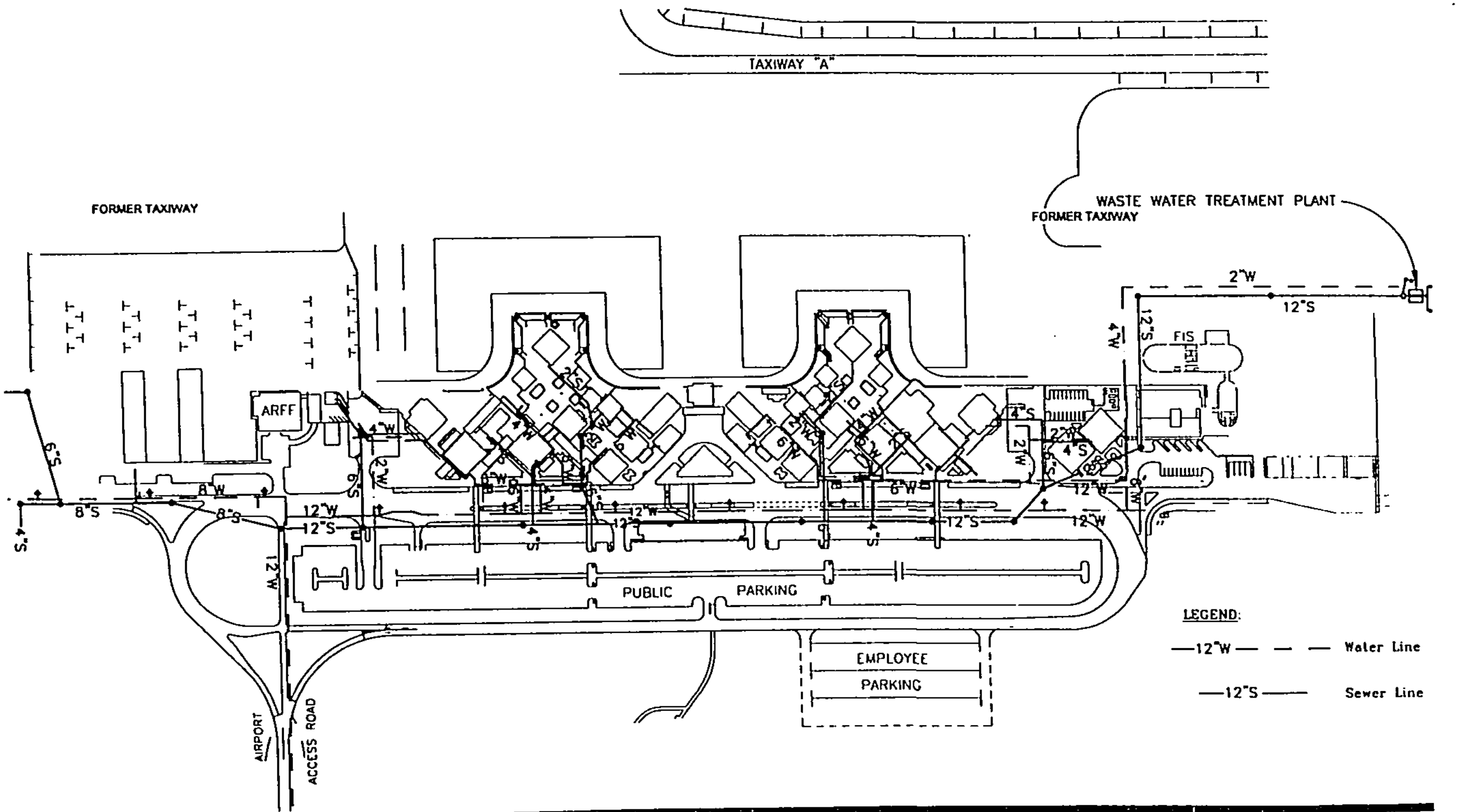

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FIGURE 7-4
EXISTING TERMINAL WATER & SEWER SYSTEM
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

Keahole Associates Inc.

R. M. Towill Corporation
JAN 1999

A. Impacts

No adverse impacts are anticipated as domestic water requirements can be met satisfactorily and the overall distribution system is in fair physical condition.

B. Mitigation

A new 16-inch water main has recently replaced the 12-inch pipeline between the highway and Road "N". A future North Kona consortium tap will replace the 12-inch municipal water line near the highway and will connect to the recently installed 16-inch water main.

Until additional sources are on-line, airport water use guidelines should be established for flow monitoring and regulation. Fixture designs should include flow restriction devices to avoid waste. Future off-site facilities will be phased on an as needed basis. Such phasing will allow smoother transition between construction projects. Effluent reuse for irrigation will reduce potable water demands.

7.3 WASTEWATER TREATMENT AND DISPOSAL

The existing wastewater treatment plant (WWTP) has a capacity of 40,000 gallons per day (GPD). The WWTP parcel occupies an area of 7,250 SF (**Figure 7-4**). Secondary treatment is obtained by an extended aeration operation followed by clarification and chlorination. The effluent is disposed through 20-foot deep injection wells into porous lava rock. The maintenance of this WWTP is presently contracted out to INCOM Inc.

Wastewater flow, as with water, follows arrival and departure schedules. The main collection line is a 12-inch gravity line which parallels the peripheral road along the terminal in a south-north direction. Collected sewage is conveyed to an on-site treatment plant at the north end of the airport site. Wastes from United Airlines aircraft are disposed of at the on-site WWTP. However, wastes from Aloha Airlines and Hawaiian Airlines are disposed of at Honolulu International Airport wastewater facilities.

A new WWTP system has been proposed to increase capacity to handle approximate average daily flows of 130,000 GPD, with peak capacity of 1.25 million gallons per day (MGD). This system will be used to collect sewage from all airport facilities. The new treatment plant (water reclamation facility) will be designed for R1 water, which will be used for irrigation within the airport. In the event that a component in the treatment plant fails to produce the quality of water required for R1 uses, an injection well will be required as an alternate disposal method.

A. Impacts

Since the new WWTP system will be self contained, no impacts will result on the local County system. The treated effluent will be diluted with the groundwater and be naturally filtered and purified prior to eventual migration to the ocean. No significant impacts are anticipated to Class AA coastal waters.

Saturation of the underlying basalt may occur and some odors could be generated without proper maintenance of the treatment plant. Therefore, regular maintenance of the treatment plant is necessary to insure no odor or injection well clogging problems.

B. Mitigation Measures

Most of the treated effluent will be dispersed over a wide area through effluent reuse irrigation systems. This will reduce leachate build-up concentration levels and maintenance requirements, thereby extending the life of the injection wells. Effluent spray contact with humans can be minimized by providing sufficient landscaped buffer zones that use potable water.

A program of groundwater monitoring and coastal water quality may be executed prior to WWTP development to ensure compliance with applicable water quality standards and to establish baseline data on water quality.

Because of the relatively small requirements of the sewage treatment plant a prefabricated package type treatment plant will be developed. Plant maintenance may be contracted to a private operation contractor specialized in maintaining private sewage treatment facilities. Periodic inspections by qualified State personnel shall also be conducted. The closest development to the WWTP will be the new terminal facilities, located approximately 0.5 miles to the south offering sufficient buffer space for the dispersal of any odors.

The sewage pump station will be a buried package facility. Odors are not anticipated in the vicinity from a properly designed and maintained facility.

7.4 STORM WATER DRAINAGE

The existing drainage system at the airport performs satisfactorily as a result of favorable geologic characteristics. Layers of basalt lava rock cover most of the area, making for excellent infiltration and subsurface flow conditions. The present system of dry wells, swales, and culverts is planned to be expanded as more areas are developed. There is no County drainage system in the area.

A. Impacts

There are no defined waterways of any kind in the area which will be disrupted by the proposed expansion. Collected runoff will be disposed of in deep pits. The airfield and terminal improvements will significantly increase the amount of impervious area thereby increasing the amount of runoff.

Adequate drainage is available in the surrounding terrain, so the increased runoff generated from the airport facilities will be accommodated resulting in no impacts on adjacent developments (HOST Park and NELH).

B. Mitigation Measures

At this time a National Pollutant Discharge Elimination System (NPDES) permit is not required because no runoff from the airport discharges to State waters. A total of approximately 49 dry wells, along with a collection system, provides for the disposal of on-site generated runoff. The dry wells are permitted by the State Department of Health (DOH) through the underground injection well permitting program. The existing dry wells are permitted for runoff of rainwater. If the runoff is contaminated by industrial activities, however, pretreatment will be required.

The quantities of runoff disposed of by the dry wells are estimated to be 10 cubic feet per second (cfs) per dry well. Runoff entering from off-site areas will be diverted around the development (if necessary) by perimeter swales. The terminal and airfield drainage facilities will be designed to accommodate 5-year storm intensities. Other measures proposed include the preparation of guidelines for the prevention of chemical and fuel spills and guidelines for the general safety of the public with respect to the various drainage facilities.

7.5 ELECTRICAL AND COMMUNICATIONS SYSTEM

The offsite power system is maintained by the Hawaii Electric Light Company (HELCO). A substation, located at the intersection of the Airport Access Road and Queen Kaahumanu Highway, will be used to provide electrical power for the expanded airport facilities. Source transmission is via a HELCO 69 kilovolt (KV) overhead line along the Queen Kaahumanu Highway. The current capacity of the HELCO system is 196.8 megawatts (MW) with peak demand reaching 169.6 MW, which occurred on December 7, 1998.

On-site airport power and communications links consist of underground ducts along the airport access and circulation roads (**Figure 7-5**). Emergency backup generators and additional electrical and telecommunications switching facilities will occupy the electrical control building, near the existing air traffic control tower. This building will need some improvement to accommodate the additional backup power generators needed to ensure noninterruption to key airport facilities.

A. <u>Impacts</u>
The proposed improvements will place additional demands on the HELCO power system. No other significant impacts are expected.

B. <u>Mitigation Measures</u>
Improvements to the off-site electrical system will be performed as necessary by HELCO as part of their regional system upgrades. Maintenance activities to ensure safety and efficiency of operations at KOA include:

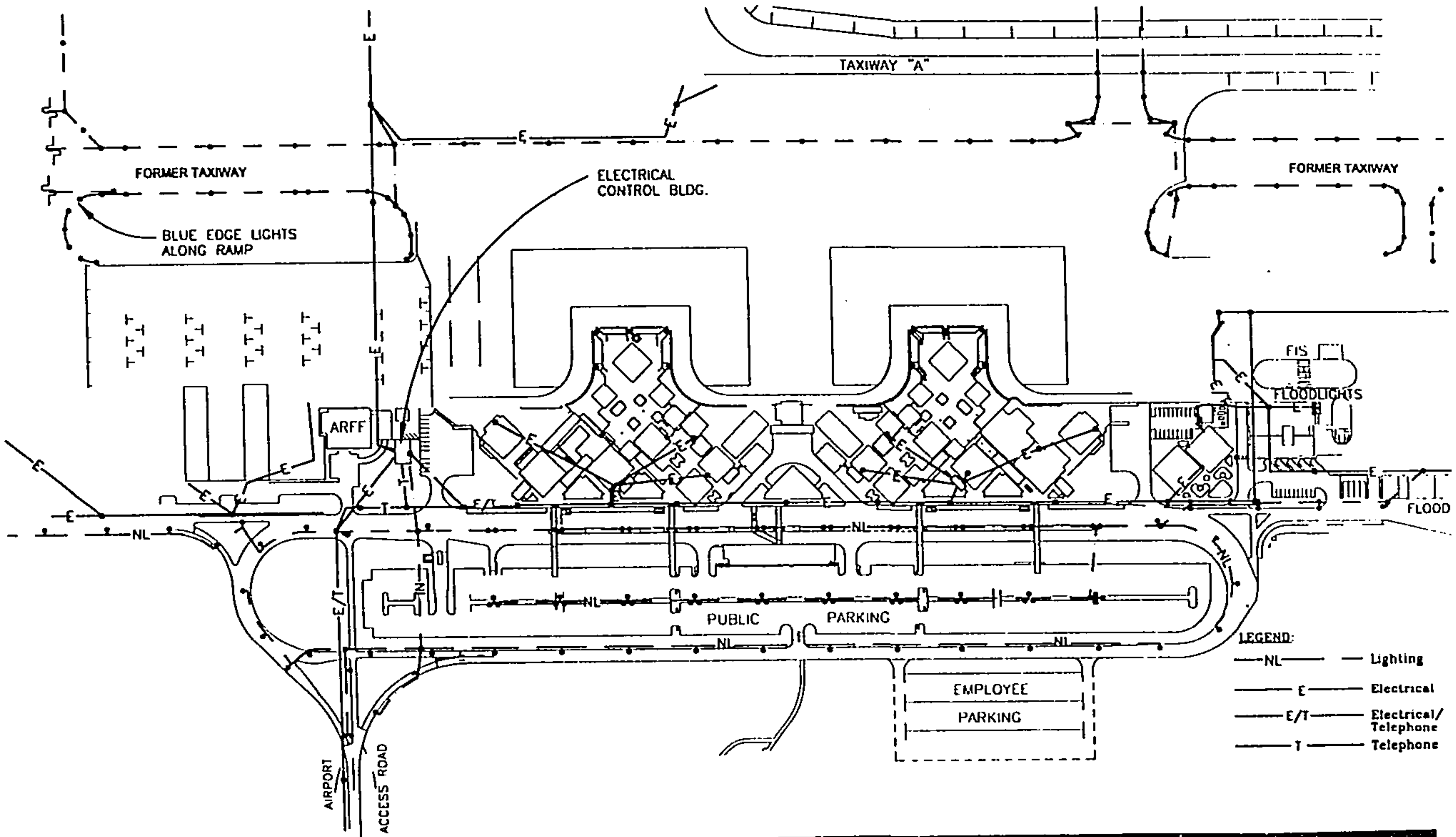

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FIGURE 7-5
EXISTING TERMINAL
ELECTRICAL & LIGHTING LAYOUT
Kona International Airport at Keahole
Master Plan Update
North Kona, Hawaii

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- HELCO has requested DOT authorization to install an alternate 12 KV tie line from the HOST Park substation. The tie line will connect from the existing pole line at HOST Park to KOA to provide an alternate source of power in the event that the KOA substation fails or when the KOA substation is de-energized for maintenance purposes.

- Future power requirements may necessitate the future upgrade of the existing KOA substation. Based on projected demands, the substation will be upgraded from the current 1.5 MVA to a 10 MVA capacity facility.

As recommended by HELCO, energy efficient and conservation features will be utilized at KOA.

7.6 LIGHTING SYSTEM

The airfield utilizes existing high intensity white/amber edge lighting along the runway (HIRL) and medium intensity blue lighting along the taxiways (MITL). Flashing approach lights are used along the extended runway centerline about 2,500 feet off each end of the runway (MALSR). Bright omni-directional runway end/threshold lights are used to alert pilots of their location in relation to the runway ends, and red and white beams of light are used to inform incoming aircraft of their approach slopes (VASI). A rotating green/white civil airport beacon on top of the air traffic control tower is also operating. Parking lot lighting utilizes overhead lamps suspended on aluminum poles.

The proposed airfield and terminal lighting system at the airport will be expanded to enhance the existing airfield lighting system. New lighting fixtures will be added or expanded to new terminal buildings and parking lot areas.

A. <u>Impacts</u>

There will be some impacts as a result of the increased amount of airport lighting. The electrical demand from lighting is estimated at 60 KW. This will impact the HELCO power system servicing the airport.

Airfield approach lighting facilities will be located at various sites far from the airport proper. Disturbance of the terrain will occur in isolated patches off both ends of the runway. Light emitted from these facilities may cause some visual impacts, as they may contrast with the presently undeveloped surroundings.

B. Mitigation Measures

There are no proposed mitigation measures for the proposed airfield lighting facilities. The clear visibility of these facilities from their intended directions is essential for their function and for the safety of aviators and the flying public. Terminal and parking lot lighting will utilize glare shields to reduce stray light.

The electrical power demands of the lighting facilities (and the remainder of the airport expansion) will need to be coordinated with HELCO for review of necessary regional system upgrades.

7.7 FUELING SYSTEM

There are two types of fueling services at KOA; use of tanker trucks which deliver fuel to the aircraft, and use of a fueling pit. Distribution to the air carriers, General Aviation (GA), and helicopter areas is provided by tanker trucks. Distribution of AvGas is via a fueling pit. Fuel being used by aircraft at KOA is currently provided by the following:

EXISTING CONDITIONS

SUPPLIER	STORAGE FACILITIES
Circle Rainbow	2 - 20,000 gallon Jet-A Tanks
Century Aviation	1 - 10,000 gallon aviation gas (AvGas) Tank
	1 - 12,000 gallon Jet-A Tank
	1 - 20,000 gallon Jet-A Tank

Upgrades to the GA system have already been proposed to meet future requirements. Short term future GA fuel facilities would include:

FUTURE PROPOSED CONDITIONS

SUPPLIER	STORAGE FACILITIES
Sporty's Academy Hawaii	1 - 10,000 gallon AvGas Tank
Air Service Hawaii	1 - 30,000 gallon Jet-A Tank
	1 - 12,000 gallon AvGas Tank
	1 - 30,000 gallon Jet-A Tank (long term future)
Hawaii Fueling Facilities Corporation (HFFC)	2 - 30,000 gallon Jet-A Tanks
	1 - 30,000 gallon Jet-A Tank (long term future)

The main fueling and fuel storage area is located north of the terminal complex. The main fuel area is used for Jet A and 100 octane AvGas, as well as for bulk storage of Jet A and bonded Jet A-1 fuel. Presently, there is no fueling system with hydrants servicing the aprons.

A proposed fuel farm north of the terminal complex is under consideration. The selected site will be graded and prepared for fuel storage, and leased to a fuel supplier who will construct the on-site tanks, fuel transfer pumps, fire protection, and tanker loading and unloading racks. An initial proposal for bulk fuel storage involved the development of 2 - 10,000 barrel tanks, with expansion capacity for an additional 6 future 10,000 barrel tanks. The fuel farm would facilitate the refueling of overseas domestic and international flights. However, the project is on hold at this time due to funding restrictions.

A. Impacts

The impacts resulting from the expanded fueling facilities include possible contamination of groundwater and coastal waters from accidental leaks and spills. In addition, increased traffic from fuel trucks will result from the need to maintain required fuel storage levels.

B. Mitigation Measures

Possible solutions for these impacts involve appropriate design and construction of the fueling system. Storage tanks may be constructed above ground, with impermeable concrete foundations designed to contain any spillage. Pipelines may be installed with flexible couplings or joints to account for potential seismic induced ground movement. Improvements to the airport access and circulation roads will facilitate the delivery of fuel by large trucks.

7.8 POLICE SERVICE

KOA has its own security force operated by Wackenhut (contractor for the State) which consists of 20 personnel. In addition, there are 6 people for terminal security areas during operational hours which are also contracted to Wackenhut directly by the air carriers. As a result of international flights, security at the airport has been required to upgrade to Level III security.

A. Impacts
The present security force will be inadequate to accommodate the expansion of airport facilities.

B. Mitigation Measures
KOA will need to contract more police officers and security guards to maintain the security of the airport. Additional security screening guards at the departure gates will need to be contracted by the airlines.

7.9 AIR RESCUE AND FIRE FIGHTING FACILITIES, AND MEDICAL SERVICES

7.9.1 AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF) FACILITY

An Aircraft Rescue and Fire Fighting Facility (ARFF) satisfies requirements for an INDEX C airport as described in Federal Aviation Regulations (FAR) Part 139.49. Major equipment available on-site includes: one fire fighting vehicle with 3,000-gallon water capacity and two fire fighting vehicles with 1,500 gallon and 150 gallon light water (aqueous film forming foam) capacities. The ARFF building (Bldg. No. 347), occupies an area of 6,034 square feet, and is in good condition. Three shifts of eight persons per shift plus the ARFF chief form a total crew of 25 persons.

7.9.2 ARFF TRAINING FACILITY AND MEDICAL SERVICES

The ARFF Training Facility is located northeast of the public parking lot from the terminal area and satisfies the requirements for an Index C airport. Paramedical services are also provided by the

ARFF unit. Ambulances are dispatched from Fire Station No. 7, located in Kailua-Kona approximately 9 miles away, and Kona Hospital, located approximately 20 miles from the airport.

The ARFF roads extend outward from each side of the runway centerline providing access to potential aircraft accident areas. Critical rescue and fire fighting access areas are 500 feet outward from each side of the runway centerline and extend 3,300 feet beyond the ends of the runway. In addition, an ARFF access road is provided from the ends of the runway to the end of the runway protection zone.

AIR RESCUE AND FIRE FIGHTING FACILITIES, AND MEDICAL SERVICES IMPACTS AND MITIGATION

A. <u>Impacts</u>
No significant impacts are anticipated to ARFF as a result of the Master Plan expansion. ARFF facilities are sufficient to meet the needs of the proposed airport expansion.

B. <u>Mitigation</u>
No further mitigation is recommended at this time.

7.10 SOLID WASTE COLLECTION AND DISPOSAL

Solid waste collection and disposal is currently contracted with a private firm. Refuse is collected from 8 to 9 dumpsters three times a week and disposed of at the Puuanuhulu Municipal Sanitary Landfill located approximately 10 miles north of KOA.

A. <u>Impacts</u>
The volume of solid waste is expected to increase with development of the proposed facilities.

B. <u>Mitigation Measures</u>
The current practice of trucking the refuse to Puuanuhulu Municipal Sanitary Landfill is recommended for future operations. Additional dumpsters should be provided as needs increase for immediate storage of solid waste.

As practicable, DOT-A will consider the use of new technologies and practices that would facilitate a reduction in the volume of solid waste requiring disposal at the landfill. These potential practices may include future consideration for waste recycling and/or source reduction in conjunction with State and County of Hawaii policies and/or procedures to reduce the solid waste stream.

SECTION 8
OTHER ENVIRONMENTAL CONSIDERATIONS

This section lists additional environmental considerations for which no adverse impacts are anticipated. This section is provided to fulfill requirements of the Airport Environmental Handbook (FAA, October 1985).

8.1 FEDERAL DEPARTMENT OF TRANSPORTATION ACT SECTION 4(f) LANDS

Section 4(f) of the DOT Act requires that the Secretary of the DOT shall not approve any program or project which requires the use of public land unless there is no feasible and prudent alternative to the use of such land, and such program or project includes all possible planning to minimize harm resulting from such use. Section 4(f) lands of particular concern include public lands which are from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; or land of an historic site of national, state or local significance.

There are no federal DOT Section 4(f) lands in the vicinity of the proposed project.

8.2 WETLANDS

Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds. Wetlands also include estuarine areas, tidal overflows, and shallow lakes and ponds with emergent vegetation. The wetland ecosystem will also include those areas which affect or are affected by the wetland itself, e.g., adjacent uplands or regions upstream and downstream.

There are no delineated wetlands within the vicinity of the project site. This is most likely due to the location of KOA on an existing lava field which provides little to no opportunity for the collection and impingement of stormflows or groundwater.

8.3 FLOODPLAIN

The federal DOT is required by Executive Order 11988 to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

As noted in Section 5.3, KOA is located outside of any floodway or flood fringe zone as described by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM). The terminal buildings at the airport are outside the evacuation zone for tsunami hazards. The limits of the evacuation zone are west of the existing runway.

8.4 COASTAL ZONE MANAGEMENT ACT

The Federal Coastal Zone Management (CZM) Act of 1972 requires that all federally licensed or permitted activities affecting the coastal zone must be conducted in a manner consistent with provisions of the Act. Jurisdiction of Hawaii's coastal zone resources are administered through the Hawaii Coastal Zone Management Program and the counties, through their respective county Special Management Area/Shoreline Setback Variance permit system (Chapter 205A, Hawaii Revised Statutes).

Although the overall Master Plan update itself will not require a CZM permit, each of the various construction projects at KOA will need to be evaluated separately by DOT-A and FAA to determine applicability of permitting with the Hawaii CZM Program.

The project area is in the County of Hawaii, Special Management Area (SMA), which includes the entire KOA property makai or west of the SMA boundary, which is the Queen Kaahumanu Highway. In 1989, an SMA permit was filed with the County to include all projects proposed for the 1987 Master Plan. Based on approval of the 1989 SMA permit, a new permit filing is not anticipated to be required. The new projects proposed for the 1999 Master Plan update are primarily a continuation of the 1987 Master Plan. The Master Plan update will require no new land and consideration for proposed new land uses will be consistent with the level of analysis provided in the prior 1987 Master Plan, for potential impacts and mitigation measures, to ensure no adverse effect to the environment.

The proposed project will not directly impact the coastal resources of the area, nor will the proposed development foreclose access to recreational opportunities. Historic, scenic and open space resources within the airport boundaries will continue to be preserved, but will not be open to the public for safety reasons.

8.5 COASTAL BARRIERS

The Coastal Barriers Act of 1982, prohibits, with some exceptions, Federal financial assistance for development within the Coastal Barrier Resources System which consists of undeveloped coastal barriers along the Atlantic and Gulf coasts. The proposed project is located in Hawaii and therefore, is not subject to this requirement.

8.6 WILD AND SCENIC RIVERS

The Wild and Scenic Rivers Act describes those river areas eligible to be included in a system afforded protection under the Act as free flowing and possessing, "...outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values."

There are no officially designated wild and scenic river areas in Hawaii located at KOA or within vicinity of the proposed project site.

8.7 FARMLAND

The Farmland Protection Policy Act authorizes the federal Department of Agriculture to develop criteria for identifying the effects of federal programs on the conversion of farmland to nonagricultural uses. Federal agencies are directed to use the developed criteria: to identify and take into account the adverse effects of Federal programs on the preservation of farmland; to consider appropriate alterative actions which could lessen adverse effects; and to assure that such federal programs, to the extent practicable, are compatible with state, local, and private programs and polices to protect farmland.

The Keahole Agricultural Park is located adjacent to KOA, approximately 1 mile from the KOA Air Traffic Control Tower, on the mauka or eastern side of the Queen Kaahumanu Highway (see **Figure 5-3**). No adverse impacts are anticipated to the ongoing use of the agricultural park. Land on which the park is situated is owned by the State and will not be required to complete the proposed Master Plan update. The land on which the agricultural park is situated is also outside of the 55 DNL noise contour for both the base year and projected year 2001 conditions (see **Figure 5-6-Base Year Noise Map** [1996], and **Figure 5-7-Five Year Noise Exposure Map** [2001]).

8.8 ENERGY SUPPLY

As noted in Section 7-Public Facilities, Services, and Airport Support Utilities, additional demands will be placed on the existing Hawaiian Electric Light Company (HELCO) power system. This will include improvements to the roadway and runway lighting system, and construction of various new terminal facilities such as the OST, GA, Fuel Farm, Post Office, etc. No adverse impacts are anticipated as sufficient improvements will be made to the off-site HELCO distribution system. These improvements will be part of HELCO's program to provide regional system upgrades to maintain reliability of power supply.

8.9 LIGHT EMISSIONS

The primary source of light emissions will be from runway related navigational aids which are used to facilitate safe takeoffs and landings from Runway 17-35. As noted in Section 7.6-Lighting System, there will be some impacts due to increased airport lighting. While terminal and parking lot lighting fixtures will utilize glare shields to reduce stray light, other lighting systems associated with use of the runway will continue to be in use. The clear visibility of these fixtures are essential to maintain continued safety for aviators, passengers, and the general public within the surrounding region.

8.10 ENVIRONMENTAL JUSTICE

Agencies applying for federal financial support are required to identify the project potential for adverse negative impacts to the human health and environment of minority and low-income populations. As noted in Section 6-Environmental Consequences of Proposed Action-Socioeconomic Environment, human settlement patterns are not anticipated to be adversely affected by the proposed Master Plan update.

Land surrounding the airport had been earlier set aside in open space to preserve the safety and operational requirements of KOA. Consequently, there are no communities within the immediate airport environs that could be adversely affected. Surrounding communities above the airport including Keahole Agricultural Park, Kona Palisades Subdivision, Kona Wonder View Lots, and Kona Acres, are located outside the 55 DNL noise contour (**Figure 5-6** and **Figure 5-7**) and would not be adversely affected due to aircraft noise. Because HDOT-AIR is concerned about potential expansion requirements at KOA, continued emphasis will be placed on limiting developments which could involve noise sensitive uses. According to the Noise Compatibility Program Report (NCPR), these uses include residences, hospitals, day care facilities, and churches and schools (see Section 6.1-Human Settlement Patterns and Proposed Land Use).

Direct and indirect population impacts may result due to new employment opportunities that would either help support tourism or provide services that are required by the airport. Area businesses may also create indirect employment opportunities as new residential growth away from the airport generates the need for additional goods and services. These employment impacts, however, are not anticipated to require mitigation since increased jobs would benefit the area economy.

SECTION 9
LIST OF INDIVIDUALS, ORGANIZATIONS AND AGENCIES CONSULTED

The following list is derived primarily from individuals, organizations and agencies contacted during preparation of the 1988 Keahole Airport Master Plan Environmental Impact Statement (EIS). Additional persons are identified in the Keahole Airport Technical Advisory Committee, which is also listed in this section.

<u>FEDERAL</u>

Department of Transportation
- Federal Aviation Administration
  - - Air Traffic Manager
  - - Airports District Office

Department of the Army

Department of the Interior
- U.S. Fish and Wildlife Service

Department of Agriculture
- Natural Resources Conservation Service (formerly Soil Conservation Service)

<u>STATE</u>

Department of Land and Natural Resources
Department of Transportation
Department of Business, Economic Development & Tourism
Department of Agriculture
Office of Environmental Quality Control
State Land Use Commission
Department of Accounting and General Services
The Honorable Virginia Isbell

<u>COUNTY OF HAWAII</u>

Office of the Mayor
County Council
Department of Water Supply
Department of Public Works
Department of Planning
Office of Economic Development

INDIVIDUALS AND ORGANIZATIONS

Air Transport Association
Airline Pilots Association
Bank of Hawaii
Big Island Air
The Estate of Bernice Pauahi Bishop
Chamber of Commerce
First Hawaiian Bank
Hawaii Island Economic Development Board
Hawaii Leeward Planning Conference
Hemmeter Aviation Services
Hertz Rent-A-Car
High Technology Development Corporation
Honolulu Airline Committee
Host International
Huehue Ranch
Kohala Resort Association
Kona Helicopters, Inc.
Kona-Kohala Chamber of Commerce
Kona Palisades Community Association
Mauna Kea Properties, Inc.
Mauna Lani Resort, Inc.
Na Ala Hele
Natural Energy Laboratory of Hawaii
Outdoor Circle
Sierra Club - Moku Loa Group

TECHNICAL ADVISORY COMMITTEE MEMBERSHIP

FEDERAL AVIATION ADMINISTRATION

Mr. Dean Edmonds, Air Traffic Manager
Mr. David Welhouse, Airport Planner

STATE AGENCIES

Mr. Frank Kamahele, Airport District Manager, Airport District Office
Mr. High Ono, Highways Administrator, DOT Highways Division

Mr. Michael Wilson, Director, State Board of Land and Natural Resources

Dr. Thomas Daniel, PhD, Scientific Director, Natural Energy Laboratory of Hawaii Authority

COUNTY AGENCIES

Ms. Virginia Goldstein, Planning Director, County of Hawaii Planning Department

Ms. Donna Kiyosaki, Chief Engineer, County of Hawaii Public Works Department

Mr. Milton Pavao, Manager, County of Hawaii Water Supply Department

Ms. Diane S. Quitiquit, Director, County of Hawaii Department of Research and Development

LOCAL AGENCIES

Mr. Pete L'Orange, President, Hawaii Leeward Planning Conference

Ms. Noelani Whittington, Executive Director, Kohala Coast Resort Association

Ms. Marni Herkes, President, Kona Chamber of Commerce

AVIATION INDUSTRY

Mr. Tim Flournoy, Hawaii Regional Safety Chairman, Airline Pilot Association

Mr. John Thatcher, Executive Director, Airlines Committee of Hawaii and Hawaii Fueling Facility Corporation

Mr. Lou Salomon, Director - Technical Services, Airport Aviation Professionals, Inc.

UTILITY COMPANIES

Mr. Clyde H. Nagata, P.E., Manager of Engineering, Hawaii Electric Light Company

Mr. Gordon Yadao, Supervising Engineer, GTE Hawaiian Tel

SECTION 10
FINDINGS AND REASONS SUPPORTING DETERMINATION

In accordance with the provisions set forth in Chapter 343, Hawaii Revised Statutes, and the significance criteria in Section 11-200-12 of Title 11, Chapter 200, this assessment has determined that the project will have no significant adverse impact to water quality, air quality, existing utilities, noise, archaeological sites, or wildlife habitat. All impacts will be temporary or will be addressed by use of appropriate mitigation measures as described in this EA. According to the significance criteria:

1. *Irrevocable commitment to loss or destruction of natural or cultural resources -*

The proposed project is not anticipated to adversely impact natural or cultural resources at KOA. Prior archaeological studies have determined that previous development activities have resulted in alteration and in some cases, destruction or removal of sites which may have been of historic or cultural value. An existing petroglyph field east of the public parking lot is one of the only remaining sites at KOA that has been preserved in its natural state.

A Public Access Shoreline Hawaii (PASH Act 50 Session Laws of Hawaii 2000) series of interviews were conducted to determine potential concerns related to land uses at KOA. The PASH interviews indicate that shoreline access is a problem and concern for residents although vehicular access, camping and fishing, were not compromised by construction of KOA. DOT-A has provided a shoreline access road to maintain the public right to visit and use the shoreline.

Land uses surrounding KOA have resulted in some loss of access. The primary land use surrounding KOA, NELH, is not subject to development associated with the KOA Master Plan Update. However, because of issues raised, DOT-A will provide a copy of the archaeological survey to NELH to advise them of public concerns.

2. *Curtailment of the range of beneficial uses of the environment -*

KOA has been in continuous use for airport purposes since 1970. The resulting development patterns that have emerged since that time have led to the long-term reservation of undeveloped land to ensure safety of airport operations while providing for future expansion of the terminal and airfield. The proposed action, therefore, is not anticipated to curtail the range of beneficial uses of the environment at KOA.

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

The proposed project is consistent with the environmental polices, goals and guidelines in Chapter 343, HRS, and the National Environmental Policy Act. Potential sources of adverse impacts have been identified and appropriate measures developed to mitigate or minimize impacts to negligible levels.

4. *Substantially affects the economic or social welfare of the community or state -*

The proposed Master Plan is expected to provide positive benefits to the State and the Keahole-Kona region through: 1) the maintenance and upkeep of existing airport facilities; and 2) construction of new facilities to maintain and improve the safety and efficiency of airport operations.

Construction will provide immediate benefits through short term employment for Hawaii's construction industry. Longer term employment will be provided to the public sector through new personnel required to administer, operate or maintain new facilities. Private sector employment would occur through new personnel who will be operating businesses from facilities such as an expanded overseas terminal, the heliport, or the general aviation areas. Taxable revenues and user fees would similarly be generated from development of airport facilities.

5. *Substantially affects public health -*

The several projects which together comprise the Master Plan Update are expected to improve and increase safety and efficiency of airport operations which is a positive public health benefit.

Construction of the proposed project will be in accordance with federal, state, and county rules and regulations governing public safety and health. It is anticipated that any potential for adverse impacts can be minimized or brought to negligible levels by appropriate use of the mitigation measures described in this document.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities -*

The proposed project is not anticipated to result in adverse secondary impacts. Construction of the project may result in the short term increase of workers necessary to complete the various projects associated with the Master Plan Update. It is expected that while some construction workers will be residents from the Keahole-Kona region or the Big Island, most of the workers could be from elsewhere within the State. As the various phases of construction are completed, however, the temporary workers would return to their respective places of residence.

The longer term impacts of construction are expected to generate some increase in the area population, which would require need for public services. However, it is expected that any new requirements for services would in part be offset through the generation of additional tax revenues and user fees.

7. *Involves substantial degradation of environmental quality -*

The proposed project will be developed in accordance with the environmental polices of Chapter 343, HRS, and the National Environmental Policy Act. The project site is on land which has been previously disturbed during construction of the Keahole Airport in 1970. The proposed project can be considered to be less obtrusive than this previous activity since it will only involve supplemental construction and land uses that are consistent with the existing facility.