NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

AUG 23 2012

IN REPLY REFER TO:
AIR-EP
12.0088

FILE COPY

'12 AUG 10 A9:35
OFC. OF ENVIRONMENTAL QUALITY CONTROL
RECEIVED

August 9, 2012

Mr. Gary Hooser, Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Subject: Draft Environmental Assessment for
Airfield, Terminal and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
State Project No. AH2011-05

Dear Mr. Hooser:

The State of Hawaii, Department of Transportation (DOT) has reviewed the Draft Environmental Assessment (DEA) for the subject project and anticipates a Finding of No Significant Impact. The DEA has been prepared pursuant to Chapter 343, Hawaii Revised Statutes and Chapter 11-200, Hawaii Administrative Rules. Please publish notice of this DEA in the next available issue of OEQC's *The Environmental Notice*.

We have enclosed one (1) each of the following items:

- Hardcopy of the OEQC publication form and DEA; and
- CD including the DEA and OEQC publication form in pdf format.

Please contact Ms. Lynn Becones of our department at 838-8817 or lynn.becones@hawaii.gov if you have any questions.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

Attachments

c: Mr. Earl Matsukawa, Wilson Okamoto Corporation

Agency Action EA
Chapter 343, HRS
Publication Form

Project Name: Draft Environmental Assessment for Airfield, Terminal, and Facility Improvements for the Kona International Airport at Keahole

Island: Hawaii

District: North Kona

TMK: 7-3-043: portion of 001, 002, and 003, which include parcels 006-018, 022-035, 037, 038, 040, 044-050, 052-059, 062, 064, 095-097, and 103-105; and, 7-2-005: 007

Permits:

- Noise Variance Permit
- National Pollutant Discharge Elimination System (NPDES) Individual Permit for Storm Water Associated with Construction Activity
- Underground Injection Control (UIC) Permit
- Conservation District Use Permit
- Coastal Zone Management (CZM) Federal Consistency Certification
- Land Use District Boundary Amendment
- Special Management Area Use Permit
- County of Hawaii Plan Approval
- County of Hawaii Zoning Variance
- Grading/Grubbing Permit
- Building Permit

Proposing/Determination Agency:

Department of Transportation, Airports Division
400 Rodgers Boulevard, Suite 700
Honolulu, HI 96819
Contact: Ms. Lynn Becones
Telephone No.: (808) 838-8817

Consultant:

Wilson Okamoto Corporation
1907 S. Beretania Street, Ste. 400
Honolulu, HI 96826
Contact: Mr. Earl Matsukawa, AICP
Telephone No.: (808) 946-2277

Status: 30-day comment period

Summary:

The State of Hawai'i Department of Transportation Airports Division (DOT-A) is proposing various improvements at the Kona International Airport located in Keahole, North Kona, Hawai'i. In October 2010, the DOT-A completed the *Kona International Airport at Keahole Airport Master Plan* which provides a long-range vision of developments on airport property. The currently proposed improvements are those that are anticipated to be implemented within the next five to ten years. Included are airfield improvements and airport facilities presented in the master plan, as well as smaller projects that are not specified in the master plan. The proposed improvements include the following:

- Expansion of the General Aviation Facilities;
- Construction of a new Helicopter Facility;
- Extension and Widening of the KATR;
- Construction of Road M;
- Relocation of the Onizuka Space Center;
- Construction of the Terminal Modernization Phase I;
- Construction of a High-Pressure Hydrogen Fuel Storage and Fueling Station;
- Construction of a Regional ARFF Training Facility;
- Construction of a Medical Transitional Facility;
- Interior renovations of the existing ARFF Station for a new Commuter Terminal; and,
- Construction of a temporary State Department of Agriculture Inspection Facility.

DRAFT ENVIRONMENTAL ASSESSMENT

AIRFIELD, TERMINAL, AND FACILITY IMPROVEMENTS FOR THE KONA INTERNATIONAL AIRPORT AT KEĀHOLE

Prepared By:

WILSON OKAMOTO
CORPORATION

Prepared For:

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION
AIRPORTS DIVISION

AUGUST 2012

DRAFT ENVIRONMENTAL ASSESSMENT

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

Keāhole, North Kona, Hawai‘i

State Project No. AH2011-05

Prepared For:

State of Hawai‘i
Department of Transportation
Airports Division
400 Rodgers Boulevard, Suite 700
Honolulu, Hawai‘i 96819

Prepared By:

Wilson Okamoto Corporation
Engineers and Planners
1907 South Beretania Street, Suite 400
Honolulu, Hawai‘i 96826
WOA Job No. 7213-01

August 2012

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

Page

LIST OF TABLES

LIST OF APPENDICES

PREFACE

This Draft Environmental Assessment (EA) / Anticipated Finding of No Significant Impact (FONSI) has been prepared pursuant to Chapter 343, Hawaiʻi Revised Statutes (HRS), and Title 11, Chapter 200, Hawaiʻi Administrative Rules (HAR), Department of Health, State of Hawaiʻi. The State Department of Transportation, Airports Division is proposing various improvements at the Kona International Airport at Keāhole in the North Kona District of the island of Hawaiʻi. The project requires the use of State lands and State funds. Therefore, the project is subject to the State environmental review process.

In October 2010, the DOT-A completed their update of the *Kona International Airport at Keāhole, Airport Master Plan* which provides a long-range vision of developments on airport property. The purpose of the update was to evaluate the airport's capabilities and role, to review forecasts of future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the master plan update was to provide systematic guidelines for the airport's overall development, maintenance, and operations for the next 20 years.

The proposed action assessed herein is the construction and operation of those projects that are anticipated to be implemented within the next five to ten years. Included are airfield improvements and airport facilities presented in the master plan, as well as smaller projects that are not specified in the master plan.

(This page intentionally left blank)

SUMMARY

Proposing Agency:	State of Hawai‘i Department of Transportation, Airports Division
Approving Agency:	State of Hawai‘i Department of Transportation, Airports Division
Location:	Keāhole, North Kona, Hawai‘i
Tax Map Keys (TMKs):	7-3-043: 001 por. , 002 por., 003 por., 006-018, 022-035, 037, 038, 040, 044-050, 052-059, 062, 064, 095-097, and 103-105; and, 7-2-005: 007
Recorded Fee Owner:	State of Hawai‘i
Existing Use:	Kona International Airport at Keāhole
State Land Use Classification:	Urban and Conservation District
Community Plan Designation:	Industrial and Conservation
County Zoning Designation:	Industrial (MG-1a) and Open

Proposed Action:

The proposed action involves various improvements at the Kona International Airport at Keāhole. The currently proposed improvements are those that are anticipated to be implemented within the next five to ten years. Included are airfield improvements and airport facilities presented in the master plan, as well as smaller projects that are not specified in the master plan. The proposed improvements include the following:

- Expansion of the GA Facilities;
- Construction of a new Helicopter Facility;
- Extension and Widening of the KATR;
- Construction of Road M;
- Relocation of the Onizuka Space Center;
- Construction of the Terminal Modernization Phase I;
- Construction of a High-Pressure Hydrogen Fuel Storage and Fueling Station;
- Construction of a Regional ARFF Training Facility;
- Construction of a Medical Transitional Facility;
- Interior renovations of the existing ARFF Station for a new Commuter Terminal; and,

- Construction of a temporary State Department of Agriculture Inspection Facility.

Impacts: No significant impacts are anticipated from the construction and operation of the proposed improvements. Construction activities are anticipated to have short-term noise, traffic, and air quality impacts in the surrounding area. Construction noise and air quality impacts will be minimized by compliance with applicable State Department of Health Rules. No significant long-term environmental or community impacts in the vicinity of the project site are anticipated.

Anticipated Determination: Finding of No Significant Impact (FONSI)

Parties Consulted During Pre-Assessment:

<u>Federal Agencies</u>
U.S. Air Force
U.S. Army Corps of Engineers (COE)
COE, Civil Works Technical Branch
COE, Regulatory Branch
U.S. Coast Guard
U.S. Department of Agriculture (DOA)
U.S. Department of Homeland Security (DHS)
DHS, Customs and Border Protection
DHS, Transportation Security Administration
U.S. Environmental Protection Agency
Federal Aviation Administration
Federal Highway Administration
U.S. Fish and Wildlife Service
U.S. Geological Survey
U.S. Natural Resources Conservation Service (NRCS)
National Oceanic and Atmospheric Administration (NOAA)
NOAA, Habitat Conservation Division
NOAA, National Marine Fisheries Service (NMFS)
U.S. Postal Service

<u>State Agencies</u>
Department of Agriculture
Department of Accounting and General Services
Department of Business, Economic Development and Tourism (DBEDT)
DBEDT, Hawaiʻi Housing Finance and Development Corporation
DBEDT, Hawaiʻi State Energy Office
DBEDT, Hawaiʻi Tourism Authority

State Agencies (Continued)
DBEDT, Office of Planning
Department of Defense
Department of Education
Department of Hawaiian Home Lands
Department of Health (DOH)
DOH, Clear Air Branch
DOH, Clean Water Branch
Department of Human Services
Department of Labor and Industrial Relations
Department of Land and Natural Resources (DLNR)
DLNR, Aquatics Division
DLNR, Office of Conservation and Coastal Lands
DLNR, State Historic Preservation Division
Natural Energy Laboratory of Hawai‘i Authority
Office of Hawaiian Affairs
University of Hawai‘i Environmental Center
Department of Transportation (DOT)
DOT, Highways Division
DOT, Harbors Division
DOT, Statewide Transportation Planning Office

County of Hawai‘i Agencies
Department of Environmental Management
Department of Planning
Department of Parks and Recreation
Department of Public Works
Department of Transportation
Department of Water Supply
Police Department
Fire Department
Office of the Mayor

Elected Officials
Senator Josh Green
Senator J. Kalani English
Representative Cindy Evans
Representative Joseph Souki
Governor’s Representative – West Hawai‘i
Hawai‘i County Council Chair Dominic Yagong,

Other Interested Parties and Individuals
Big Island Visitors Bureau
Greeters of Hawai‘i
Hawai‘i Leeward Planning Conference
Hokulia

<u>Other Interested Parties and Individuals (Continued)</u>
Kohala Coast Resort Association
Kona-Kohala Chamber of Commerce
Onizuka Memorial Committee
West Hawaiʻi Regional Board
Mr. Bob Ward
Ms. Hannah Springer

1. INTRODUCTION

1.1 Introduction

The State of Hawai'i (State) Department of Transportation, Airports Division (DOT-A), is proposing several improvements at the Kona International Airport at Keāhole (KOA). In October 2010, the DOT-A completed their update of the *Kona International Airport at Keāhole, Airport Master Plan* which provides a long-range vision of developments on airport property. The purpose of the update was to evaluate the airport's capabilities and role, to review forecasts of future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the master plan update was to provide systematic guidelines for the airport's overall development, maintenance, and operations for the next 20 years.

The currently proposed improvements discussed herein are those that are anticipated to be implemented within the next five to ten years. Included are airfield improvements and airport facilities presented in the master plan, as well as smaller projects that are not specified in the master plan.

1.2 Project Location

KOA is located at Keāhole, North Kona, on the island of Hawai'i (see Figure 1-1), approximately 7-miles from the town of Kailua-Kona. The airport is situated on approximately 3,450-acres and is located within four large Tax Map Key (TMK) parcels: TMK (3) 7-3-043: portions of 001, 002, and 003 and TMK (3) 7-2-005: 007 (see Figure 1-2). Within TMK 7-3-043: 003 are various smaller parcels as shown in Figure 1-3. The smaller TMKs are comprised of the following: 7-3-043: 006-018, 022-035, 037, 038, 040, 044-050, 052-059, 062, 064, 095-097, and 103-105.

1.2.1 Existing Uses

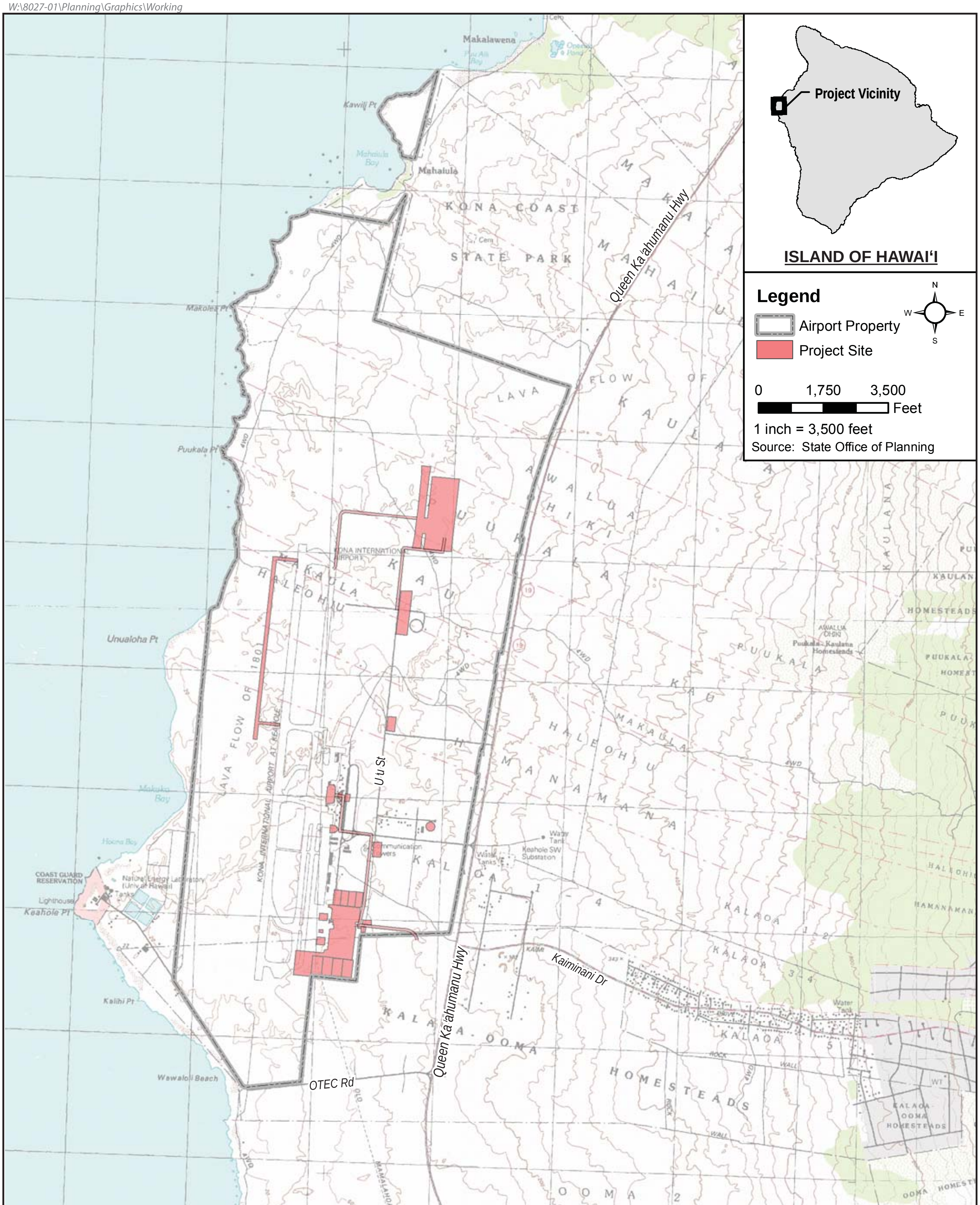
The existing KOA facilities can be classified into two broad categories; airfield and landside (see Figures 1-4, 1-5, and 1-6). The airfield category includes those facilities directly associated with aircraft operations while the landside category includes those facilities to provide a safe transition from surface to air transportation and support aircraft parking, servicing, storage, maintenance, and operational safety.

Airfield Facilities:

Airfield facilities at KOA include a runway, taxiways, lighting, markings, navigational aids, weather reporting, and an air traffic control tower.

Runways: KOA has a single runway (Runway 17-35) which is 11,000-feet long by 150-feet wide (see Figure 1-4). It is oriented in a north-south direction and is constructed of asphalt. The runway is equipped with 35-feet wide paved shoulders, and both runway ends have paved blast pads.

W:\8027-01\Planning\Graphics\Working



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

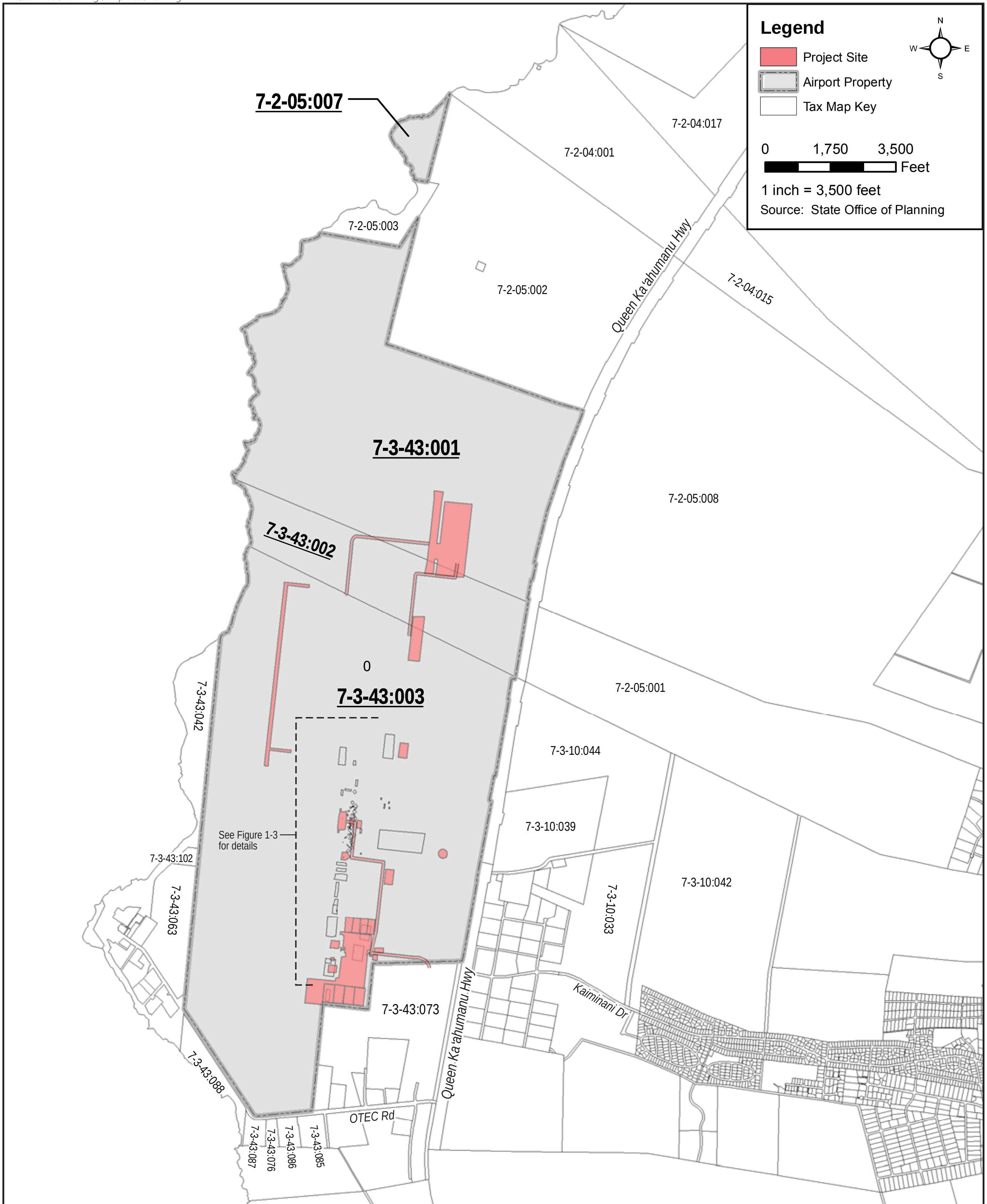
Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

LOCATION MAP

FIGURE

1-1

W:\8027-03\Planning\Graphics\Working



WILSON OKAMOTO CORPORATION
ENGINEERS ● PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

TAX MAP KEY

FIGURE 1-2

Taxiways: There are 8 taxiways at KOA that are identified by a single letter and include the following (see Figure 1-4):

- Taxiway A: Parallel taxiway to Runway 17-35;
- Taxiway B: Abandoned taxiway that is now used as a ramp;
- Taxiway C: High-speed exit taxiway for Runway 17-35;
- Taxiway D: Connecting taxiway for south general aviation ramp to Taxiway A;
- Taxiway E: Abandoned taxiway;
- Taxiway F: Abandoned taxiway;
- Taxiway G: Exit taxiway for Runway 17-35; and
- Taxiway H: Exit/connecting taxiway from terminal apron to Runway 17-35.

All of the taxiways are at least 75-feet wide with 35-foot wide paved shoulders. The centerline separation between the runway and the parallel taxiway is 887-feet.

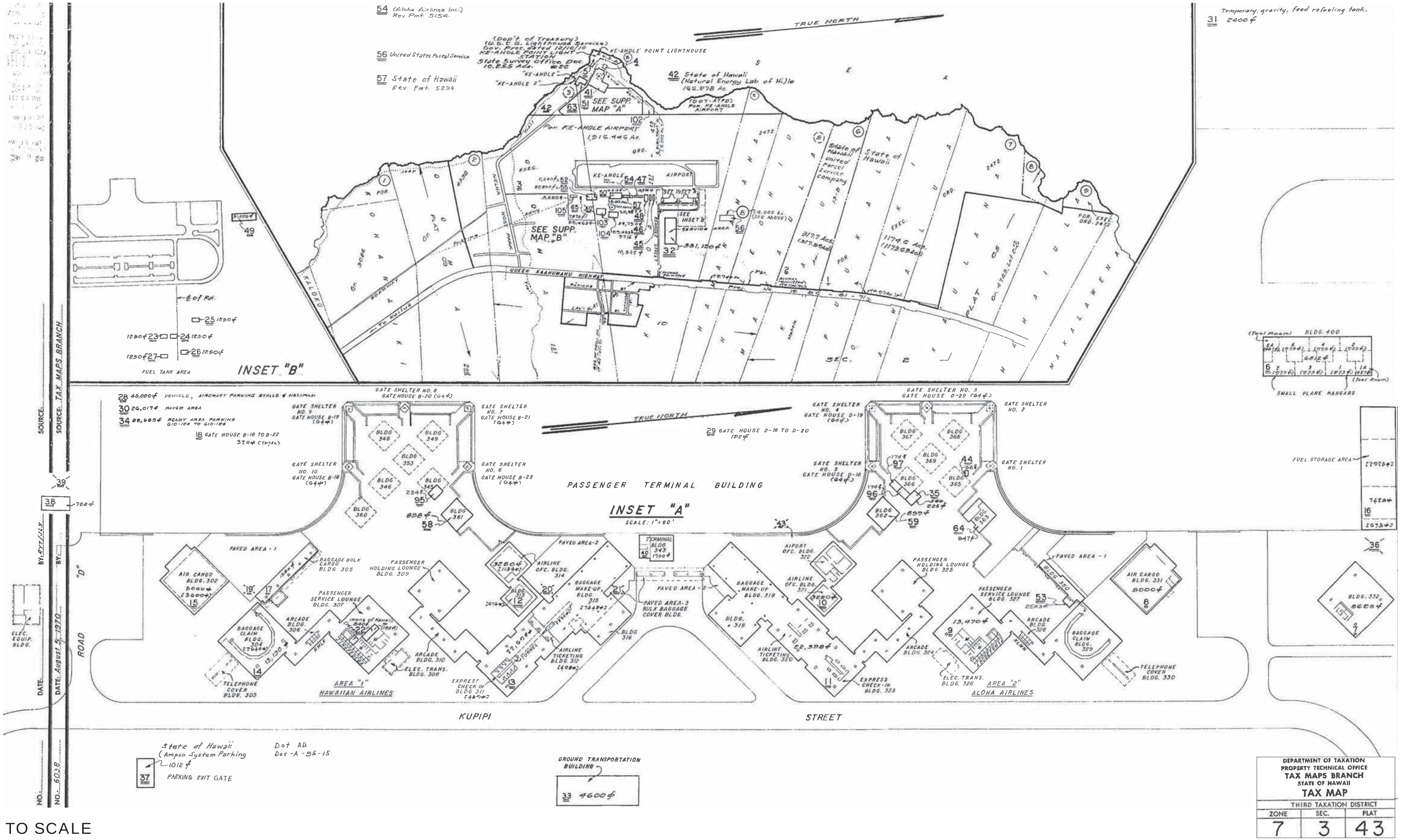
Navigational Aids: Navigational aids are electronic devices that transmit radio frequencies, which pilots translate into point-to-point guidance and position information. There are three types of navigational aids located at KOA; the very-high frequency omni-directional range (VOR), the non-directional beacon (NDB), and the global positioning system (GPS). The VOR provides azimuth readings to pilots by transmitting a radio signal to provide 360 degree, individual navigational courses. In the case of KOA, military tactical air navigation aids (TACANs) and the VOR have been combined to form what is commonly known as a VORTAC. A VORTAC provides distance and direction information to civilian and military pilots. The Kona VORTAC serves the entire Kona area, including KOA and is located on the southern end of the airport.

The NDB transmits non-directional radio signals, whereby the pilot can determine the bearing to or from the NDB facility and then track to or from the station. The NDB for KOA is located approximately 29 miles east of KOA.

The use of GPS provides for more freedom for in flight planning and allows for more direct routing to the final destination. The present GPS provides for enroute navigation and instrument approaches with both course and vertical navigation. KOA has GPS approaches available to both runway ends.

Weather Reporting: KOA is served by an automated surface observing system (ASOS) which provides automated aviation weather observations 24-hours per day. The system updates weather observations every minute and reports cloud ceiling, visibility, temperature, dew point, wind direction, wind speed, barometric pressure, and density altitude. The ASOS is located on the west side of the runway, near the perimeter fence (see Figure 1-4).

Air Traffic Control Tower (ATCT): The KOA ATCT is currently located east of the runway on the south side of the airport terminal (see Figure 1-4 and Figure 1-5, No. 9). However, a new ATCT is currently under construction on the northern side of the airport terminal (see Figure 1-4). Construction was completed at the end of 2011 and the tower is expected to be commissioned and fully operational by December 2012.



NOT TO SCALE

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

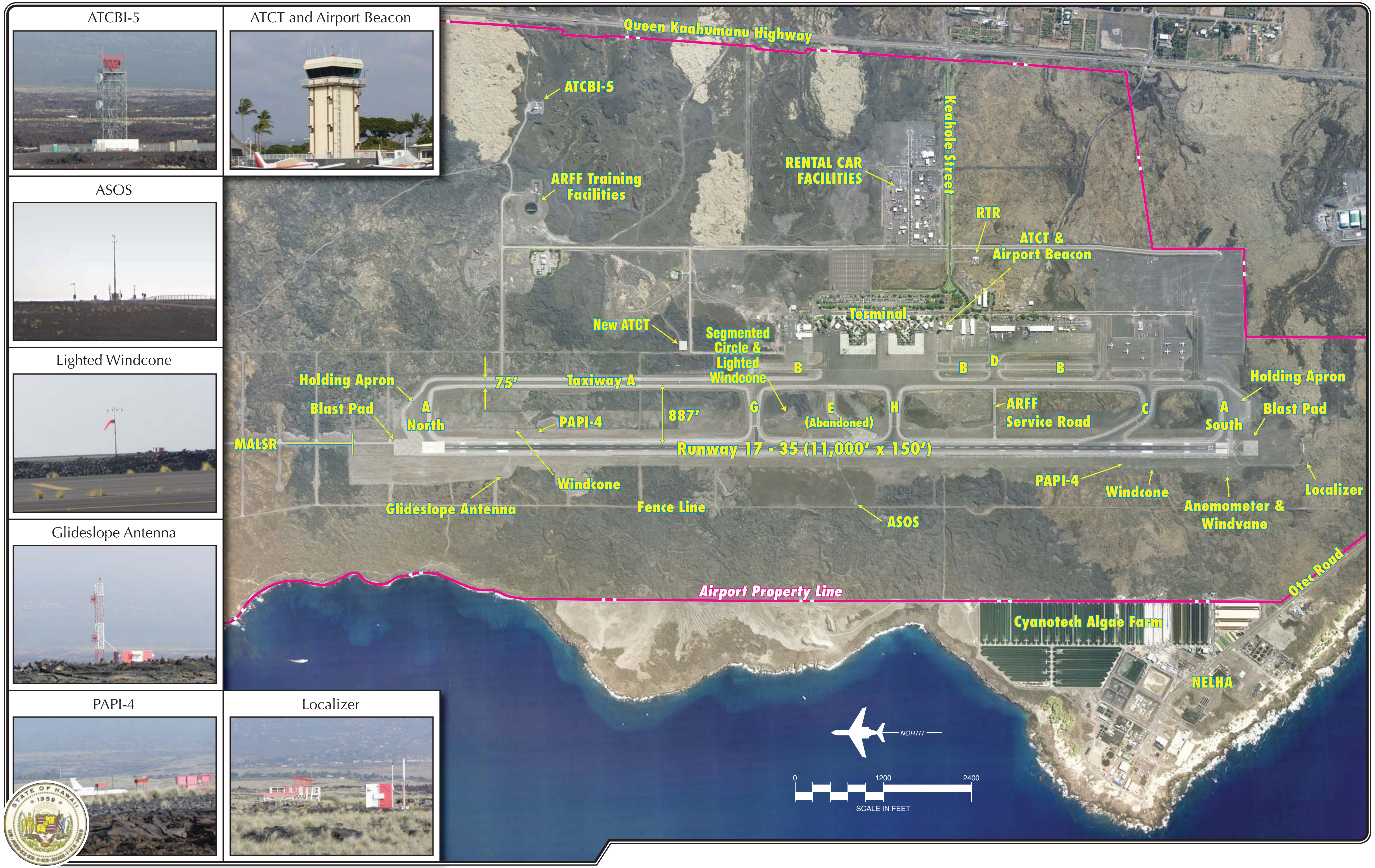
Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

TAX MAP KEY WITHIN 7-3-43:003

FIGURE 1-3

W:\8027-03\Planning\Graphics\Working

06MP06-1D-3/22/10



Source: Kona International Airport at Keāhole
Airport Master Plan, 2010

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

PROJECT SITE EXISTING USES

FIGURE 1-4

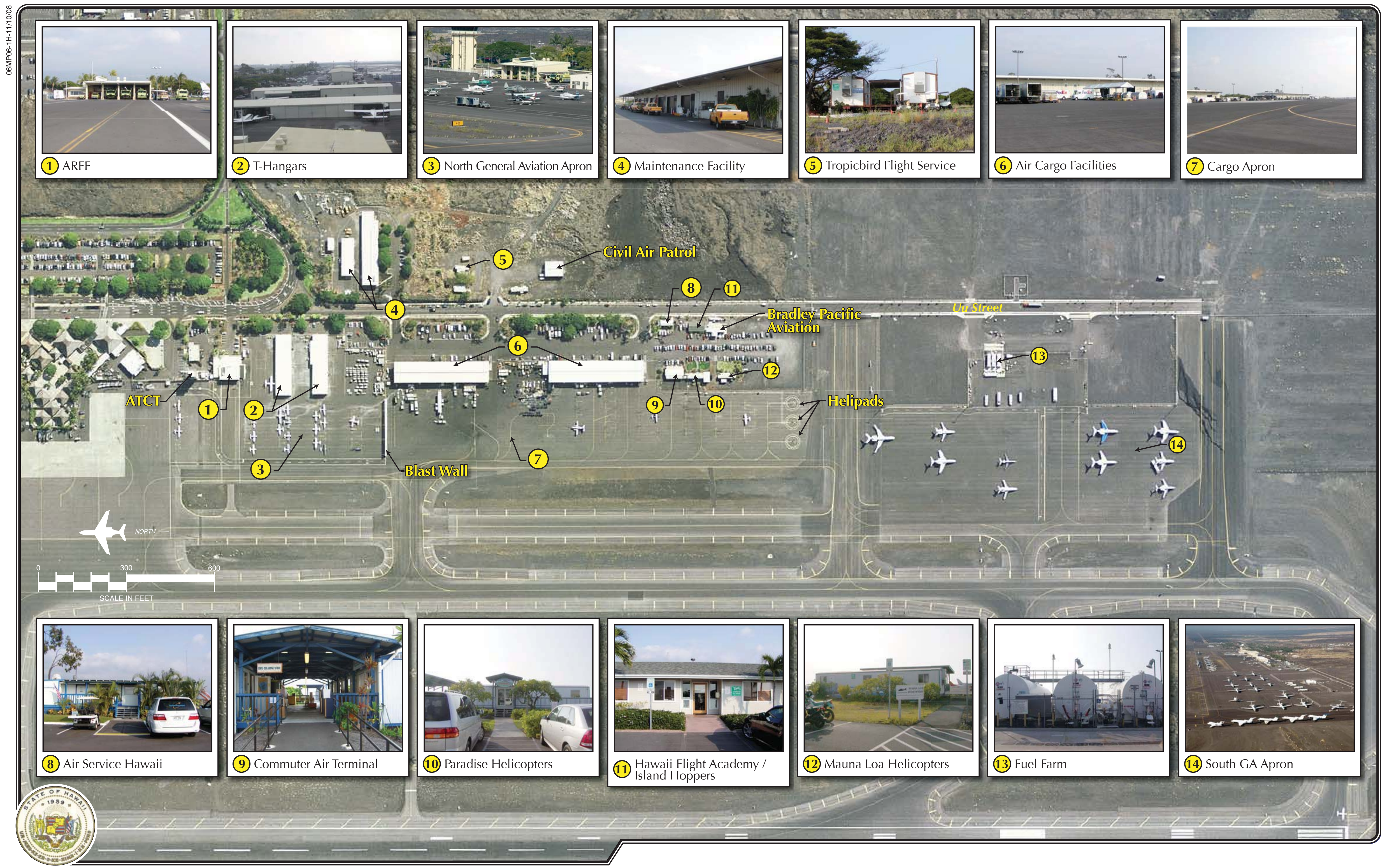
Source: Kona International Airport at Keāhole Airport Master Plan, 2010

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for Kona International Airport at Keāhole

PROJECT SITE EXISTING USES

FIGURE 1-5



Source: Kona International Airport at Keāhole
Airport Master Plan, 2010

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

PROJECT SITE EXISTING USES

FIGURE
1-6

There is also an airport traffic control beacon interrogator (ATCBI-5) located adjacent to the existing ARFF Training Facility as shown on Figure 1-4. The ATCBI-5 is a long-range radar used in enroute air traffic control.

Landside Facilities:

Passenger Terminal: The passenger terminal at KOA includes the aircraft parking apron, passenger terminal facilities, terminal curbs and drives, terminal roadways, and public parking within the terminal roadway loop.

Aircraft Apron and Terminal Facilities: The aircraft apron at KOA is parallel to the runway and begins adjacent to the General Aviation (GA) area to the south and continues to the international arrivals buildings to the north (see Figure 1-5, No. 8).

Passenger terminal facilities at KOA for interisland and overseas (mainland and international) travel are centrally located and are divided into a north terminal and south terminal (see Figure 1-5, No. 7). Separating the terminals is the Astronaut Ellison S. Onizuka Space Center (see Figure 1-5, No. 5). To the north of the main terminal area are the airport administration buildings and further north are the temporary facilities for international arrivals processing of passengers (see Figure 1-5, No. 4).

The terminal area is provided regional access from Queen Kaʻahumanu Highway at its intersection with Keāhole Street, which is the entrance to the airport (see Figure 1-5, No. 11). Keāhole Street connects to the terminal roadway loop also called Kūpīpī Street (see Figure 1-5, No. 10). Public parking is located within the terminal roadway loop and employee parking is located directly adjacent to and east of the terminal roadway loop and has recently been expanded (see Figure 1-5, No. 2).

Airport Administration: As stated earlier, the airport administration offices are located in two buildings between the passenger terminal and the international arrivals building (see Figure 1-5). The southern most building includes the office of the Airport District Manager and other related administrative personnel as well as the airport security badging and identification (ID) office. The other building houses a training room as well as the office of the District Airport Engineer.

Rental Car Facilities: Rental car facilities are located on the north side of the airport entrance road between Queen Kaʻahumanu Highway and the terminal (see Figure 1-4). Arriving rental car customers proceed from the terminal to the median curb of the terminal roadway loop where they are picked up by shuttles operated by each of the eight rental companies at the airport. These companies currently include Alamo, Avis, Budget, Dollar, Enterprise, Hertz, National and Thrifty.

Air Cargo Facilities: There are two cargo buildings located south of the terminal between the GA facilities (see Figure 1-6, No. 6). Truck docks and parking are provided on the mauka side of the buildings. A parking apron is available on the makai side of the buildings.

General Aviation (GA) Facilities: The GA facilities are located on the south side of the airport (see Figure 1-6, No. 3 and 14). GA aircraft are primarily stored on the ramp in two T-hangars south of the existing Aircraft Rescue and Fire Fighting (ARFF) Station. There are currently 43 tie-down spaces available. An additional ramp for GA use is located to the south of the air cargo facilities as well as on the south GA ramp.

Aircraft Rescue and Firefighting (ARFF) Station: The existing ARFF Station is 6,034-square feet and is located on the airfield to the south of the ATCT (see Figure 1-6, No. 1). The major equipment stored and maintained at the facility include one 3,000-gallon storage capacity fire fighting vehicle and two 1,500-gallon storage capacity fire fighting vehicles.

An ARFF training facility is located on airport property to the northeast of the terminal area and is used for live fire exercises (see Figure 1-4).

Maintenance Facilities: The airport field maintenance facilities are located mauka of the GA and cargo area of the airfield (Figure 1-6, No. 4). This building proves office space as well as storage of some equipment. In addition, a shade hangar also provides additional storage for equipment.

1.2.2 Surrounding Uses

Uses surrounding the airport property include Kekaha Kai State Park to the north, Queen Kaʻahumanu Highway and the HELCO Keāhole Power Plant to the east, OTEC Road to the south and the Natural Energy Laboratory of Hawaiʻi Authority (NELHA) property to the south and west (see Figure 1-7).

The NELHA property to the south of the airport is comprised of the NELHA Gateway Center, and various tenants including Sopogy, Inc., Goodfellow Brothers, Inc., West Hawaiʻi Explorations Academy, Destiny Deep Sea Water LLC, Hawaiʻi Deep Marine, Inc., Koyo USA Corporation, Kona Deep Corporation, Savers Holdings Ltd., Moana Technologies LLC, Big Island Abalone Corporation, and Noritech Hawaiʻi, Inc. The NELHA makai properties to the west include tenants such as Cellana, LLC, Cyanotech, Taylor Shellfish, High Health Aquaculture, Inc., Kona Coast Shellfish LLC, Indo-Pacific Sea Farms, Troutlodge Marine Farms Kona LLC, Pacific Planktonics, Kona Cold Lobsters, Ltd., Mera Pharmaceuticals, Royal Hawaiian Sea Farms, King Ocean Farms, Inc., Ocean Rider, Inc., Black Pearls, Inc., and Shrimp Improvement Systems Hawaiʻi LLC.

W:\8027-03\Planning\Graphics\Working

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

SURROUNDING USES MAP

FIGURE 1-7

(This page intentionally left blank)

2. PROJECT DESCRIPTION

2.1 Project Purpose and Need

The State of Hawaiʻi DOT-A is proposing various improvements at the Kona International Airport at Keāhole. The currently proposed improvements are those that are anticipated to be implemented within the next five to ten years. Included are airfield improvements and airport facilities presented in the master plan, as well as smaller projects that are not specified in the master plan. The proposed improvements include the following (see Figure 2-1):

The purpose and need for each project is described below:

1. Expansion of the General Aviation (GA) Facilities: The expansion of the GA facilities will help to relieve current congestion problems at KOA. Currently, KOA does not have any hangars for GA aircraft storage. While there is current demand for storage space, the demand for hangar space is also expected to grow based upon the number of GA aircraft forecast in the airport master plan. In addition, KOA is lacking hangar facilities for aircraft maintenance and other services. The expansion of the GA facilities will not only help to meet current demands for space, but also plan for the forecast future growth and demand of the GA operations at KOA.

2. Construction of a new Helicopter Facility: With the growing demand for GA facilities, continued mixing of helicopters (rotary wing) and fixed-wing aircraft in the same location poses a potential safety hazard. With the air traffic control tower (ATCT) currently being relocated to a more centralized location, DOT-A can proceed to separate the two GA operations and, thus, reduce the potential safety hazard.

3. Extension and Widening of the planned Kona Auxiliary Training Runway (KATR): The U.S. Air Force is currently pursuing construction of the KATR, possibly at KOA, for flight training. However, the dimensions of the runway that the Air Force is proposing to construct would not be sufficient for use by commercial aircraft in the event of an emergency or when the main runway is closed for repairs. To allow DOT-A to have the option of using the KATR runway for commercial aircraft when the Air Force is not using it, DOT-A would like to extend and widen the runway. It could then be used for emergency purposes as well as by GA aircraft when the main runway is congested.

4. Construction of a new road, Road M (Phase I): Road M would serve the south area of the airport (i.e. the GA area), and relieve traffic from the terminal loop road and Pāoʻo Street. The eastern end of Road M would also be in conformance with NELHA's Master Plan in which Road M would eventually extend to Queen Kaʻahumanu Highway, opposite of Kaʻiminani Drive to form a cross intersection.

5. Construction of a Seawater Air Conditioning System (SWAC): DOT-A, through cooperation and collaboration efforts with NELHA, is proposing to utilize the cold seawater from NELHA to air condition the terminal and, thereby, reduce electrical demand at KOA.

6. Relocation of the Astronaut Ellison S. Onizuka Space Center: Currently, the Onizuka Space Center is located between the north and south terminal areas at KOA. However, to accommodate the proposed terminal modernization project (see item 7 below), the Onizuka Space Center will need to be relocated.

7. Construction of the Terminal Modernization (Phase I): Phase one of the terminal modernization project will involve centralizing the check-in area. This will consolidate the inspectors for the U.S. Department of Agriculture (USDA) and the Transportation Security Administration (TSA) who are currently assigned to each of the two terminals. This will increase efficiency for inspections. It will also streamline the check-in process for the public using a new in-line baggage handling system to transport baggage through an underground system, freeing up more floor space for passengers in the terminal.

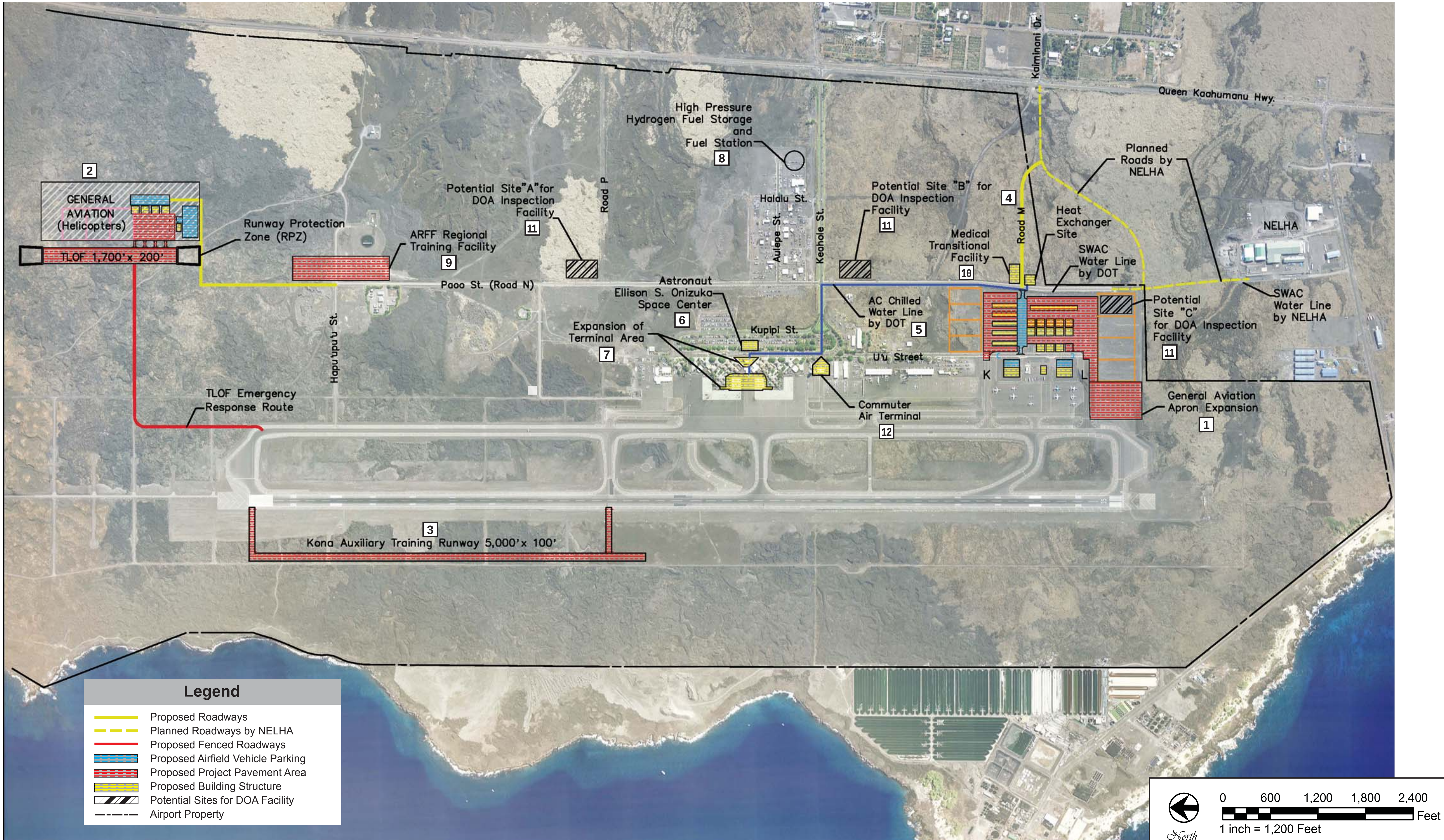
8. Construction of a High-Pressure Hydrogen Fuel Storage and Fueling Station: Hawai‘i Revised Statutes (HRS) Chapter 196, Section 10 established a Hawai‘i Renewable Hydrogen Program to manage the State's transition to a renewable hydrogen economy. Part of this effort includes establishing a "hydrogen highway" on the island of Hawai‘i, with one of a series of refueling facilities around the island located at KOA. Locating the facility at KOA would not only serve residents and airport operations related vehicles, but offer the option to visitors driving rental cars.

9. Construction of an ARFF Regional Training Facility: During the previous State administration, the need for a regional training center for various types of rescue workers was identified for neighbor island personnel. The multi-purpose training facility would not only be used by airport ARFF personnel, but also by the County and other first responders. Thus, its location should be one that Federal, State and County rescue personnel could readily access for training. KOA is a favorable location because the airport would facilitate access for neighbor island personnel, land is available, the proposed site is surrounded by mostly of barren lava fields, and is far from residential, resort, commercial, and industrial areas. In addition, there is an existing burn pit available for use.

10. Construction of a Medical Transitional Facility: Due to the lack of medical personnel on the Big Island, doctors frequently commute to Kona from Honolulu to see patients in the region. Arriving at KOA, the doctors would need to drive approximately 18 miles or about 30 minutes to get to Kona's nearest hospital. The medical transitional facility will enable doctors from Honolulu to see their patients at the airport, saving valuable time. Also, patients who need to be transported to Honolulu for emergency care can be monitored or stabilized while awaiting transport by medivac aircraft.

11. Construction of a temporary State Department of Agriculture (DOA) Inspection Facility: In 2008, the Hawai‘i State Legislature passed the Biosecurity Law (HRS 105A-52 and 53) with the objective to "establish a multi-dimensional system to prevent the entry into the State and interisland movement of pests and prohibited or restricted organisms without a permit." To implement this law, DOA was given authority to "establish, operate, or

W:\8027-01\Planning\Graphics\Working



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

PROJECT SITE PLAN

FIGURE 2-1

participate in operating port-of-entry facilities where multiple government agencies may inspect, quarantine, fumigate, disinfect, destroy, or exclude as appropriate …" KOA currently does not have a facility where inspections can be conducted. An interim inspection facility would help to achieve compliance with this law, until such time that a permanent inspection facility can be constructed. Presently, the permanent facility is planned to be constructed in conjunction with the future cargo buildings in the northern portion of the airport property.

12. Interior renovations to the existing ARFF Station for a new Commuter Air Terminal: The existing Commuter Air Terminal is increasingly difficult to maintain and has inadequate restroom facilities to accommodate the volume of commuter passengers. The location is ideal since ramp access is available and it is much closer to the main terminal, making it more convenient for passengers walking between them.

2.2 Project Description

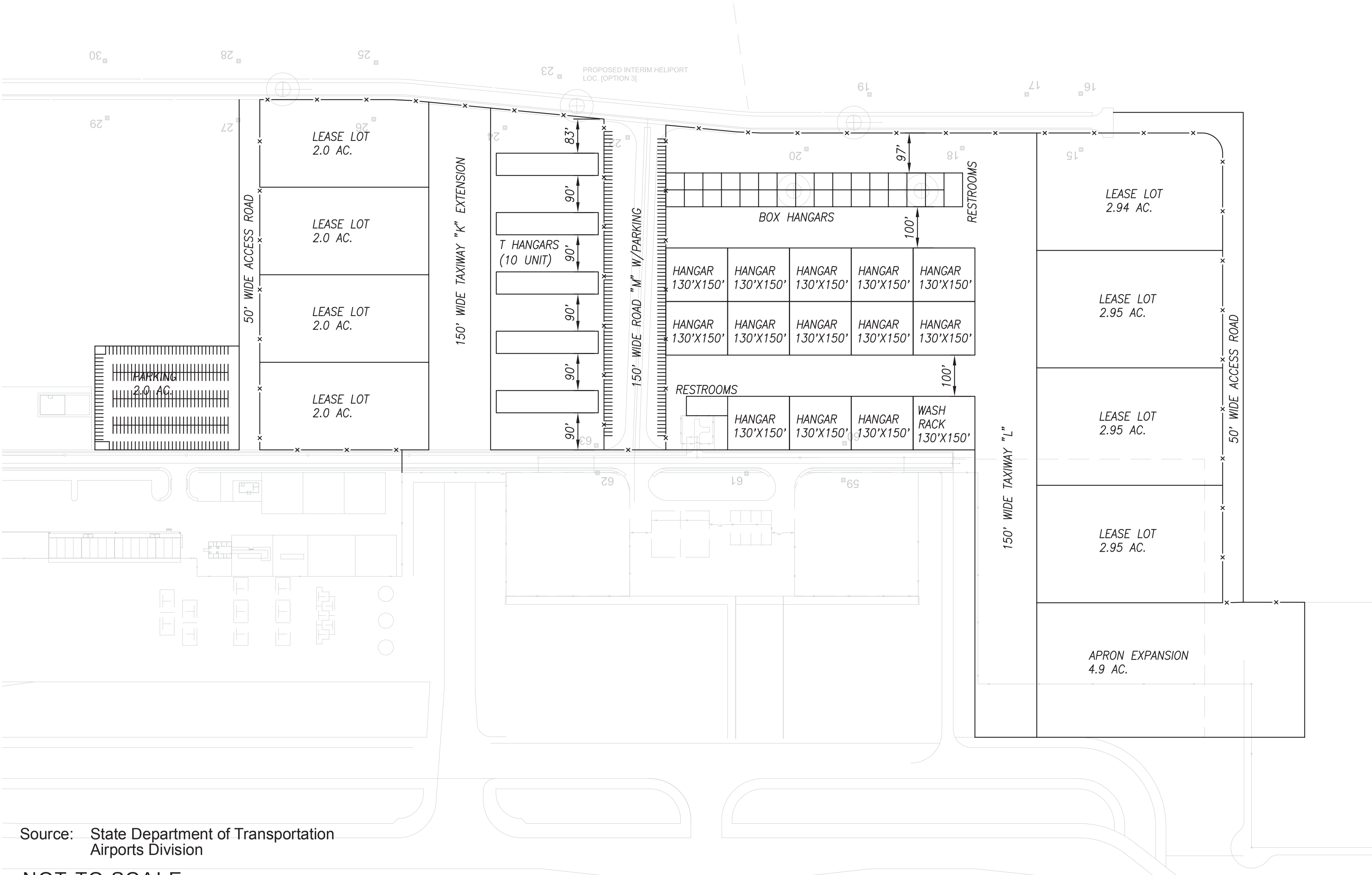
Below is a description of the individual projects and improvements DOT-A is proposing.

1. Expansion of the GA Facilities: The GA facility at the south ramp will be expanded and dedicated for use by non-carrier fixed-wing aircraft to relieve congestion. Meanwhile, general rotary wing aircraft (helicopter) operations in the south ramp area will be relocated to the north side of the airport (see item 2, below). Proposed improvements in the south ramp GA area include the following (see Figure 2-2):

   - Establishing a new area for GA facilities between Pāoʻo Road (Road N) and Uʻu Street. Comprising approximately 22 acres, this area will be developed to include additional ramp space for staging aircraft, hangars, maintenance and storage facilities, aircraft parking areas, an aircraft wash rack and lighting. Road M will bisect this area, providing vehicular access and parking.
   - Extending the existing aircraft parking apron over a previously graded area of approximately 10 acres. The apron extension will include ramp lighting and approximately 20 aircraft tie-down anchors.
   - Extending two existing taxiways, K and L, to the east, each to a finished size of approximately 150-feet wide and 850-feet long. The extended taxiways will provide access between the runway and the previously described new area for GA facilities.

2. Construction of a new Helicopter GA Facility: The new helicopter GA facility will be located approximately 3,000-feet mauka of the north end of the existing runway. Encompassing approximately 34 acres, the helicopter facility will include a new helicopter runway (approximately 200-feet wide and 1,700-feet long), a touchdown and lift-off facility (TLOF), hover pads, parking apron, taxi lanes, associated vehicle parking, an area for maintenance and storage facilities and tenant improvements. Pāoʻo Street will be extended 2,560-feet to access the new facility.

W:\8027-03\Planning\Graphics\Working



Source: State Department of Transportation
Airports Division

NOT TO SCALE

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

GENERAL AVIATION FACILITY EXPANSION CONCEPTUAL PLAN

FIGURE 2-2

In addition, an emergency response road approximately 1,940-feet long will be extended from the airfield to the facility to facilitate access by airport rescue fire fighting personnel.

3. Extension and Widening of the planned KATR: The U.S. Air Force is proposing to construct the KATR for flight training, primarily “touch and go” exercises. The DOT-A proposes to lengthen and widen the KATR from the Air Force’s planned size of 4,550-feet long by 90-feet wide to 5,000-feet long by 100-feet wide. This expansion will allow the runway to be used by commercial aircraft as an emergency runway or for when the main runway is undergoing maintenance. In addition, the State will petition the Air Force to use the runway for GA operations when the Air Force is not using it and the main runway is congested. The Air Force is currently in its early design phase for the KATR and the dimensions of the runway may change as the project moves forward.

   This EA describes and assesses the DOT-A’s proposal to extend and widen the KATR beyond the Air Force’s plans. Since the design plans for the extension and widening have yet to be developed, additional requirements such as the runway safety zone (RSA) and the runway protection zone (RPZ) are undetermined. Therefore, DOT-A plans to prepare a separate EA for the extension and widening of the KATR after the Air Force determines that it will proceed with its project and the DOT-A’s design for the extension and widening have been sufficiently developed.

4. Construction of a new road, Road M (Phase I): Road M is planned to be a two-lane, two-way road that will eventually provide public access from Queen Kaʻahumanu Highway to the airport’s south ramp area. It currently intersects existing and planned north-south roads within and extending beyond the airport. In the future, it will intersect with additional planned north-south roads. The proposed initial construction of Road M will extend eastward, approximately 850-feet from its intersection with Pāoʻo Street (Road N). This is opposite the portion of Road M that will be constructed in conjunction with the previously described new GA facilities area. Its eastern end will eventually connect with a roadway that the neighboring Natural Energy Laboratory of Hawaiʻi Authority (NELHA) plans to build on its property.

   NELHA plans to construct the unnamed continuation of Road M, extending from the aforementioned eastern end of DOT-A’s proposed Road M to its intersection with Queen Kaʻahumanu Highway, opposite Kaʻiminani Drive, where it will form a cross intersection.

   NELHA also plans to construct a two-lane, two-way road from its main facility to connect with the airport’s Pāoʻo Street (Road N). Pāoʻo Street is the airport’s primary north-south road, extending 1.86-miles from the airport’s south ramp GA area northward to the wastewater treatment plant. As described in item 2, Pāoʻo Street is proposed to be extended even further north to the proposed helicopter GA facility. It intersects and crosses, Keāhole Street, which is the airport’s primary access road from Queen Kaʻahumanu Highway.

5. <u>Construction of a SWAC System</u>: The SWAC system would pipe cold seawater recovered at NELHA to the airport, where a heat exchange facility will chill fresh water. The chilled fresh water will be piped to and circulated within the terminal and other buildings for air-conditioning. The cold seawater will be conveyed by an 18-inch buried pipe that would run from NELHA along Pāoʻo Street to the new Road M intersection, where the heat exchanger will be located on the southeast corner. From the heat exchanger site, the chilled fresh water pipe would run along Pāoʻo Street to the terminal area. The spent seawater will return via pipe to NELHA, which has other uses for it.

6. <u>Relocation of the Astronaut Ellison S. Onizuka Space Center</u>: The Onizuka Space Center, which is located between the two terminal areas, will be relocated across the terminal to the former ground transportation area. This will allow the terminal area to be expanded, as described in item 7, below. The proposed floor plan and a rendering of the new Onizuka Space Center are shown in Figure 2-3 and 2-4.

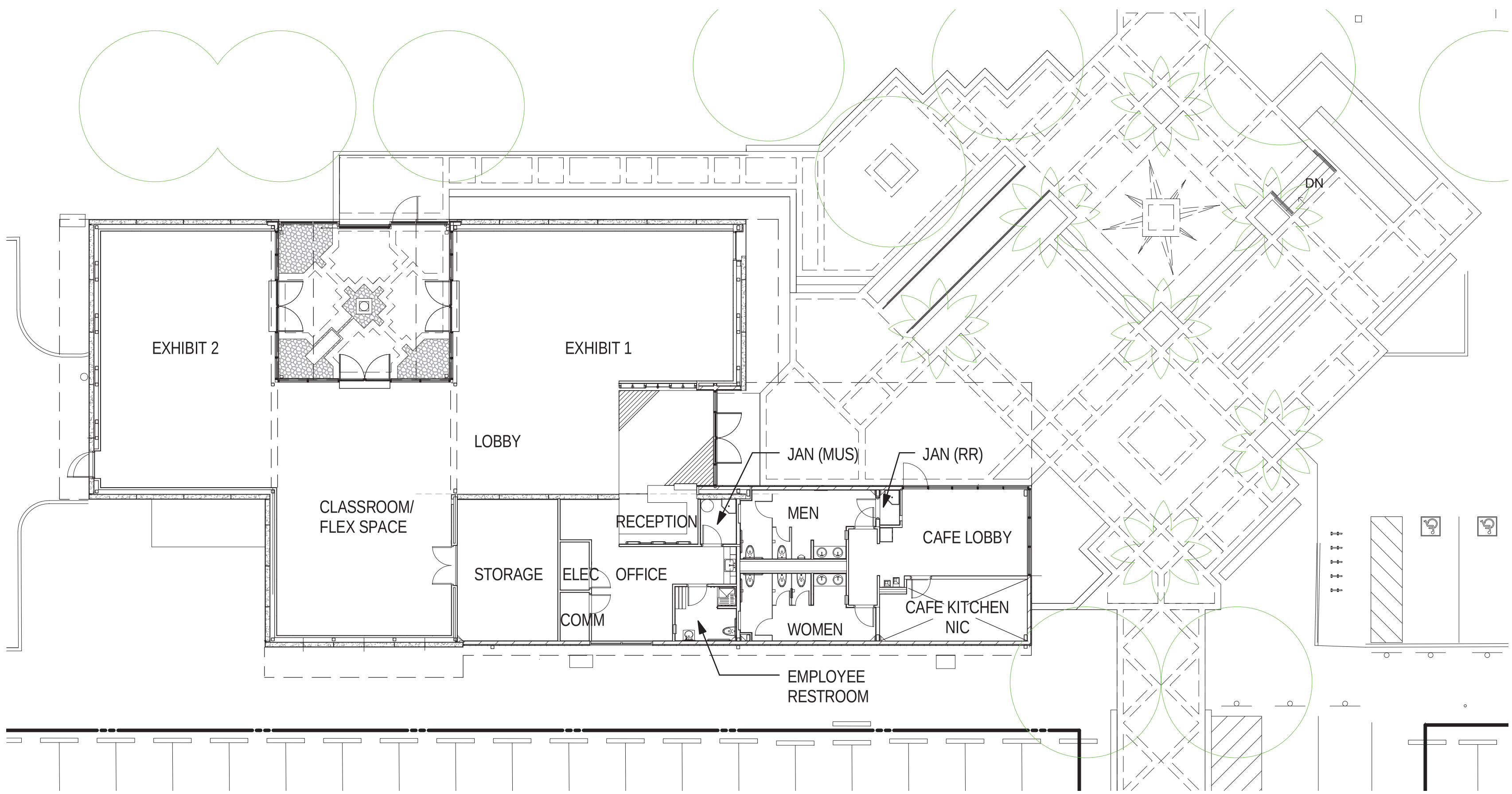
   The new Space Center will be a single story structure, approximately 35-feet tall at its highest point, and will provide approximately 6,135-square feet of floor area (see Figure 2-5). It will include an auditorium, exhibition spaces, a classroom/conference room, a lobby with display area, a gift shop and reception area, restrooms, and a cafe. The center will also include staffing and maintenance space.

   To construct the new Space Center, the existing buildings in the former ground transportation area will need to be demolished. In addition, 75 existing parking stalls from the adjacent parking lot will be lost. The new facility will provide 14 new parking stalls, an ADA parking stall, and a bike rack to meet the parking requirements for the Space Center. In addition, three ADA stalls that were lost through the demolition of the existing parking lot will be replaced near the new Space Center to serve the terminal.

   Water, wastewater, and drainage connections to existing lines along Kūpīpī Street will serve the new Space Center.

7. <u>Construction of Terminal Modernization (Phase I)</u>: Relocation of the Onizuka Space Center will allow the terminal areas to be connected by a single new building featuring a centralized check-in area and in-line baggage handling system (see Figure 2-6). The expanded terminal will improve passenger and baggage processing for the airlines. This project is the first phase of the terminal modernization plan. Included in this phase are the centralized check-in, an explosive detection system (EDS), passenger communication upgrade (Flight information display system, paging system, baggage information display system, gate information display system), and the in-line baggage handling system. The in-line baggage system will be located beneath the terminal floor so baggage can be conveyed to the apron without interrupting floor level operations.

W:\8027-03\Planning\Graphics\Working



AREA SUMMARY

TOTAL BUILDING FLOOR AREA (MUSEUM, CAFE, AND PUBLIC RESTROOM): 6135 SF

EXHIBIT 1	1082 SF	EMPLOYEE RESTROOM	81 SF	OFFICE	319 SF
EXHIBIT 2	1126 SF	RECEPTION	355 SF	CAFE LOBBY	581 SF
CLASSROOM/FLEX SPACE	1122 SF	STORAGE	480 SF	MEN'S RESTROOM	205 SF
ELECTRICAL ROOM	35 SF	JANITOR (MUSEUM)	41 SF	WOMEN'S RESTROOM	202 SF
COMMUNICATION ROOM	36 SF	LOBBY	452 SF	JANITOR (RESTROOM)	18 SF

Source: kya design group

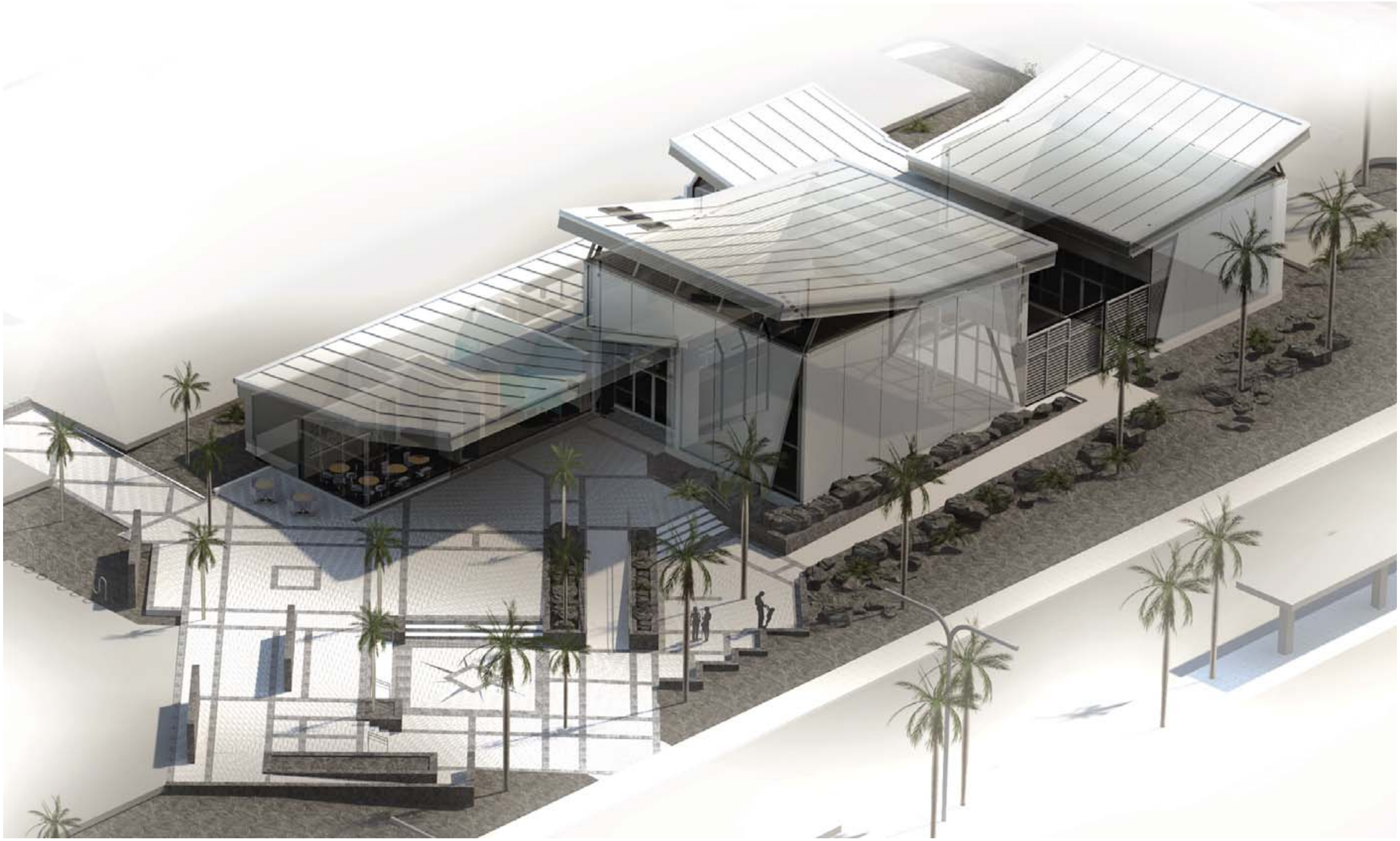
NOT TO SCALE

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

FLOOR PLAN OF ASTRONAUT ELLISON S. ONIZUKA SPACE CENTER

FIGURE 2-3



Source: kya design group

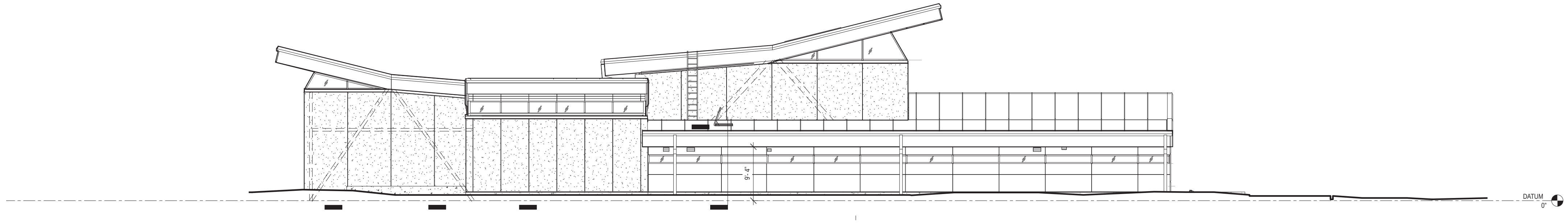
NOT TO SCALE

WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

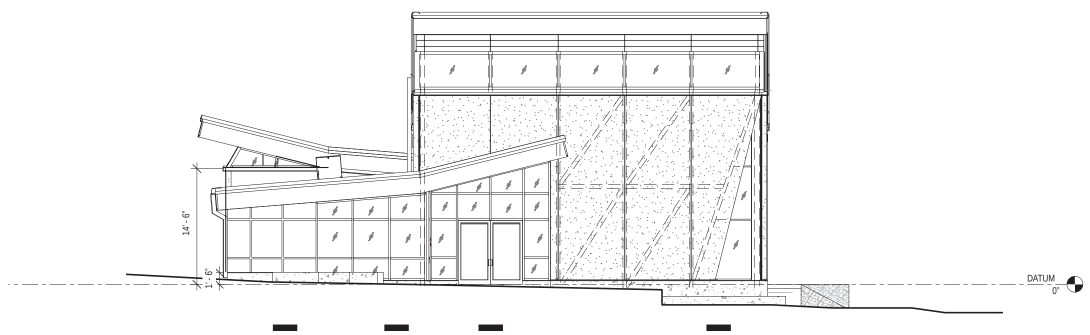
Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

RENDERING OF ASTRONAUT ELLISON S. ONIZUKA SPACE CENTER

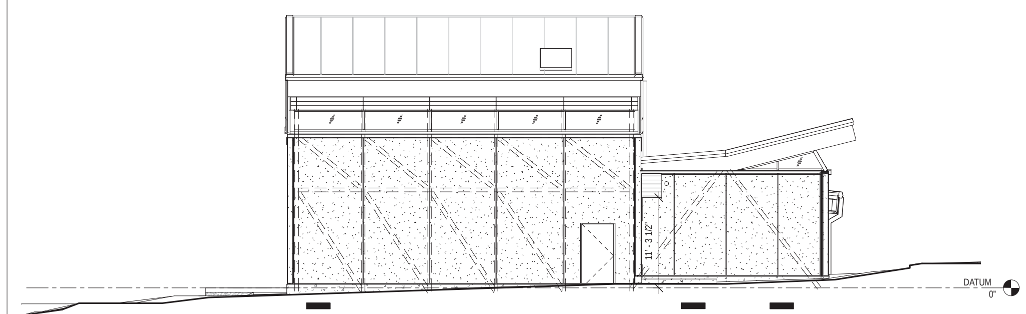
FIGURE 2-4



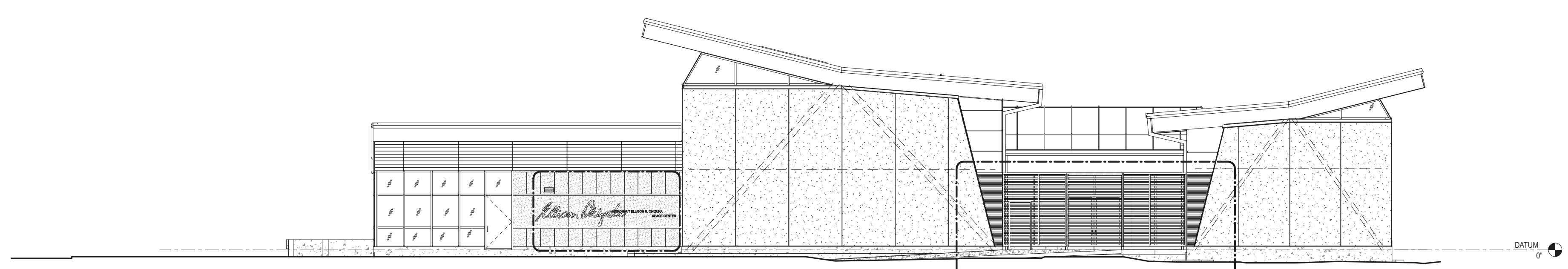
1 EAST ELEVATION



2 NORTH ELEVATION



3 SOUTH ELEVATION



4 WEST ELEVATION

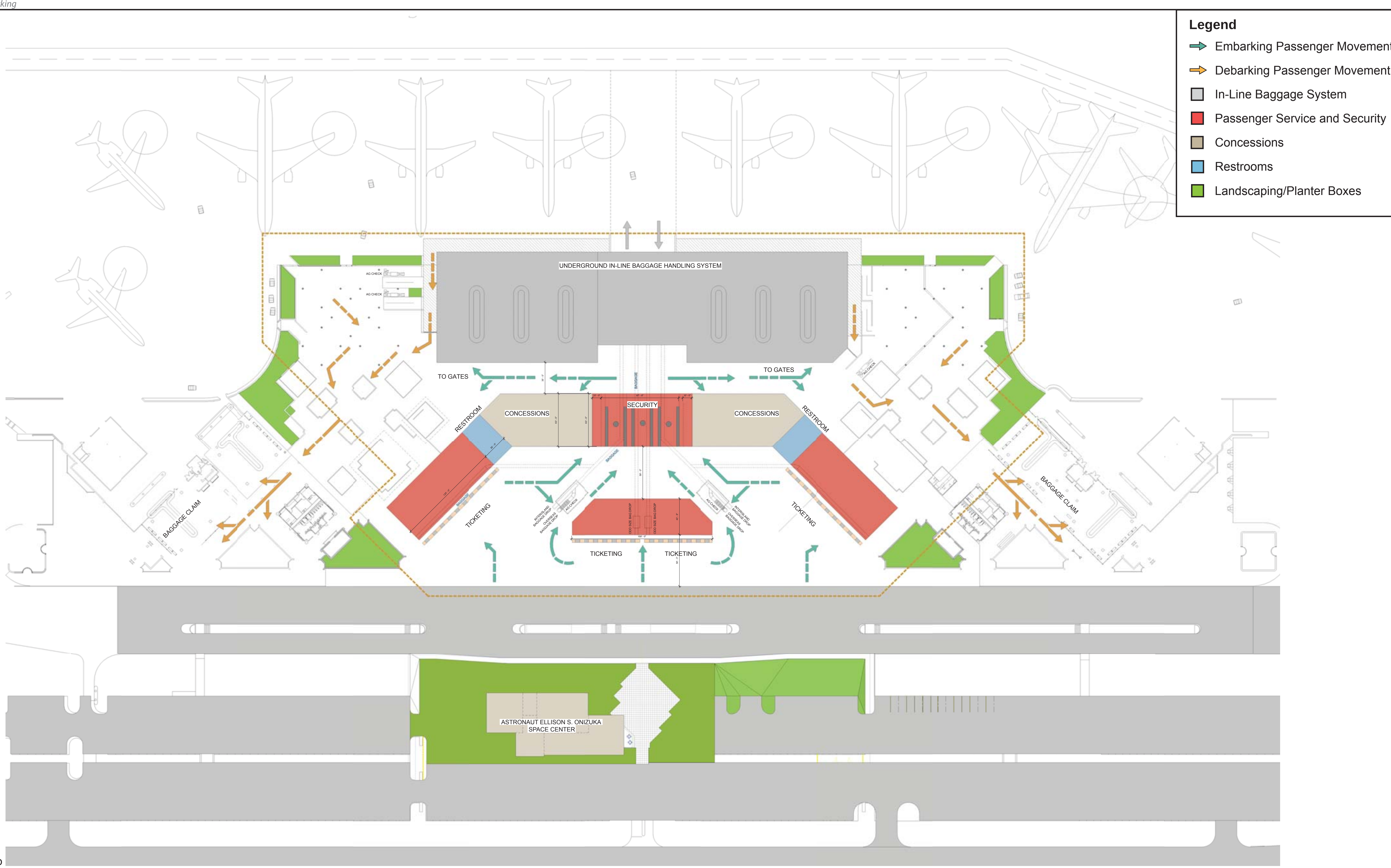
Source: State Department of Transportation Airports Division

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

ASTRONAUT ELLISON S. ONIZUKA SPACE CENTER EXTERIOR ELEVATIONS

FIGURE 2-5



Source: kya design group

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

TERMINAL MODERNIZATION PHASE 1 CONCEPTUAL DESIGN

FIGURE 2-6

8. Construction of a High Pressure Hydrogen Fuel Storage and Fueling Station: The proposed hydrogen fueling station would be located in close proximity to the ground transportation operations. In addition to a fueling station, there will also be three, 30-foot American Society of Mechanical Engineers (ASME) tubes, which can store up to 20 kilograms of hydrogen fuel per tube. A rendering of the station is shown in Figure 2-7.

9. Construction of an ARFF Regional Training Facility: The ARFF regional training facility will be located on the north side of the airport property, adjacent to the existing burn pit area. The training facility would be utilized two to three times a week, initially by airport ARFF personnel and County of Hawaiʻi fire fighting personnel and would eventually be opened up to all First Responders for training. The training center is comprised of a fuel spill trainer, a specialized air craft fire trainer (SAFT), a two-story control tower and classroom facility, a fuel farm, water storage tanks, a water recycling plant, and a three-story burn building. Figure 2-8 is conceptual drawing of the training facility.

10. Construction of a Medical Transitional Facility: The proposed medical transitional facility would be constructed on a four to six acre site. The facility would be a two story structure, providing approximately 45,000 gross square feet of floor area. The medical transitional facility would house an emergency room where patients could be received and stabilized prior to being transported by air to Honolulu or other off-island hospital for further treatment. It would also house an out-patient clinic where doctors from Honolulu, and even the mainland, could see patients from Kona during periodic visits.

11. Construction of a temporary State DOA Inspection Facility: The proposed DOA temporary inspection facility would be built on an approximately one to two acre site located at one of three possible locations:

    A. On the east side of Pāoʻo Street adjacent to the proposed AARF station;

    B. On the east side of Pāoʻo Street, between Keāhole Street and Road M; or

    C. The area directly south of the GA facility.

    In ten to twenty years, a permanent facility is planned to be constructed in conjunction with a new cargo building.

12. Interior renovations of the existing ARFF Station for a new Commuter Terminal: DOT-A is currently pursuing the construction of a new ARFF Station into which the existing ARFF operations will be relocated. After the new ARFF Station is occupied, DOT-A plans to renovate the existing ARFF Station building to be used as a new Commuter Terminal Building.

W:\8027-03\Planning\Graphics\Working

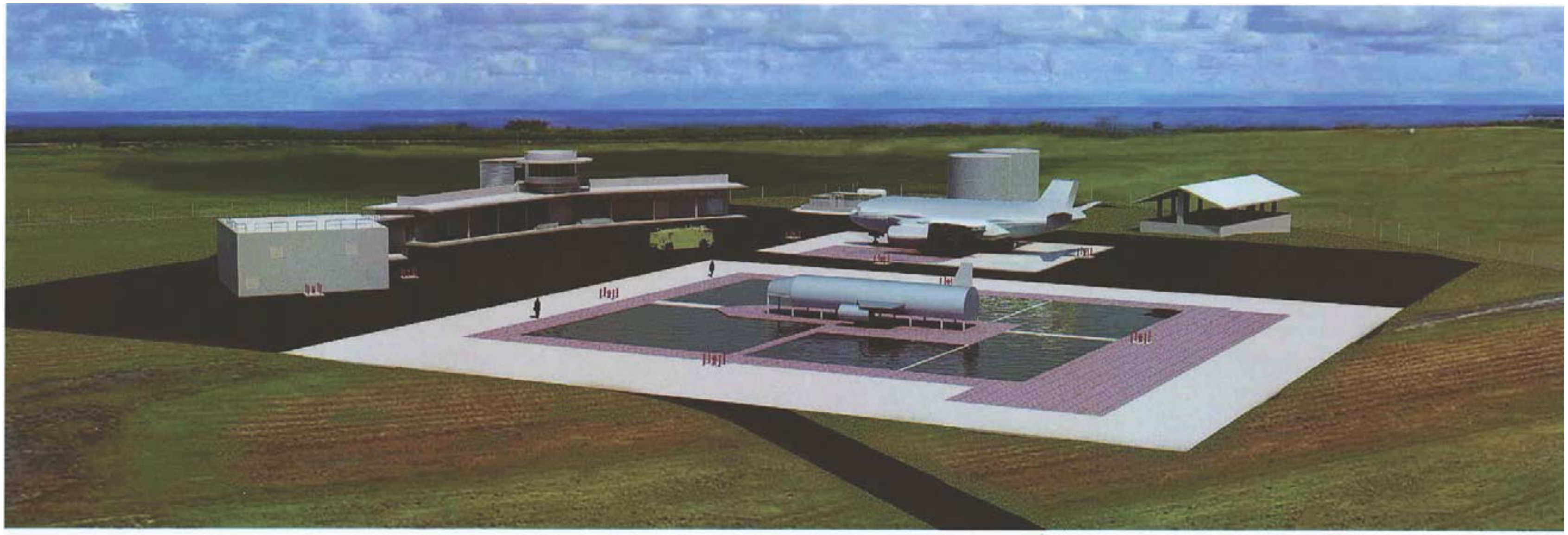
NOT TO SCALE

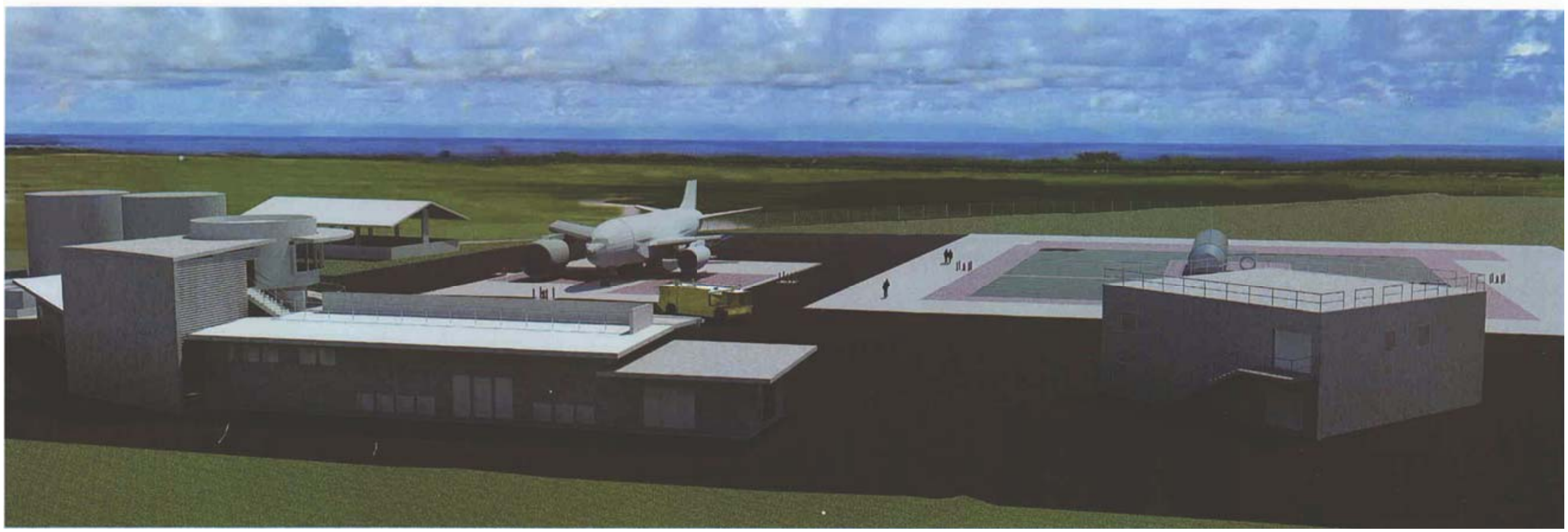
WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

HYDROGEN FUEL STATION RENDERING

FIGURE 2-7





Source: AECOM New Zealand Limited

NOT TO SCALE

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

ARFF REGIONAL TRAINING FACILITY CONCEPTUAL DESIGN PERSPECTIVES

FIGURE 2-8

2.3 Project Cost and Schedule

The proposed improvements are anticipated to be constructed within the next five to ten years. Development costs are estimated at $611 million, utilizing State and Federal funds, as well as public/private partnerships.

3. DESCRIPTION OF EXISTING ENVIRONMENT, IMPACTS, AND MITIGATION MEASURES

3.1 Climate

The Kailua-Kona area of the island of Hawaiʻi is characterized by a tropical climate, consisting of a dry (November to March) and a wet (April to October) season. There are local climatic differences across the island due primarily to the mountainous terrain created by Mauna Kea, Mauna Loa, Kīlauea, Hualālai, and the Kohala Mountains. The tradewinds that affect the east side of the island are blocked by the mountains, leaving the west side of the island drier and subject to ground heating and cooling.

Average temperatures in the Kailua-Kona region range from 72 degrees Fahrenheit in the coolest month to 77 degrees in the warmest month. August is generally the warmest month, while January is generally the coolest. KOA is located in the drier region of the island with an average precipitation of 25 inches per year. Rainfall in the region is highly seasonal, with most of the precipitation occurring in the winter months.

Northeast tradewinds prevail approximately 80 to 85 percent of the time. Tradewinds originating from the northeast average 10 to 15 miles per hour during the afternoons, with slightly lighter winds occurring during the mornings and evenings. However, between October and April, southerly winds generated from Kona storms may be experienced.

Impacts and Mitigation Measures

No significant impacts on climate in the project area are anticipated. Construction and operation of the proposed project are not anticipated to affect temperatures, wind, or rainfall levels in the project area.

3.2 Physiography

3.2.1 Geology and Topography

The island of Hawaiʻi is composed of five major volcanic mountains. All of them are very young, and three have been active in historic time. A sixth volcano, Lōʻihi, which is presently submerged, may well form an island off the southeast coast of Hawaiʻi within the next several thousands of years. Also, at least one additional volcano that helped to form the island has been buried by more recent ones.

KOA is located on the western flank of Hualālai and is comprised of a series of four lava flows. The most recent lava flow, often referred to as the 1801 lava flow, comprises the majority of the airport property on the north side. Further south, the Keāhole Point lava flow (approximately 2,140 years before present (bp)) comprises the remainder of the property, with a few areas of much older flows (greater than 5,000 years bp). A small portion of the Kohanaiki lava flow (approximately 3,000 years bp) can be found in the southwestern portion of the airport property.

The average slope at the site is less than 5 percent. The elevation of the project area adjacent to Queen Kaʻahumanu Highway is approximately 130-feet above mean sea level while the elevation of the project area nearest the runway is at approximately 47-feet above mean sea level.

Impacts and Mitigation Measures

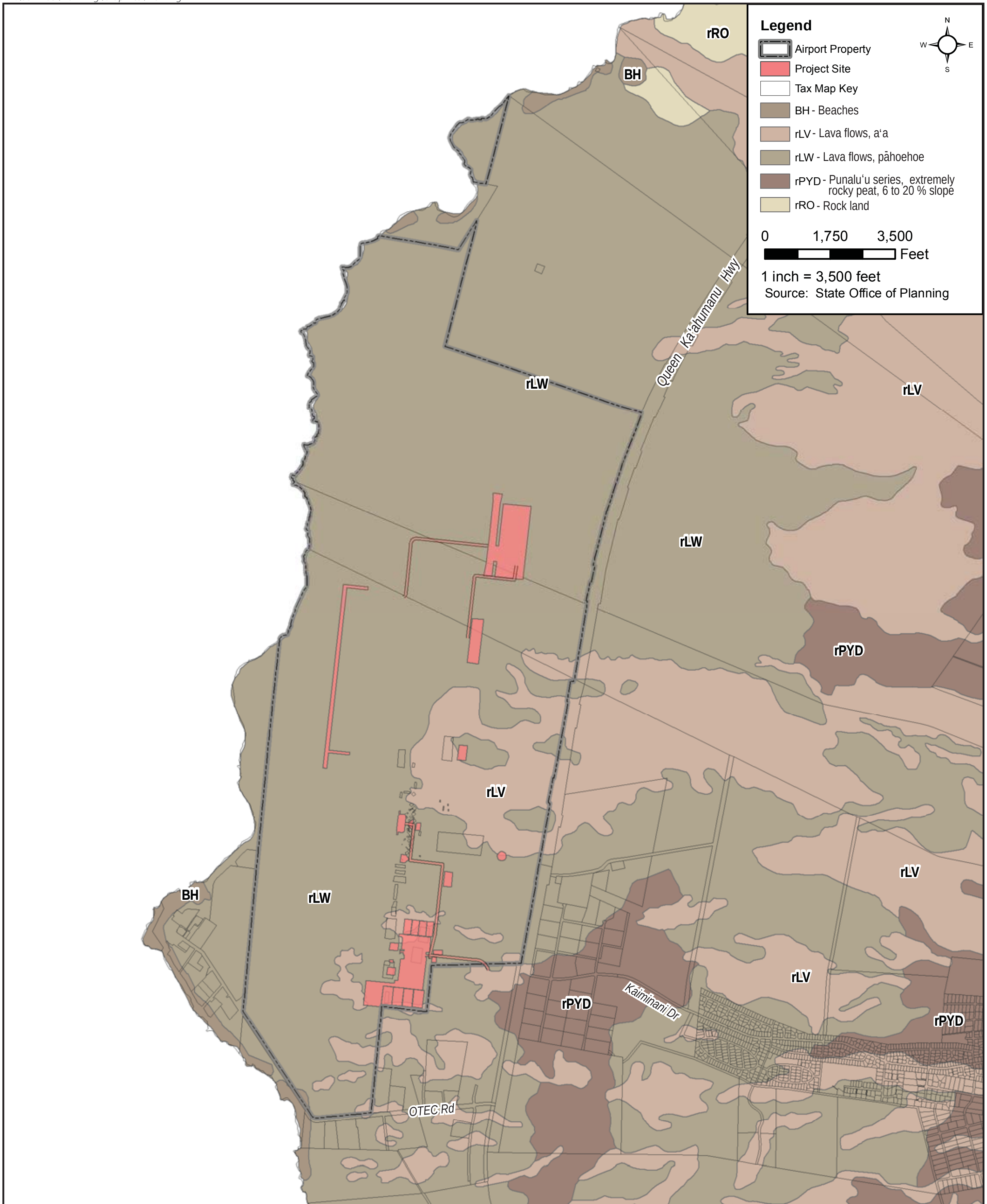
No significant impacts to the geology and topography are anticipated as a result of the construction and operation of the proposed project. Construction of the proposed project improvements will involve grading and excavation of presently undeveloped areas and developed areas within the project site.

Potential water quality impacts to surface and near shore coastal waters during construction of the project will be mitigated by adherence to State and County water quality regulations governing grading, excavation and stockpiling. A National Pollutant Discharge Elimination System (NPDES) Individual Permit for Storm Water Associated with Construction Activity, as administered by the State Department of Health (DOH), will be required to control storm water discharges for those improvements anticipating an area greater than 1-acre of soil disturbance. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural Best Management Practices (BMPs) such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

3.2.2 Soils

According to the U.S. Department of Agriculture Natural Resources Conservation Service, the project site is comprised of soils classified as two types of lava flows, ‘a‘ā (rLV) and pāhoehoe (rLW), both which are classified as a miscellaneous land type (see Figure 3-1). The majority of the project site is comprised of pāhoehoe lava. This type of lava has a billowy, glassy face that is relatively smooth. In some areas however, the surface is rough and broken, with the presence of hummocks and pressure domes. Pāhoehoe lava has no soil covering and is typically bare of vegetation except for mosses and lichens. In areas of higher rainfall, however, scattered trees, ‘ōhelo berry, and ‘a‘ali‘i have gained a foothold in cracks and crevices. This type of lava can be found at an elevation from sea level to 13,000 feet. Some flat slabs of pāhoehoe lava are used as facings on buildings and fireplaces. In areas of higher rainfall, this lava contributes to the ground-water supply.

On the southern end of the project site there are scattered patches of ‘a‘ā lava. ‘A‘ā lava has practically no soil covering and is bare of any vegetation, except for mosses, lichens, ferns, and a few small ‘ōhi‘a trees. It exists at an elevation ranging from near sea level to 13,000-feet and is associated with pāhoehoe lava and many soils. This lava type is rough and broken. It is a mass of clinkery, hard, glassy, sharp pieces piled in tumbling heaps. In areas of high rainfall, it contributes substantially to the underground water supply and is used for watershed.



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

SOILS MAP

FIGURE 3-1

The *Detailed Land Classification – Island of Hawai'i* published by the University of Hawai'i Land Study Bureau (LSB) evaluates the quality or productive capacity of certain lands on the island for selected crops and overall suitability in agricultural use. A five-class productivity rating system was established with "A" representing the class of highest productivity and "E" the lowest. The area that encompasses the developed portion of the airport property is "Not Classified while the undeveloped, surrounding property has a soil productivity rating of "E," which is very poorly suited for agricultural production (see Figure 3-2).

Impacts and Mitigation Measures

No significant impacts on soils are anticipated with the construction and operation of the proposed project. Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed project will be regulated by the County's grading ordinance and the NPDES permit requirement administered by the State DOH. An NPDES Individual Permit for Storm Water Associated with Construction Activity will be required for those projects anticipating soil disturbance exceeding one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

The proposed improvements are not anticipated to have any long-term impacts on area soils. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

3.3 Hydrology

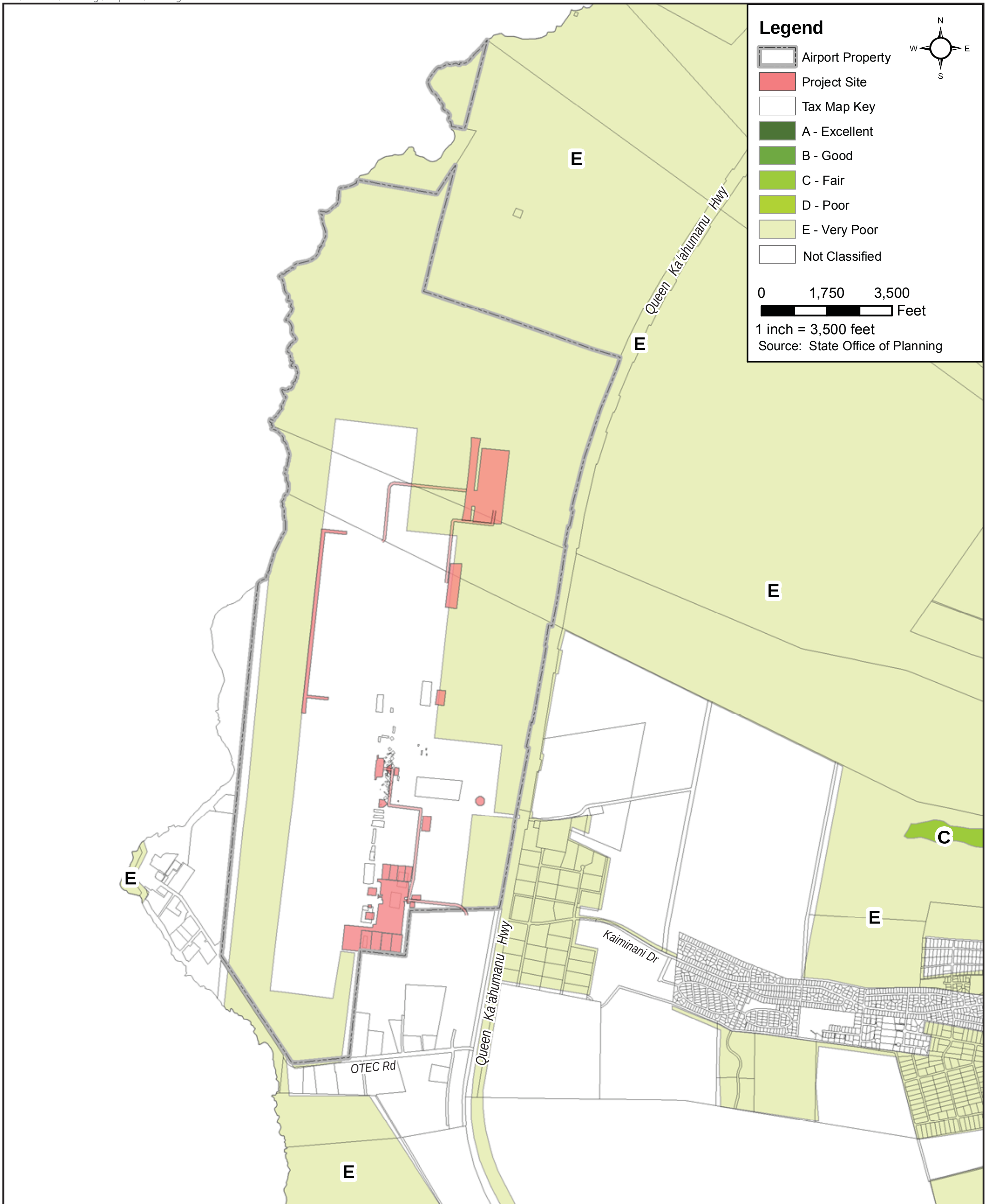
3.3.1 Surface Water

As the existing KOA site is located on geologically recent lava flows, there are no fresh water perennial or intermittent streams located on or within the vicinity of the KOA property. The nearest wetland features to the project site are the Ōpae'ula and Keahialaka fishponds located approximately 2,000-feet and 3,250-feet, respectively, to the north of the project site (see Figure 3-3). In addition, the Pa'aiea fishpond is located 3.8-miles to the west of the project site.

Impacts and Mitigation Measures

No significant impacts to surface waters in the surrounding project vicinity are anticipated with the construction and operation of the proposed project. Construction activities associated with the proposed project would not alter existing streams or drainage patterns associated with any perennial streams. Potential construction-related impacts to the quality of surface water in the greater project vicinity during

W:\8027-03\Planning\Graphics\Working

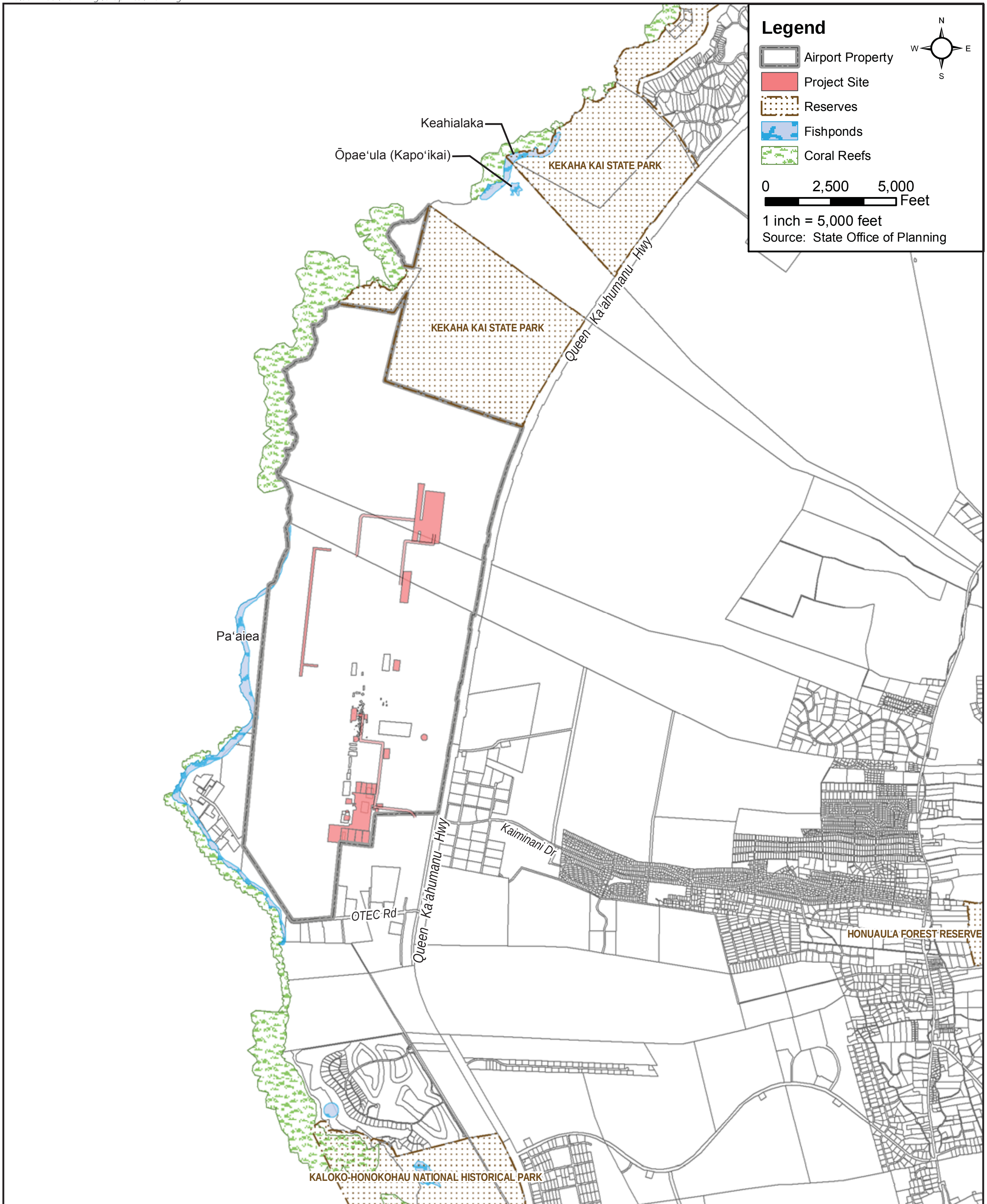


WILSON OKAMOTO CORPORATION
ENGINEERS ● PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

FIGURE 3-2

UNIVERSITY OF HAWAIʻI LAND STUDY BUREAU MAP



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

SURFACE WATER MAP

FIGURE 3-3

excavation and grading activities will be regulated by the County's grading ordinance and the NPDES permit administered by the State DOH. An NPDES Individual Permit for Storm Water Associated with Construction Activity will be required if the anticipated area of soil disturbance from activities such as clearing, grubbing, grading, and stockpiling exceed one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

The proposed project is not anticipated to adversely impact surface water quality in the project vicinity. The proposed drainage system improvements for the project will consist of drain inlets, catch basins, and seven on-site retention basins. With the addition of the retention basins, the flow rates and drainage patterns will be kept to pre-development conditions, and the run-off generated by the proposed project will not adversely affect the adjacent properties and down-gradient areas. The proposed project will be designed to comply with State DOH requirements to address the containment and proper disposal of industrial fluids from daily operations. The project's on-site WWTP will produce R-1 quality reclaimed water for irrigation, which will be applied in compliance with State DOH requirements to site appropriate landscaping. The potential for wastewater spills impacting vicinity surface water resources during rain storms will be mitigated by design and operation of the facility to accommodate peak flows and plant upset situations.

3.3.2 Groundwater

Groundwater occurs within portions of geologic formations called aquifers that are favorable for receiving, storing and transporting water. The island of Hawai'i is divided into nine groundwater sectors, identified as Aquifer Sector Areas, which reflect broad hydrogeological (subsurface) similarities while maintaining hydrographic (surface), topographic, and historical boundaries. Within the Aquifer Sector Areas, smaller sub-regional hydrologic units, or Aquifer System Areas are delineated based on hydraulic continuity and related characteristics. The project site is located within the Hualālai Aquifer Sector Area, and specifically within the Keauhou Aquifer System Area, which extends over the western and southwestern flank of Hualālai and the entire coastline from Mahai'ula to Keikiwaha point. The Keauhou Aquifer is described as being comprised of a basal water system in the coastal area with the possibility of having high-level, dike confined groundwater near the rift zones of Hualālai. The State DLNR Commission on Water Resource Management (CWRM) estimates that the Keauhou Aquifer has sustainable yield of 38 million gallons per day (mgd), based on a recharge estimate of 87 mgd and an unconfined, thin basal water development scenario. However, this estimate may be underestimated due to the discovery of high-level groundwater occurrence in the southern and northern regions of North Kona. Based upon water level data from 14 wells (from Kalaoa to Ke'ei), the hydrologic discontinuity between the high-level groundwater and basal-water aquifers roughly aligns with Māmalahoa Highway, and the high-level water appears to occur between 42- and 490-feet above sea level. This high-level groundwater is considered to be of pristine quality, largely due to the lack of saltwater intrusion and little to no urban development overlying the aquifer recharge area.

The Underground Injection Control (UIC) program, administered by the State DOH's Safe Drinking Water Branch, was established to protect the quality of underground sources of drinking water from contamination by subsurface disposal of fluids. The UIC Line is the boundary between non-drinking water aquifers, generally located makai, or seaward, of the UIC Line, and underground sources of drinking water, generally located mauka, or toward the mountains, of the UIC Line. The project area is located directly makai of the UIC line (see Figure 3-4).

Impacts and Mitigation Measures

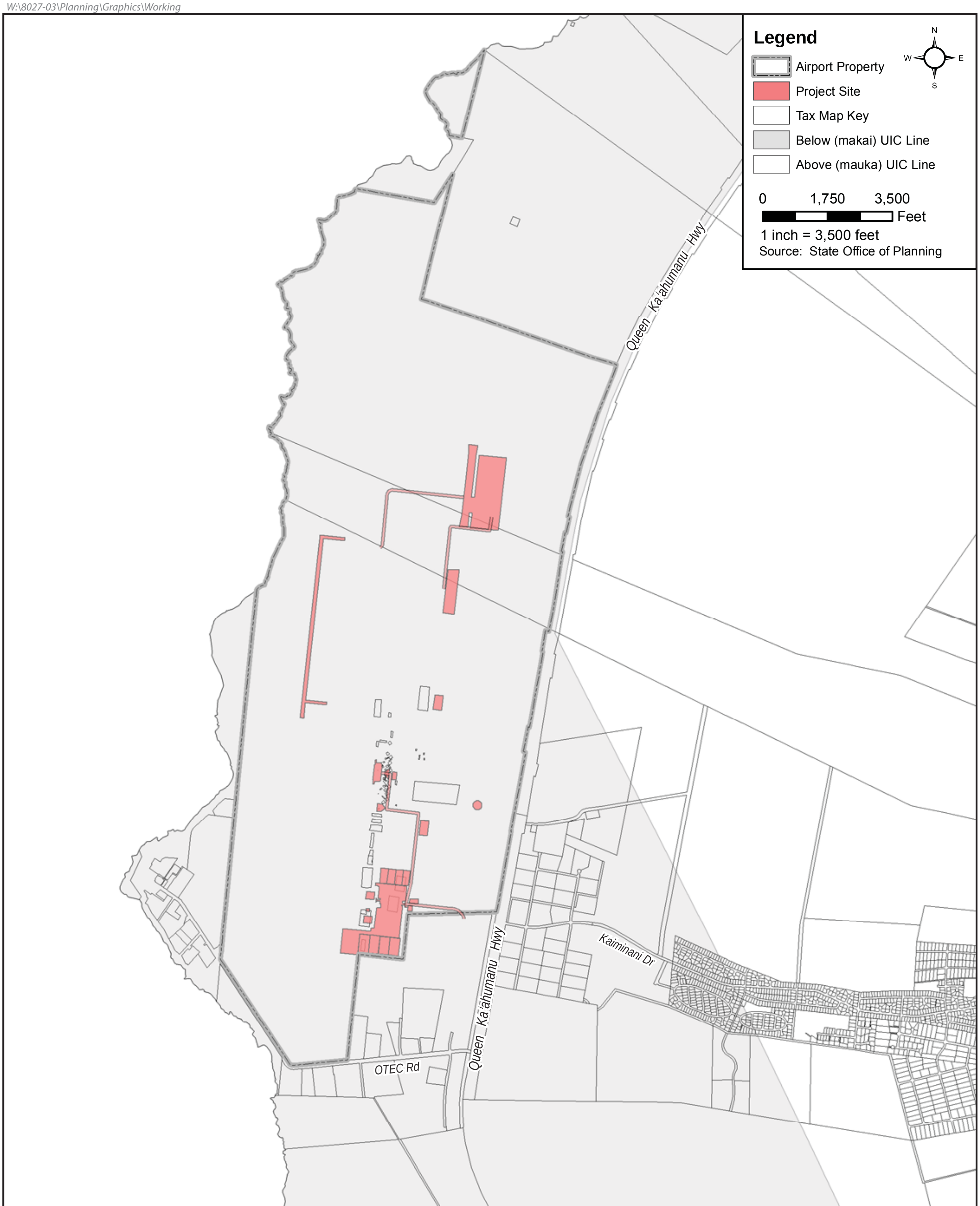
No significant impacts to groundwater resources associated with the project site are anticipated as a result of the construction and operation of the proposed improvements. Construction activities are not likely to introduce to, nor release from the soil any materials which could adversely affect groundwater. Construction material wastes will be appropriately disposed of to prevent leaching. Dewatering activities are not anticipated for this project.

3.3.3 Coastal Waters

The nearest coastal water offshore of the project site is Makako Bay, located approximately 0.1-miles to the west. Pursuant to Hawai'i Administrative Rules (HAR) Title 11, Chapter 54, Water Quality Standards, Makako Bay is classified as AA Marine waters. Class AA Marine waters are recognized as high quality coastal waters with the objective that "these waters 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".

Impacts and Mitigation Measures

No significant impacts on coastal waters in the greater project vicinity are anticipated as a result of the construction and operation of the proposed improvements. Construction activities will involve land-disturbing activities that may result in some soil erosion, however, mitigative measures will be incorporated into the project's construction plans to minimize soil disturbances and potential storm water erosion. Potential construction-related impacts to the quality of coastal waters in the greater project vicinity will be regulated by the County's grading ordinance and the NPDES permit administered by the State DOH. For those improvements anticipating an area of soil disturbance greater than one acre, an NPDES Individual Permit for Storm Water Associated with Construction Activity will be required. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

UNDERGROUND INJECTION CONTROL LINE MAP

FIGURE 3-4

3.4 Natural Hazards

3.4.1 Flood Hazard

According to the Flood Insurance Rate Map (FIRM) (Community Panel Numbers 1551660466C, 1551660468C, 1551660681C and 1551660683C, Effective Date: September 16, 1988 prepared by the Federal Emergency Management Agency (FEMA)), the project site is located within Zone "X", defined as "Areas determined to be outside the 0.2% annual chance floodplain" (see Figure 3-5). The project site is located outside of the tsunami inundation zone.

Impacts and Mitigation Measures

Construction and operation of the proposed improvements are not anticipated to increase flood risks or cause any adverse flood-related impacts at the project site or lower elevation properties.

3.4.2 Seismic Hazard

Earthquakes in the Hawaiian Islands are primarily associated with volcanic eruptions from the expansion or shrinkage of magma reservoirs. Earthquakes are fairly common on the island of Hawai‘i where active volcanism at Kīlauea is a source of significant seismicity.

The International Building Code (IBC) includes a system which classifies seismic hazards on the basis of the expected strength of ground shaking and the probability of the shaking actually occurring within a specified time. The IBC seismic provisions contain six seismic zones, ranging from 0 (no chance of severe ground shaking) to 4 (10 percent chance of severe ground shaking in a 50-year interval). The entire island of Hawai‘i is designated Seismic Zone 4, the highest rating among the major Hawaiian Islands.

Impacts and Mitigation Measures

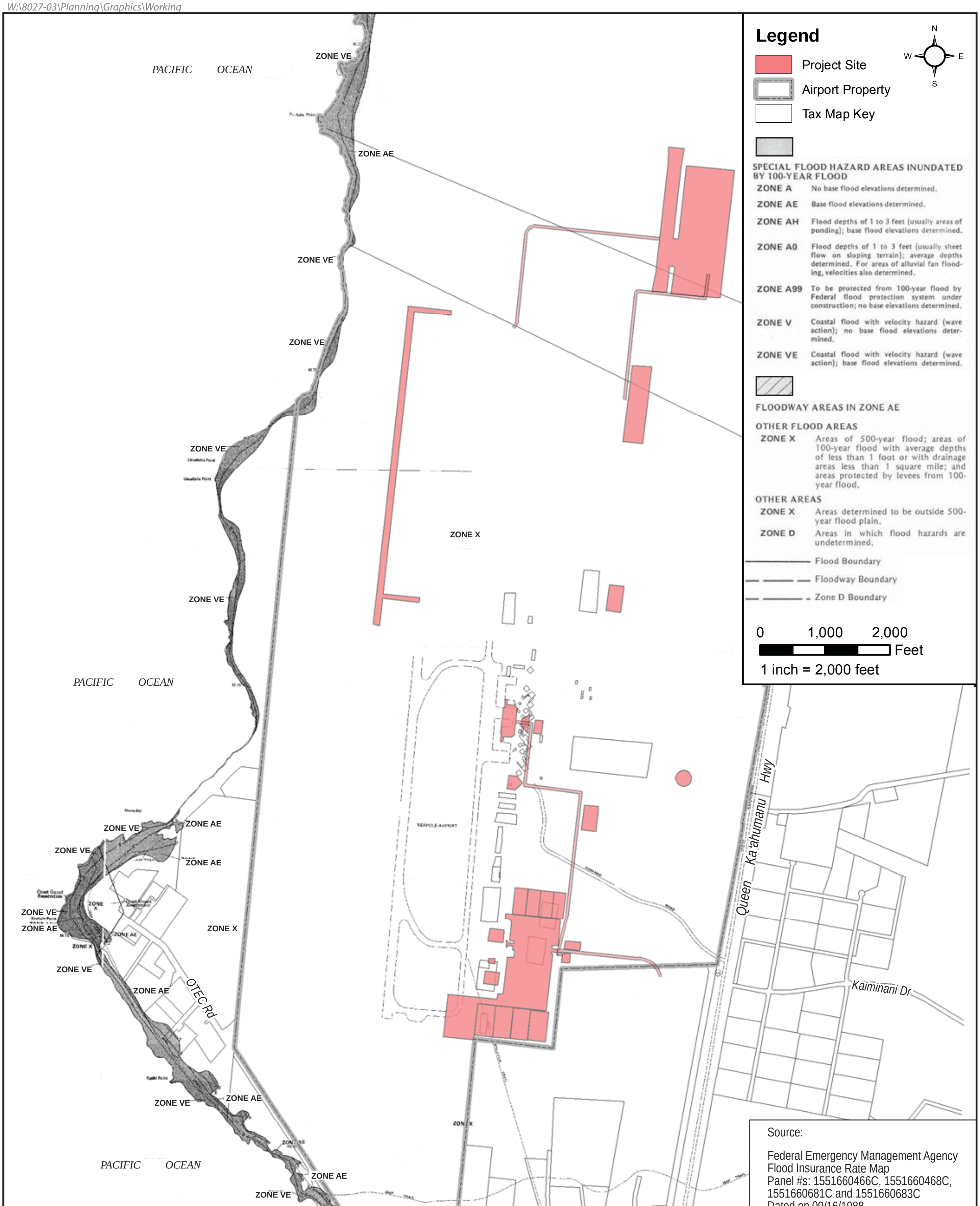
The proposed improvements will be designed and built to Seismic Zone 4 standards of the IBC to ensure that potential seismic activities do not adversely affect the project buildings.

3.5 Natural Environment

3.5.1 Flora

A botanical survey of the project site was conducted by Palmer & Associates in December 2011 and January 2012. The botanical survey is included in Appendix A and is summarized below.

Field surveys of the KOA property were conducted on December 1, 5, 8, and 13, 2011 and on January 10, 2012. The airport property is mostly comprised of the Hualālai 1801 lava flow which is largely barren, unweathered pāhoehoe lava. However a sparse pioneer plant community is present consisting of scatter maiapilo (*Capparis sandwichiana*), *Fimbristylis Hawaiiensis*, the ferns *Nephroplepis* and *Dorypteris*, as well as fountain grass (*Pennisetum setaceum*). Maiapilo and *Fimbristylis Hawaiiensis* are both found on the U.S. Fish and Wildlife's (USFWS) Species of Concern.



WILSON OKAMOTO CORPORATION
ENGINEERS ● PLANNERS

Airfield, Terminal and Facility Improvements for the Kona Airport at Keāhole

FLOOD INSURANCE RATE MAP

FIGURE 3-5

Coral strand vegetation occurs along the coast of the 1801 flow in scattered sites where sand and/or other fine material has accumulated. A small area (approximately 1 hectare) of Coastal Dry Forest is located in the southwest corner of the property between the OTEC Road and the airport's south access road. In this area, a mixture of native and introduced plants is present. Kiawe (*Prosopis pallida*) makes up most of the tree canopy, with shrubs of naio (*Myoporum sandwicense*), naupaka (*Scaevola taccada*), Christmas berry (*Schinus terebinthifolius*), klu (*Acacia farnesiana*) and noni (*Morinda citrifolia*) also present. In addition, the native sedge mau‘u ‘aki‘aki (*Fimbristylis cymos*) can be found near an anchialine pond located between the Coastal Dry Forest patch and the airport fence. The remainder of the property can be described as "disturbed/ruderal and fountain grass scrub" as land disturbance of varying degrees has occurred over most of the property. In heavily disturbed areas, ruderal species (i.e. alien weeds) are present with fountain grass as the primary component. In disturbed sites adjacent to irrigated landscapes, numerous alien species are present. On the older lava flow areas (mostly on the Keāhole Point flow), the area is mostly disturbed and either barren with only a few pioneer species, or are occupied by fountain grass and a mix of other species including ‘uhaloa (*Waltheria indica*), tridax (*Tridax procumbens*), pluchea (*Pluchea carolinesis*), maiapilo, and occasionally noni. There are also patches of relatively old lava flow (undated), which support dense fountain grass grassland.

Other vegetation on the airport property consists of ruderal or weedy vegetation and landscaping in developed areas. Cultivated plants observed in the landscaped areas include the coconut (*Cocos nucifera*), kou (*Cordia subcordata*), monkey pod (*Samanea saman*), be still tree (*Cascabela thevetia*), and Tahitian gardenia (*gardenia taitensis*). Several native species are also used including naupaka, ‘ākia, and ‘ilima.

Specifically at each project location, the following botanical species were observed:

<u>General Aviation Facilities Expansion</u>: The area is mostly paved and little plant coverage remains. The native plant, ‘uhaloa was observed at this site.

<u>New Helicopter General Aviation Facility</u>: This area is located on the 1801 flow and most of the site has been previously disturbed. The remainder of the area supports sparse fountain grass and an occasional maiapilo. A few individuals of *Fimbristylis Hawaiiensis* are present.

<u>Extension and Widening of the KATR</u>: Very little vegetation is present in this location. A few clumps of fountain grass occur along the road as well as individuals of *Fimbristylis Hawaiiensis* scattered in the area.

<u>Construction of Road M</u>: Parts of the road routes pass through disturbed fountain grass shrub. Also found were a few maiapilo and *Fibristylis Hawaiiensis*, as well as ‘uhaloa, noni, and a few introduced weeds.

<u>SWAC System</u>: The pipeline itself would be buried under previously disturbed portions of the airport. The heat exchanger site is highly disturbed with fountain grass, maiapilo, ‘uhaloa, and noni present in small numbers.

Relocation of the Astronaut Ellison S. Onizuka Space Center: Construction would occur in an already developed area.

Terminal Modernization (Phase 1): Construction would occur in an already developed area.

Hydrogen Fuel Storage and Fueling Station: Construction would occur in an already developed area.

ARFF Regional Training Facility: The site is generally barren lava with scattered fountain grass patches. Some of the site has been disturbed.

Medical Transitional Facility: At this site, there is mostly barren lava with patches of fountain grass and a few other ruderal weed species. This site has been previously disturbed.

Temporary DOA Inspection Facility: At the potential Site A, dense stands of fountain grass can be found. At potential Site B, the site has been previously disturbed, however a few native plants are still present, including small numbers of maiapilo and *Fimbristylis Hawaiiensis.* Also present are a few scattered ʻaʻaliʻi. At potential Site C, the area has been previously graded. A few ʻuhaloa have colonized, but otherwise the site is barren.

No USFWS listed threatened or endangered botanical species were found on the airport property.

Impacts and Mitigation Measures

As the various project sites do not provide unique botanical habitats, no significant impacts on botanical species are anticipated from the construction and operation of the proposed projects and improvements. No listed, or proposed threatened or endangered botanical species under either the Federal or State endangered species statutes will be disturbed as a result of the proposed project. As there is no federally delineated Critical Habitat within or adjacent to the project site, the proposed project will not impact federally designated Critical Habitat.

3.5.2 Fauna

An avian and terrestrial mammalian survey of the project site was conducted by Rana Biological Consulting, Inc. in December 2011. Fieldwork was conducted on December 8, 9, and 12, 2011. The faunal survey is included in Appendix B and is summarized below.

Avian Survey:

A total of 184 individual birds of 15 species, representing 11 separate families, were recorded during the survey. All but two of these avian species recorded during the course of this survey are considered to be alien to the Hawaiian Islands. The two native species recorded were Pacific Golden-Plover (*Pluvialis fulva*) and Ruddy Turnstone (*Arenaria interpres*). Both are indigenous migratory shorebird species that nest in the high Arctic, and winter in Hawaiʻi and the Tropical Pacific.

No listed or proposed threatened or endangered avian species under either the Federal or State endangered species statutes were detected during the survey.

Avian diversity and densities were extremely low, consistent with the xeric habitat present on the site. At 47 percent of the 30 count stations, no birds were recorded. Bird numbers and densities were highest around the landscaped and watered areas within the main terminal complex and along the airport entrance road.

Three species, Common Myna (*Acridotheres tristis*), Japanese White-eye (*Zosterops japonicus*) and House Finch (*Carpodacus mexicanus*) accounted for slightly more than 45 percent of all birds recording during the station counts. Common Myna was the most frequently recorded species accounting for 18 percent of the total number of birds counted.

No seabirds were detected during the survey, but it is probable that both the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic subspecies of the Newell's Shearwater (*Puffinus auricularis newelli*), over-fly the project area in small numbers between April and the middle of December each year. Both species have been recorded flying to and from their nesting colonies over the greater Kona area. Both of these pelagic seabird species nest high in the mountains in burrows excavated under thick vegetation, especially uluhe (*Dicranopteris lineraris*) fern. There is no suitable nesting habitat for either of these seabird species on, or close to KOA.

No waterbirds were recorded during the course of this survey though several have been recorded within the airport boundaries in the past, including the endangered Hawaiian Stilt (*Himantopus mexicanus knudesni*). In the past, these birds were drawn to the general area by ponds within the Cyanotech complex, but minimization measures and biocontrol strategies have reduced the attractive nuisance posed by this aquaculture facility, thus reducing the number of birds attracted to this facility.

<u>Mammalian Survey</u>:
With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinerus semotus*), or ʻōpeʻapeʻa, as it is known locally, all terrestrial mammals currently found on the island of Hawaiʻi are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation or scat, tracks, and other animals sign.

Six terrestrial mammalian species were detected during the course of these surveys. Several European house mice (*Mus musculus domesticus*) were seen within the landscaped terminal area. Tracks, sign and scat of feral goats (*Capra h. hircus*) were seen at numerous locations within the study site (goat usage appears to be focused around areas that are planted and/or there is irrigation, especially along Pāoʻo Street). Several small Indian mongooses (*Herpestes a. auropunctatus*) were seen within the site, including carcasses of two that were likely killed by vehicles along the airport entrance road. Three cats (*Felis catus*) were seen in and around the developed terminal and infrastructure areas. Sign, scat and tracks were encountered within more remote locations as well. Dogs (*Canis f. familiaris*) were heard barking from within the NELHA facilities located to the west of the airport boundaries. Scat, tracks and sign were also encountered at other locations within the study site. Tracks and scat of donkeys (*Equus a. asinus*) were also encountered at several locations along Pāoʻo Street.

Although only European house mice were detected, it is likely that the other three established alien *muridae* found on Hawai‘i, roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), and possibly Polynesian rats (*Rattus exulans hawaiiensis)* use resources found within the site on a seasonal basis.

No Hawaiian hoary bats were detected during the course of the survey. Hawaiian hoary bats are widely distributed along the Kona coast and are present in most areas that still have trees and dense shrubs. There is very little suitable roosting habitat for this foliage roosting species within or close to KOA.

No terrestrial mammalian species were detected during the course of this survey. Thus, no listed or proposed threatened or endangered mammalian species under either the Federal or State endangered species statutes were detected during the survey.

Impacts and Mitigation Measures

As there is no federally delineated Critical Habitat present on or adjacent to the study site, the proposed improvements will not result in impacts to federally designated Critical Habitat.

No significant impacts on fauna within the project site are anticipated from the construction and operation of the proposed project.

The proposed improvements may increase the threat that birds will be downed after becoming disoriented by lights associated with the improvements during the nesting season. The two main areas that additional outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction activities, and 2) following build-out, the potential operation of streetlights, security, and/or facility lighting during the seabird nesting season.

To mitigate impacts to seabirds, it was recommended that if nighttime construction activity or equipment maintenance is proposed during the construction phase of the improvements, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground. Following build-out, it was recommended that any new streetlights, security, and/or facility lighting be shielded. This minimization measure would serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels and Newell’s Shearwaters, while at the same time complying with the Hawaii County Code §14-50 et seq. which requires the shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting to the astronomical observatories located on Mauna Kea. In addition, it was also recommended that, where appropriate and practical, native plant species be used in landscape efforts.

3.5.3 Historic and Archaeological Resources

An Archaeological Literature Review and Field Inspection for the project site was conducted by Cultural Surveys Hawai'i, Inc. in April 2012. The Archaeological Literature Review and Field Inspection report is included in Appendix C and is summarized below.

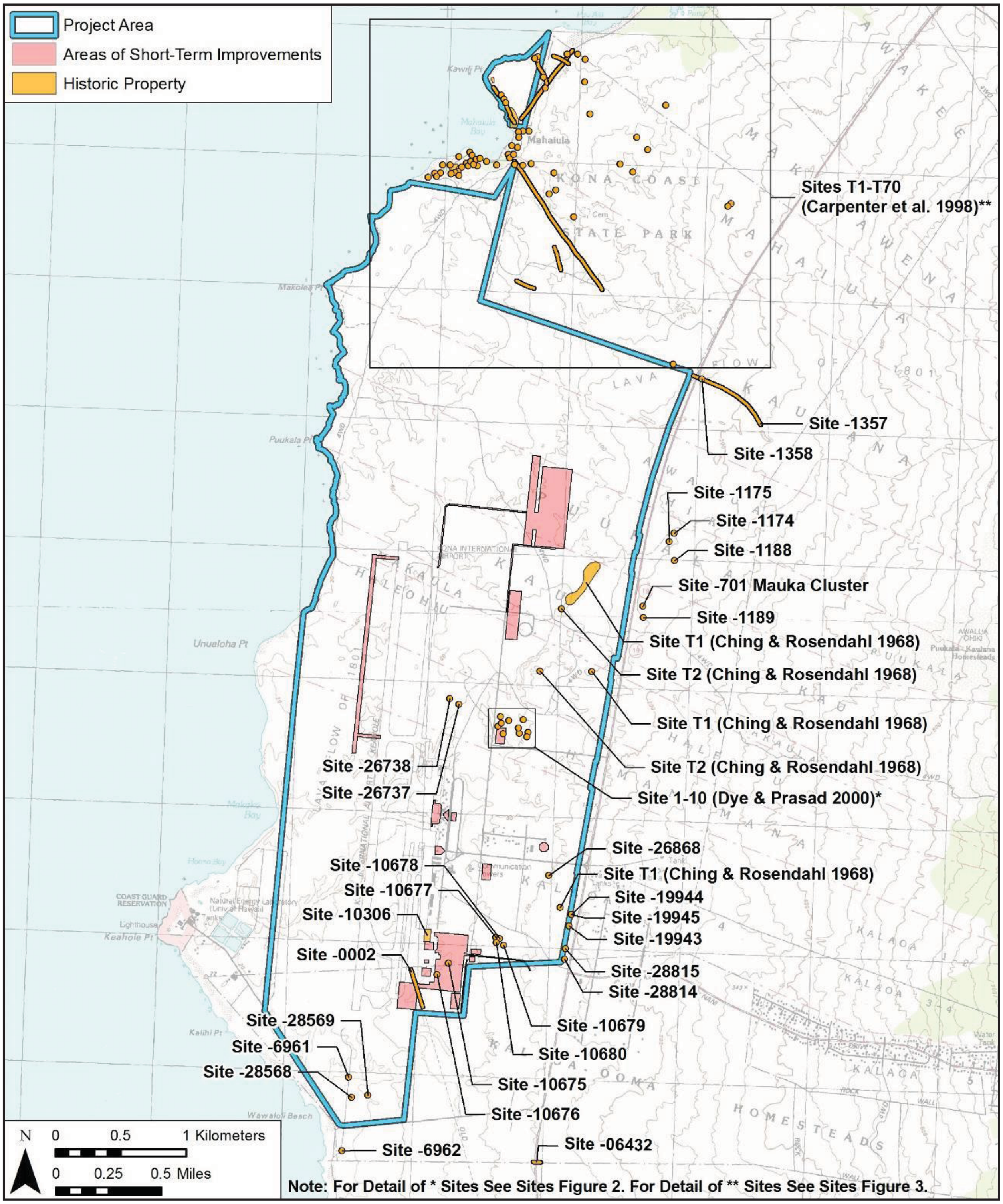
Numerous archaeological studies have been conducted at and in the vicinity of KOA. Historic properties previously recorded within the project area lie almost entirely within the Intermediate Zone (beginning at approximately 300 meters inland). This means that the concentrated site areas representing coastal settlements and activity areas fall outside, but adjacent to the current study area; the density of sites in the project area is lower.

The vast majority of the historic properties previously documented on airport property are not located within or immediately adjacent to the short-term improvement areas. These include a portion of the well-known Māmalahoa Trail (SIHP 00002) and some actively preserved sites including a petroglyph field (SIHP 00500) and a segment of stepping stone trail (SIHP 26737), among others. Other previously-identified sites have been documented to their maximum potential and have subsequently been impacted by development at the airport. Figure 3-6 depicts the locations of the previously-identified sites relative to the proposed improvements.

Out of all the sites recorded, only five previously-documented sites overlap a present improvement project (DOA Inspection Facility, Site "A"). All five of these sites, for which State site numbers could not be found, were at least cursorily recorded in 2000. Only one of these sites, temporary site number 1, was documented thoroughly. A recommendation of no further work was made for this site. The four nearby features are similar in nature, but appear to have not yet been completely documented.

The majority of sites that have been documented within the airport property are typical of their locations within the Intermediate Zone. These sites consist of temporary habitations or shelters (often modified outcroppings or lava tubes), midden scatters, pāhoehoe excavations, trails, mounds, and other features associated with the types of activities. Examples of both pre-Contact and historic era sites have been documented, and some sites show evidence of use throughout multiple time periods. Furthermore, a survey of Kekaha Kai State Park to the north documented numerous features within the Coastal Zone at the disconnected Kawili Point portion of the airport property. These features reflect the habitation and ocean-resource exploitation activities known to occur within this zone throughout pre-Contact and historic times.

A synthesis of known land-use patterns, geological lava flow data, an account of the extent of construction-related disturbance to date, and results of previous archaeological studies provides a basis for estimating the likelihood for encountering historic properties throughout the project area. Figure 3-7 represents a synthesis of this data. This map classifies the likelihood of encountering archaeological remains into three zones: low, moderate, and high. However, it should be noted that the zones depicted are approximations only and future improvements on airport property should be evaluated on a case-by-case basis.



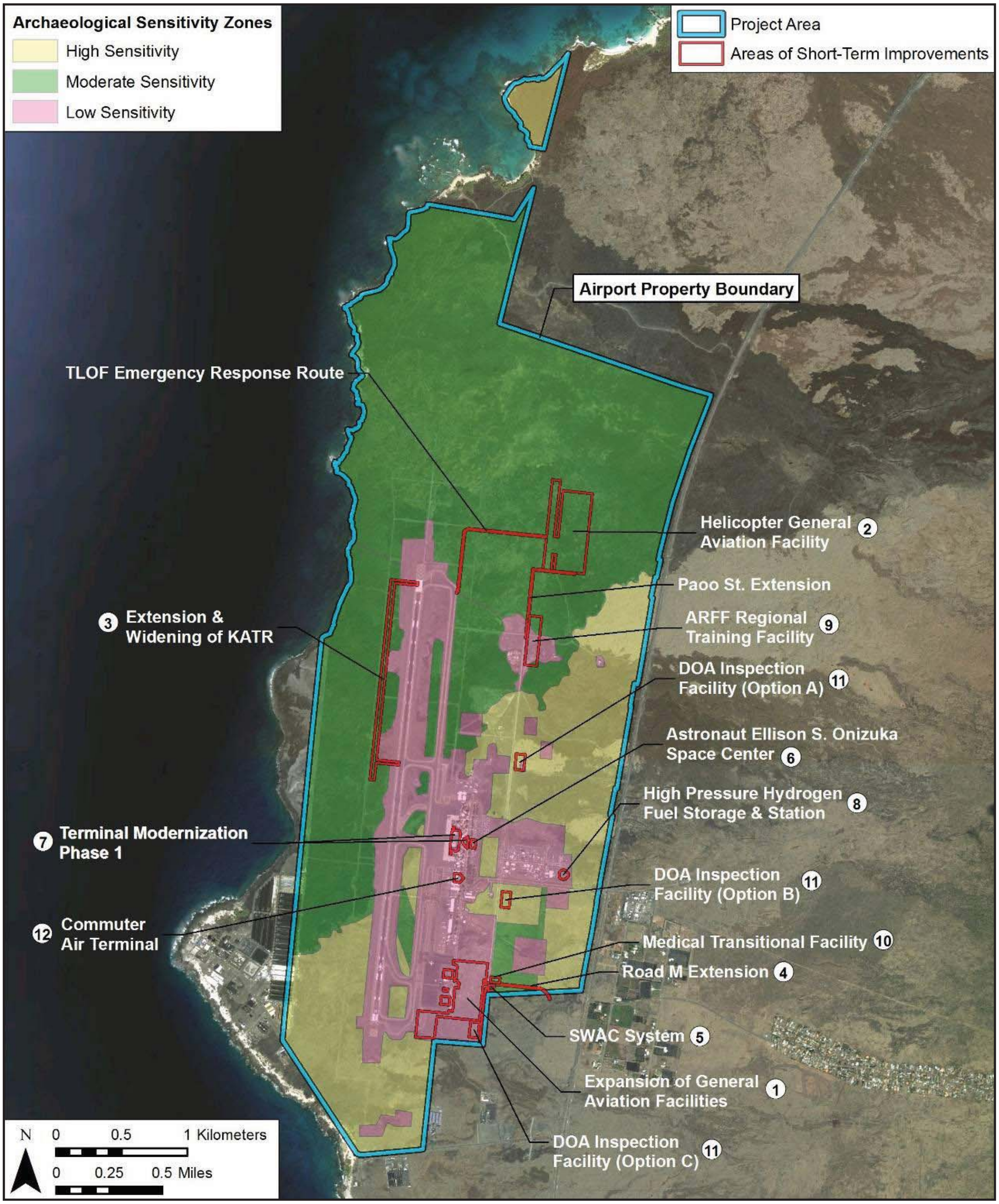
Source: Cultural Surveys Hawai'i, 2012

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

PREVIOUSLY RECORDED HISTORIC SITES IN PROJECT VICINITY

FIGURE 3-6



Source: Cultural Surveys Hawai'i, 2012

WILSON OKAMOTO CORPORATION
ENGINEERS ● PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

APPROXIMATED ZONES OF ARCHAEOLOGICAL SENSITIVITY

FIGURE 3-7

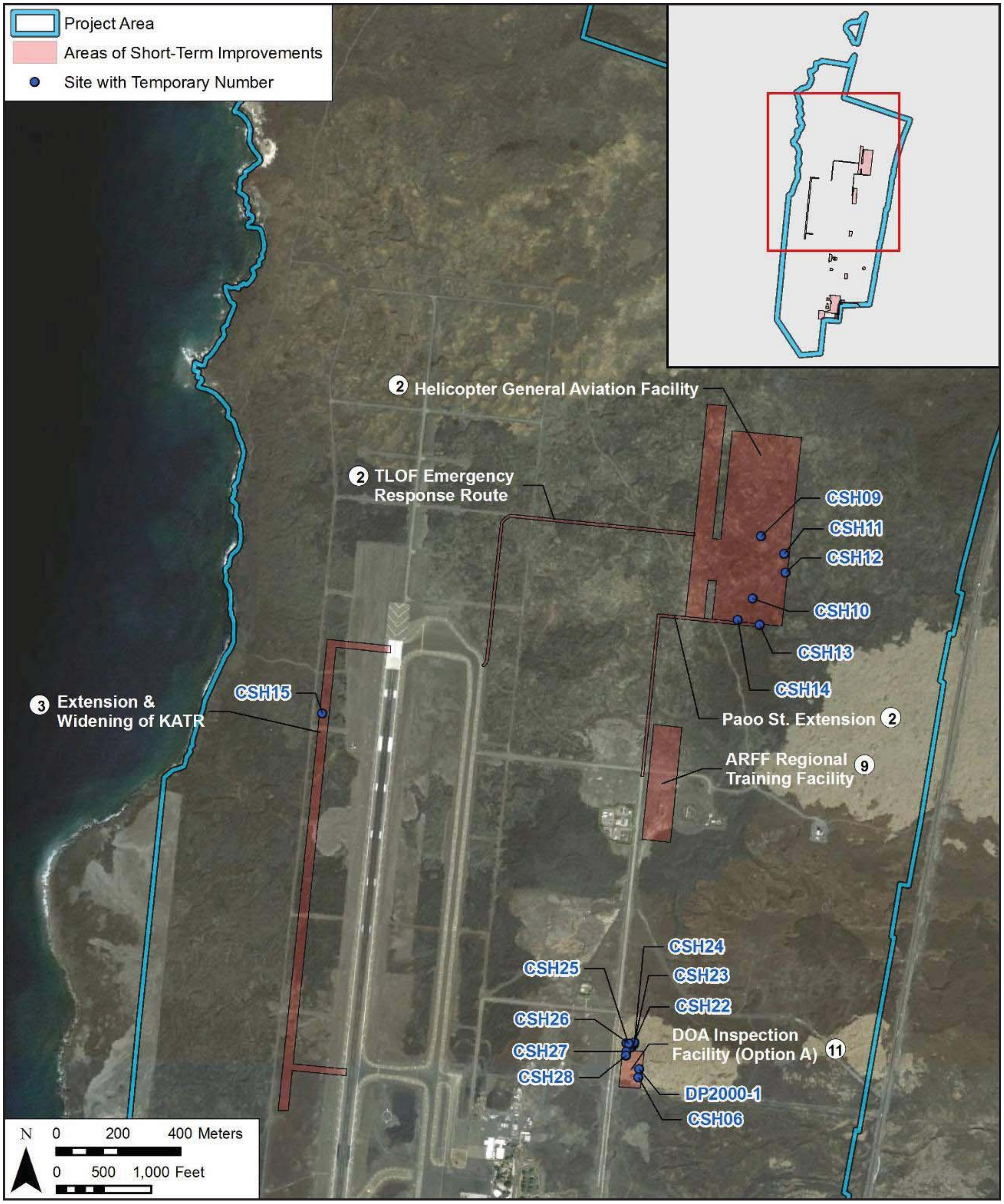
As Figure 3-7 shows, the potential for archaeological remains in undisturbed areas throughout the property is generally moderate to high. The areas of highest concern are those undeveloped portions of the property that are situated on older lava flows that have not been mitigated by recent archaeological study. In general, historic properties have been recorded in nearly every inventory survey conducted at the airport on the older flows. Within these portions of the property undisturbed by the 1801 lava flow and modern development, the types of site that might be encountered include: temporary or recurrent habitations (characterized by surface structures or modified outcrops or lava tubes); limited agricultural activity areas including pāhoehoe excavations and minimal soil enclosures; mauka-makai trails connecting coastal residences and upland agricultural areas, with branch trails extending to specific use areas within the project area lands; petroglyphs; and burial sites utilizing features of the terrain, including lava tubes and cracks. Sites that may be encountered along the coast in the northern portion of the project area include: permanent or temporary habitations and associated activity areas; lateral and/or mauka-makai trails; modified anchialine ponds; storage and agricultural pits; petroglyphs; salt manufacturing areas; religious structures such as heiau or koʻa (fishing shrines); burial sites, and historic-era structures, roads/trails, etc.

Zones of moderate sensitivity are of less concern, though these also represent potential site areas. Zones of moderate sensitivity include the undeveloped portions of the property underlain by the 1801 lava flow, and areas at the airport situated off of the 1801 flow, but that have been mitigated by older archaeological studies (typically those completed more than 15-20 years ago). Historic-era sites can be expected on the 1801 lava flow, and on more than one occasion pre-Contact sites have been found in kīpuka in this flow. Sites that have been found within kīpuka include pre-Contact trail segments, mounds, modified outcrops, enclosures and other structures. Portions of the property off of the 1801 flow that were covered by older archaeological studies tend to be grouped into this zone due to inaccuracies in reporting, obsolete methodologies, and/or lack of known mitigation. The zones of lowest archaeological sensitivity essentially fall within developed or heavily disturbed portions of the property. Some of these areas can be seen on aerial photographs, and others were documented during the present field inspection. Also included in this group are areas that have been subjected to relatively recent archaeological study (generally completed within the last 15 years), as the sites within these study areas have been mitigated.

Fieldwork for the proposed improvements was conducted in March 2012. A pedestrian survey was conducted at each individual improvement area. Below is a summary of findings at each of the improvement areas and is depicted in Figures 3-8 and 3-9:

<u>General Aviation Apron Expansion</u>: Though surrounded by undeveloped lands to the north, east and south, all of the areas covered by the proposed General Aviation Apron Expansion are presently disturbed. These areas have been completely graded and some portions are paved. They are currently being used for general aviation activities, parking, and storage. As a result, no historic properties are present within this improvement area.

W:\8027-03\Planning\Graphics\Working



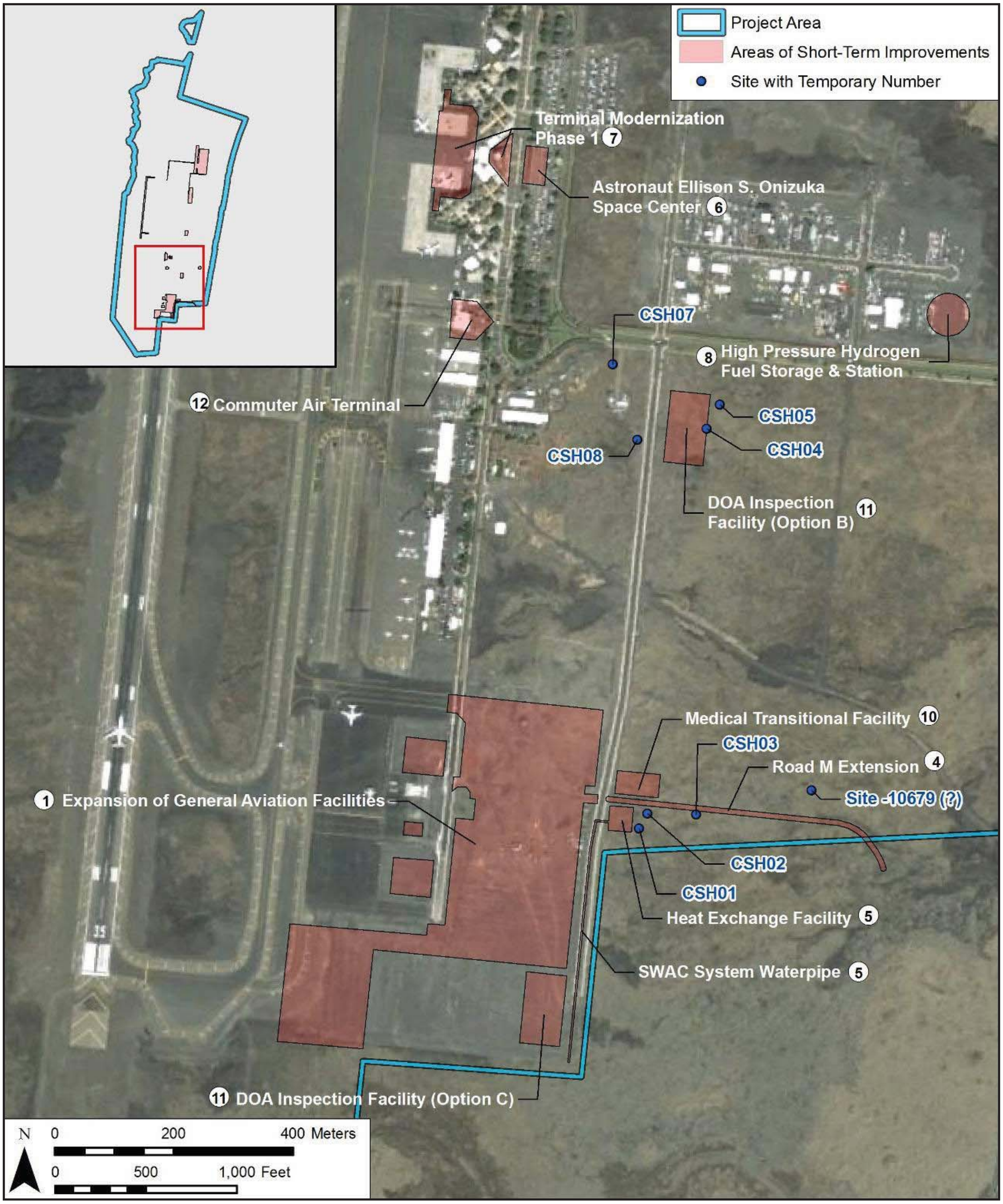
Source: Cultural Surveys Hawai'i, 2012

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

ARCHAEOLOGICAL FEATURES IN PROJECT VICINITY

FIGURE 3-8



Source: Cultural Surveys Hawaiʻi, 2012

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

ARCHAEOLOGICAL FEATURES IN PROJECT VICINITY

FIGURE 3-9

Helicopter General Aviation Facility: This area is situated completely on the 1801 lava flow. During the inspection of the General Aviation area, six modified areas were encountered (CSH 09 through CSH 14). CSH 09 represents a cairn or ahu comprised of four upright pāhoehoe slabs. No associated pit or "quarry" was identified near this feature, which has been constructed in a somewhat unusual manner by leaning the slabs against one another. However, these slabs were likely quarried in the general vicinity, as evidenced by the presence of features CSH 10 through CSH 14. These five features appear to be pāhoehoe slab quarry areas. The excavations are generally quite shallow, and of variable length and width. At some of the features, none of the slab material is present; elsewhere, it has been stacked along the side of the quarry feature; and at others, a few overturned slabs are present. These features are somewhat atypical of the ubiquitous pre-Contact pāhoehoe excavations that are found throughout this region. Traditional excavation features have been found during past studies on the older lava flow areas at and in the vicinity of the airport. Usually, traditional pāhoehoe excavations have been created along blisters or other places in the lava flow with hollow areas underneath. Often the excavated materials are more blocky than slab-like and tend to be scattered around the pit feature haphazardly. Given the location of CSH 09 through CSH 14 on the historic 1801 flow, these features cannot be pre-Contact in nature. The manner of excavation that they exhibit (i.e. shallow with little to no hollow areas exposed, no soil presence, excavated material typically stacked or removed) point to a more modern nature. It is a common modern practice throughout this area of Kona to quarry pāhoehoe slabs for use in landscaping and construction projects. Further support of this interpretation is the relative ease of access to these features via the jeep trail crossing this improvement area, and the presence of modern trash scattered throughout. Further study of these features may help to determine whether or not they are of historic or modern age. No kīpuka or other features were encountered within this improvement area.

KATR Extension and Expansion: Numerous areas of construction-related disturbance are present, including short, gravel roadways connecting the perimeter road to the runway and large graded areas directly adjacent to the runway. The southern end of the proposed KATR (approximately 500 feet) has been graded flat. One site, CSH 15, was discovered in a crevice during the inspection of the northern end of the proposed KATR. This site represents a midden scatter that includes such readily identifiable marine species as ‘opihi or limpet (Cellana spp.), cowrie (Cypraea spp.), and drupa or pūpū (Drupa spp.). While this deposit may be related to past construction activity in the vicinity, the more traditional variety of species present (as opposed to the presence of, say, just ‘opihi), lend to an interpretation of an older date. The deposit is located on the 1801 lava flow and therefore cannot be pre-Contact in age, but it may be historic. The coastline is only several hundred meters to the west of the existing perimeter road.

Construction of a new road, Road M: The portion of the proposed Road M corridor within the airport property was inspected in its entirety. The corridor begins directly mauka of the existing paved Road N, and passes between the proposed Medical Transitional Facility and Heat Exchanger Site. The areas closest to Road N shows signs of disturbance, likely related to the construction of that road. The remainder of this improvement area consists of undulating 1,500 to 3,000 year-old lava flow supporting grasses and scattered shrubs and trees. Two features were identified outside of but immediately adjacent to the corridor (CSH 02 and CSH 03), both along its eastern half. CSH 02 is a single pāhoehoe excavation located just northeast of the proposed Heat Exchanger Site. The excavated pit exploits a natural fissure in the lava flow, and is approximately one meter long. Excavated materials have been placed around the feature. CSH 03 consists of a circular alignment similar to those identified by Dye and Prasad (2000) further north along Road N. Furthermore, the large cave system (SIHP 10679) initially documented by Barrera (1987b) was observed from this corridor. Despite fairly thorough coverage of the corridor presently and during past studies, there is a potential for additional historic properties within this improvement area.

SWAC System: The Heat Exchanger site has been disturbed somewhat along its makai edge adjacent to Road N. However, the majority of this area is undisturbed 1,500 to 3,000 year-old lava flow. CSH 02 and a complex consisting of at least four pāhoehoe excavations were identified just beyond the eastern boundary of the Heat Exchanger site (CSH 01). These pits are of variable size and at each feature a substantial amount of extracted rock material has been placed nearby on the surface. Despite fairly thorough coverage of this site presently and during past studies, there is a potential for additional features of this type within this improvement area.

Relocation of the Astronaut Ellison S. Onizuka Space Center: The proposed new location for the Onizuka Space Center falls within the main airport parking area, comprising approximately one-half acre in the vicinity of the old rental car facilities. No historic properties are present within this developed area.

Terminal Modernization (Phase I): The expansion areas overlap roughly three acres of existing airport facilities, including the present site of the Onizuka Space Center. No historic properties are present within these developed areas.

High Pressure Hydrogen Fuel Storage and Fueling Station: The proposed High Pressure Hydrogen Fuel Storage and Fueling Station is situated on approximately one acre in a completely graded area presently used by the rental car facilities for parking. Between this area and the Queen Ka‘ahumanu Highway is undisturbed 1,500 to 3,000 year-old pāhoehoe flow. Given the level of disturbance, no features archaeological features were observed at this location, though there is a good potential for features immediately to the east, including a portion of a trail.

ARFF Regional Training Facility: Roughly three-quarters of the portion of this improvement area south of Hāpu‘upu‘u Street has been completely graded, though a small section of undisturbed lava flow is present at the far southeastern corner. Debris associated with burn activities were noted within this half of the improvement area, and a strong odor of creosote was noted. The portion of the site north of Hāpu‘upu‘u Street is largely undisturbed. To the east there is an existing fenced fire rescue training facility and the western-most portion of the fence line extends into the project area. This area also may be presently used as a sort of firing range, as evidenced by scattered clay and glass fragments and spent ammunition. A thorough inspection of this improvement area resulted in no findings.

Medical Transitional Facility: The portion of this site closest to Road M has been disturbed, although the majority is undisturbed 1,500 to 3,000 year-old flow. No archaeological features were identified during the inspection of this improvement area.

<u>DOA Temporary Inspection Facility</u>:

<u>Site "A"</u>: The portion of this site adjacent to Road N has been disturbed and a gravel road (Road P) defines the southern boundary. This undulating lava flow area supports a substantial amount of vegetation (mostly grasses), and a large outcrop dominates the southeastern corner of the site. An earlier study done in 2000 documented a single feature within the present bounds of DOA Site "A", and also documented an adjacent handful of similar features that fell outside the 2000 study area. These features were temporarily numbered 1 through 5, and all consisted of circular alignments. During the present inspection, feature 1 was relocated. Additionally, a total of seven similar features were presently encountered further north in the vicinity of the features 2 through 5 cluster. While blue flagging tape remnants were noted at a couple of these features, no permanent site tags or other identifiers were present. Given that more features were noted in this area during the current inspection than under the earlier study, and given that the four alignments noted here by Dye and Prasad (2000) were not described or photographed, it has proven impossible to precisely correlate those four features identified during both studies. Therefore, these features have all been assigned temporary CSH numbers. Two of these, (CSH 27 and CSH 28; Figure 82 and Figure 83, respectively) appear to lie within the bounds of DOA Site "A", while the remaining five are located just north. Furthermore, a pāhoehoe excavation (CSH 06, Figure 84) was noted along an outcrop in the southeast corner of the site, in proximity to the circular alignment (feature 1).

<u>Site "B"</u>: The westernmost portion of this site has been heavily disturbed, particularly at the southwest corner, where a dozer road cuts through the site and dozer scarring is evident across the ridge directly adjacent to the road. CSH 08 is situated on this same ridge across Road N to the west. The undisturbed inner and eastern portions of this site consist of somewhat rough to extremely smooth 1,500 to 3,000 year-old pāhoehoe flow. One archaeological feature complex (CSH 04) was encountered along the eastern boundary of DOA Site "B", and another (CSH 05) is situated just outside to the east. CSH 04 is a complex consisting of at least three pāhoehoe excavations of variable size extending mauka from the site boundary. CSH 05 includes several distinct features located along the west side of a portion of an outcrop or ridge measuring approximately 40-meters (m) long north-south and 15-m wide east-west. This ridge creates a natural windbreak, and several small overhangs are present. Midden is scattered throughout the entire complex area; at least five distinct species were noted. At the base of the ridge, pāhoehoe excavations and a small constructed pit are present. A single Hawaiian oyster shell was found nearby to the west.

<u>Site "C"</u>: Site "C" is situated along the southern boundary of the airport property in the completely disturbed area at which the General Aviation Apron Expansion has been proposed. The extensive disturbance has destroyed any archaeological features that may have once been present here, though some features may be present just outside of the airport property to the south and east on the undisturbed 1,500-3,000 year-old lava flow.

<u>Impacts and Mitigation Measures</u>

A significant portion of the project area has been disturbed by airport-related development. Any sites once present in these areas have been obliterated. Mitigation has been undertaken for some of these sites, particularly those identified during more recent studies. Few features were identified on the 1801 lava flow areas, however these features are all of indeterminate age. A greater potential for the presence of sites on the older, intact flows was evidenced by the discovery of numerous archaeological features in the improvement areas situated in these sections of the property. These features include pāhoehoe excavations, alignments, enclosures, midden scatters, modified outcrops and overhangs, and a constructed pit, all of which can be related to transitory land use as practiced (both historically and prehistorically) in the Intermediate Zone. The substantial presence of a wide array of features at Kawili Point supports the traditional pattern of coastal settlement.

Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Apron Expansion; the Relocated Onizuka Space Center the terminal modernization phase I; the High Pressure Hydrogen Fuel Storage and Fuel Station; and the DOA Inspection Facility Site “C”. A lack of findings during 100 percent coverage of the proposed ARFF Regional Training Facility, which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location.

As the proposed Road M route traverses over older lava flow areas that are more likely to contain archaeological features, it is recommended that this route be studied further. In addition, as both DOA Inspection Facility Sites “A” and “B” are situated on the same flows, should either of these DOA sites be selected, it is recommended that the selected site be studied further as well. While the Road M route has been subjected to past archaeological survey, features were found immediately adjacent to the corridor that were not documented during that survey; depending on the finalized APE of the corridor, these features may be impacted by construction, and additional features might be present. No further work is recommended for the Medical Transitional Facility (Improvement Area 11), as thorough coverage of this site yielded no finds. The Helicopter General Aviation facility (Improvement Area 2) and Kona Auxiliary Training Runway (Improvement Area 3) are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection in these improvement areas. Inventory survey is recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC/AC Chilled Water Line represents a somewhat complex situation, given the inclusion of the Heat Exchanger Site, and that the water line route has not been finalized. While the APE of this improvement area presently includes all of its component parts, approaching these components separately may require less archaeological study in the future. The presently proposed Heat Exchanger Site will require archaeological inventory, due to the discovery of previously-undocumented features in the immediate vicinity. According to the client, the location of this facility is not subject to change. The recommendations given here for the water lines are based on the routes shown on the project site plan. It is recommended that the water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U‘u Street to the north of the General Aviation Apron Expansion area, inventory survey will be necessary. If the currently-depicted route is chosen, further survey will only be necessary if the water line footprint extends beyond previously-disturbed roadways or road shoulders.

Table 3-1 summarizes the recommendations for each of the proposed short-term improvement areas. Based on the results of the archaeological inspection of the various proposed locations for the DOA Inspection Facility (Improvement Area 12), Site “C” is recommended for development based on its situation in an area of prior disturbance and lack of potential to impact historic properties.

The APE of the federally-funded improvement areas are not fluid, or subject to change. However, CSH has been informed that the APEs of the other eight proposed improvements are still considered to be somewhat fluid. The specific recommendations given for these improvement areas are only applicable to the locations that were currently inspected; if the APEs of these improvement areas do indeed change, further evaluation will be necessary. The overall archaeological predictive as shown in Figure 3-7 would be useful for planning in this circumstance.

However, should any significant pre-Contact or historic deposits (i.e. subsurface concentrations of indigenous or historic era artifacts and/or structural remnants) or human burials be encountered during the course of development of the project site, the subsurface excavation work and/or surface grading will be halted in the immediate area and the SHPD will be notified immediately.

3.5.4 Cultural Resources

To serve as a reference for future master planning at KOA and to address current and future requirements under Chapter 6E, HRS (State of Hawai‘i Historic Preservation Law) and Section 106 of the National Historic Preservation Act of 1966, DOT-A commissioned a Cultural Impact Assessment (CIA) for the entire airport property to be prepared by Cultural Surveys Hawai‘i, Inc. The study area for the CIA includes ten ahupua‘a: ‘O‘oma, Kalaoa, Hamanamana, Haleohiu, Maka‘ula, Ka‘ū, Pu‘ukala, Awalua, Kaulana, and Mahai‘ula. Consultation efforts for the CIA will include contacting Native Hawaiian organizations, agencies, and community members to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and the vicinity. As of July 2012, CSH has attempted to contact 34 community members, including government agencies or community organization representatives and individuals such as residents, cultural and lineal descendants, and cultural practitioners. From those 34, 13 people have responded and 5 kūpuna (elders) and/or kama‘āina (native-born) were interviewed for more in-depth contributions to the CIA. Below is a summary of the work done to date:

Through background research and community consultation participant interviews, it appears that, prior to the 1801 lava flow, the area around Keāhole Point was a lusher environment

Table 3-1
Summary of Project Recommendations for the Proposed Improvement Areas

Short-Term Improvement Area	Geology	Extent of Prior Disturbance	Archaeological Features Present	Further Work Recommended
1. General Aviation Expansion	N/A	Entire Area	No	None
2. Helicopter General Aviation	1801 flow	Minimal	Yes	Inventory Survey
3. KATR	1801 flow	Approximately 20% of Area	Yes	Inventory Survey
4. Road M	1,500 - 3,000 BP flow	Very Minimal	Immediately Adjacent	Inventory Survey
5. SWAC System	1,500 - 3,000 BP flow	Variable	Yes	Inventory Survey for Heat Exchanger Site, and Potentially for the Water Line
6. Relocation of the Onizuka Space Center	N/A	Entire Area	No	None
7. Terminal Area Modernization Phase I	N/A	Entire Area	No	None
8. High Pressure Hydrogen Fuel and Fueling Station	N/A	Entire Area	No	None
10. ARFF Regional Training Facility	1801 flow	At Least 50% of Area	No	None
11. Medical Transitional Facility	1,500 - 3,000 BP flow	Minimal	No	None
12. DOA Inspection Facility Site "A"	3,000- 5,000 BP flow	None	Yes	Inventory Survey
DOA Inspection Facility Site "B"	1,500 - 3,000 BP flow	Minimal	Yes	Inventory Survey
DOA Inspection Facility Site "C"	N/A	Entire Area	No	None

that was more heavily cultivated than it is today, with crops such as breadfruit, fruit trees, and vegetables. However, it was the access to and use of coastal resources that appear to be of primary importance.

Participants recall collecting water from anchialine ponds and wells, diving for fresh water fish in the ocean, and extracting water from the leaves of various limu (seaweed). Several of the participants grew up in a fishing village made up of several families in Makalawena. The village was located along the northern boundary of the Project area. They also recall people living along Mahaiʻula Bay. The shoreline and waters of the Project area are described as prime fishing grounds for the people of Kona, especially for catching ʻōpelu, spear-fishing for a variety of other fish, and for picking ʻopihi. Participants noted that they often gathered koele (large, tough ʻopihi) from boulders along the shoreline adjacent to the runway at KOA. In addition, they also gathered limu and collected salt. Salt was used to dry fish for the winter season when the ocean was rough. Salt gathering is still practiced, but it is not as common as before.

Participants recall that the area was once rich in ōpaeʻula (native shrimp) ponds. The ōpaeʻula were used as live fishing bait to catch ʻōpelu, which was a fishing method unique to the area north of Kaiwi Point. However, the ponds were also important for other reasons. They were a source of fresh water, served as "ice-boxes" where containers of water and food were stored to keep them cool and fresh, and fisherman also filled the ponds with live fish to access when the ocean as rough. In addition, the ponds were used in the drying process of ʻōpelu to rinse and remove the salt from the fish, prior to drying.

One participant shared a moʻolelo (story) about a large fishpond, presumably in the location of the current airport. Though she could not recall the name of the pond, it is likely the Fishpond of Paʻaiea, which was for the king and queen. Paʻaiea Fishpond, the largest fishpond on Hawaiʻi Island, was thought to have been three miles long and a mile and a half wide, situated in the general location of KOA. According to historic accounts, the fishpond extended from Kaʻelehuluhulu, adjoining the little fishing hamlet of Mahaiʻula in the north, and as for south as Wawaloli on the boundary of ʻOʻoma, suggesting that the fishpond spanned the entire ten ahupuaʻa of the Project area. The fishpond was used as a shortcut by fishermen traveling to Kailua and further south on their canoes, to avoid the powerful currents at Keāhole. The fishpond was destroyed and completely covered by the 1801 lava flow. It was said that the lava flow, which occurred on the fourth year of King Kamehameha I's reign, was the Goddess Pele's wrath for being denied fish and bait by the Konohiki (headman) of the fishpond.

Trail networks were important to the Hawaiian social and economic system in both pre- and post-Contact eras, serving as major routes for land units and social groups and as internal networks for transportation and communication within an ahupuaʻa. Mauka to makai trails facilitated the gathering and exchange of food and goods between coastal fishing villages with upland settlements. Participants described a mauka-makai trail that ran from Kalaoa mauka through the ahupuaʻa of Kalaoa to Wawaloli Beach and then to Keāhole Point. Another mauka-makai trail ran though the ahupuaʻa of Kaʻū to the shoreline, crossing the current runway location of the airport. A coastal road connected this trail to Mahaiʻula and Makalawena.

Native Hawaiians believe that iwi (bones) of the dead are the most cherished possession because they contain a person's mana (divine power). Kamaʻāina of Kekaha believe that burials may be present throughout the study area. Participants mentioned that there was a cemetery where family members were buried in Makalawena, but it is located north and outside of the project area.

Huʻehuʻe Ranch covered a large area of Kekaha, including the Project area. One participant states that the ranch was very important because it allowed its workers to farm on the land, fish, and hunt. Another participant stated that the area where the airport property lies was covered in lava where cattle roamed, but by 1970, all the cattle was roped and removed when the Queen Kaʻahumanu Highway to Kohala was built.

Impacts and Mitigation Measures

In the short- and long-term, no significant impacts to cultural resources are anticipated as a result of the construction and operation of the proposed improvements. As the proposed improvements are located on the existing airport property and are on the mauka side of the runway, with the exception of the KATR widening and expansion, the improvements are not anticipated to affect any cultural practices and/or resources in the project vicinity. Since there is currently no existing general public access to the shoreline through the airport due to aviation safety requirements, none of the proposed improvements, including the KATR widening and expansion, will further impede such access. The nearest public shoreline access is located at the Kekaha Kai State Park, north of KOA.

3.6 Air Quality

An Air Quality Study was conducted for the proposed project by B.D. Neal & Associates in April 2012. The study examines the potential short- and long-term air quality impacts that could occur as a result of the construction and operations of the proposed projects and improvements. The study is included in Appendix D and is summarized below.

Ambient concentrations of air pollution are regulated by both National and State ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaiʻi AAQS are defined in Chapter 11-59, HAR. National and State AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead. The State has also set a standard for hydrogen sulfide. Hawaiʻi air quality standards are comparable to the National standards, although in some cases the Hawaiʻi standards are more stringent than the National standards, such as for carbon monoxide. For some other parameters, such as for particulate matter and sulfur dioxide, the National standards are more restrictive.

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural resources. Based on previous emissions inventories that have been reported for Hawaiʻi, emissions of particulate matter and nitrogen oxides may have increased during the past several years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons have most likely declined.

It should be noted that the island of Hawaiʻi is unique from the other islands in the State in terms of the natural volcanic pollution emissions that occur. Volcanic emissions periodically plague the project area. This is especially so since the latest eruption phase of Kīlauea Volcano began in 1983. Air pollution emissions from the Hawaiian volcanoes consist primarily of sulfur dioxide. Although emissions from Kīlauea are vented on the other side of a mountain barrier more than 50-miles east of the project site, the prevailing wind patterns eventually carry some of the emissions into the Kona area. These emissions can be seen in the form of volcanic haze (vog) which persistently hangs over the area.

The project area has relatively few major sources of air pollution. KOA itself is likely one of the more significant sources. Aircraft operations, fuel storage and fueling operations, ground support equipment, motor vehicle traffic and other activities result in emissions of carbon monoxide, nitrogen oxides, sulfur oxides, hydrocarbons, particulate matter and other air pollutants.

A major industrial source of air pollution in the project vicinity is Hawaiʻi Electric Light Company's (HELCO) Keāhole Power Pant, which is located immediately east of KOA. Air pollution emissions from the power plant consist mostly of sulfur dioxide and oxides of nitrogen.

The project site is situated along Queen Kaʻahumanu Highway on the makai side. This highway is a regional arterial roadway that often carries substantial volume of traffic. Winds may sometimes carry emissions from motor vehicles traversing these roadways toward the project site.

The DOH operates a network of air quality monitoring stations at various locations around the State. Unfortunately, very limited data is available for the island of Hawaiʻi and even less data is available for the Kona area specifically. During the most recent 5-year period (2006-2010), DOH operated an air quality monitoring site in the Kealakekua area for measuring sulfur dioxide. Particulate matter (PM 2.5) was also monitored at this site, but monitoring for this parameter only began in 2008.

Measurements of sulfur dioxide concentrations at this location during the 2006-2010 monitoring period were consistently low with annual average concentrations of 0.004 to 0.009 ppm, which represents about 30 percent of the State and National standard. The highest annual second-highest 3-hour and 24-hour concentrations for these five years were 0.112 and 0.042 ppm, respectively; these are about 22 to 30 percent of the applicable standards. No exceedances of the State/National 3-hour and 24-hour AAQS for sulfur dioxide were recorded.

The annual average particulate matter (PM 2.5) concentrations for these years 2008 through 2010 ranged form 16 to 21 $\mu g/m^3$. These values exceed the National annual standard which is set at 15 $\mu g/m^3$. The 98th percentile 24-hour concentration was reported at 37 $\mu g/m^3$ for 2008 and 2009 and at 35 $\mu g/m^3$ for 2010. These values are equal to or slightly above the National standard of 35 $\mu g/m^3$. The higher concentrations of fine particulates are primarily due to volcanic emissions.

At this time, there are no reported measurements of lead, ozone, nitrogen dioxide or carbon monoxide in the project vicinity. These are primarily motor vehicle related air pollutants. Lead, ozone and nitrogen dioxide typically are regional scale problems. However, concentrations of lead and nitrogen dioxide generally have not been found to exceed AAQS elsewhere in the State. Ozone concentrations measured at Sand Island on the island of O‘ahu are somewhat elevated, but are within State and National standards. Carbon monoxide air pollution typically is a microscale problem caused by congested motor vehicular traffic. In traffic congested areas such as urban Honolulu, carbon monoxide concentrations have been found to occasionally exceed the State AAQS.

Impacts and Mitigation Measures

Short-term direct and indirect impacts on air quality could potentially occur due to construction and operation of the proposed improvements. Short-term impacts from fugitive dust will likely occur during the construction phases. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State DOH Administrative Rules, Title 11, Chapter 60-11.1 "Air Pollution Control," requires that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with State regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing any inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also help reduce dust emissions. Monitoring dust at the project boundary during periods of construction could be considered as a means to evaluate the effectiveness of the project site at off-peak traffic hours.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions for these vehicles, a computerized air quality modeling study was conducted to estimate current ambient concentrations of carbon monoxide at roadway intersections in the project vicinity and to predict future levels with the proposed improvements. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are within both the State and National ambient air quality standards.

In the year 2022 without the proposed improvements, carbon monoxide concentrations were predicted to remain about the same or decrease slightly in the project area, and concentrations should remain within State and Federal standards. With the proposed improvements in the year 2022, carbon monoxide concentrations would remain the same or increase slightly compared to without improvements, and concentrations would remain within State and Federal standards. Implementing mitigation measures for traffic-related air quality impacts is most likely unnecessary and unwarranted.

With or without the proposed improvements, aircraft operations are expected to increase by 2022, and the associated air pollution emissions will increase proportionally. However, the proposed improvements are not expected to affect the number or type of aircraft operations. Thus, the proposed improvements should not result in an increase in air pollution emissions from aircraft operations at the airport.

The proposed Regional ARFF Training Facility will include the use of the existing burn pit as well as a fuel spill trainer, a specialized aircraft fire trainer, and a three story-burn building. While these uses may affect air quality in the area due to the burning of fuels for training exercises, their use will be relatively infrequent and would not be permitted to exceed air quality standards as set forth in the National and State AAQS.

3.7 Noise

An acoustic study for the proposed improvements was prepared in June 2012 by Y. Ebisu & Associates. The study examines the potential short- and long-term noise impacts that could occur as a result of the construction and operations of the proposed project and improvements. The study is included in Appendix E and is summarized below.

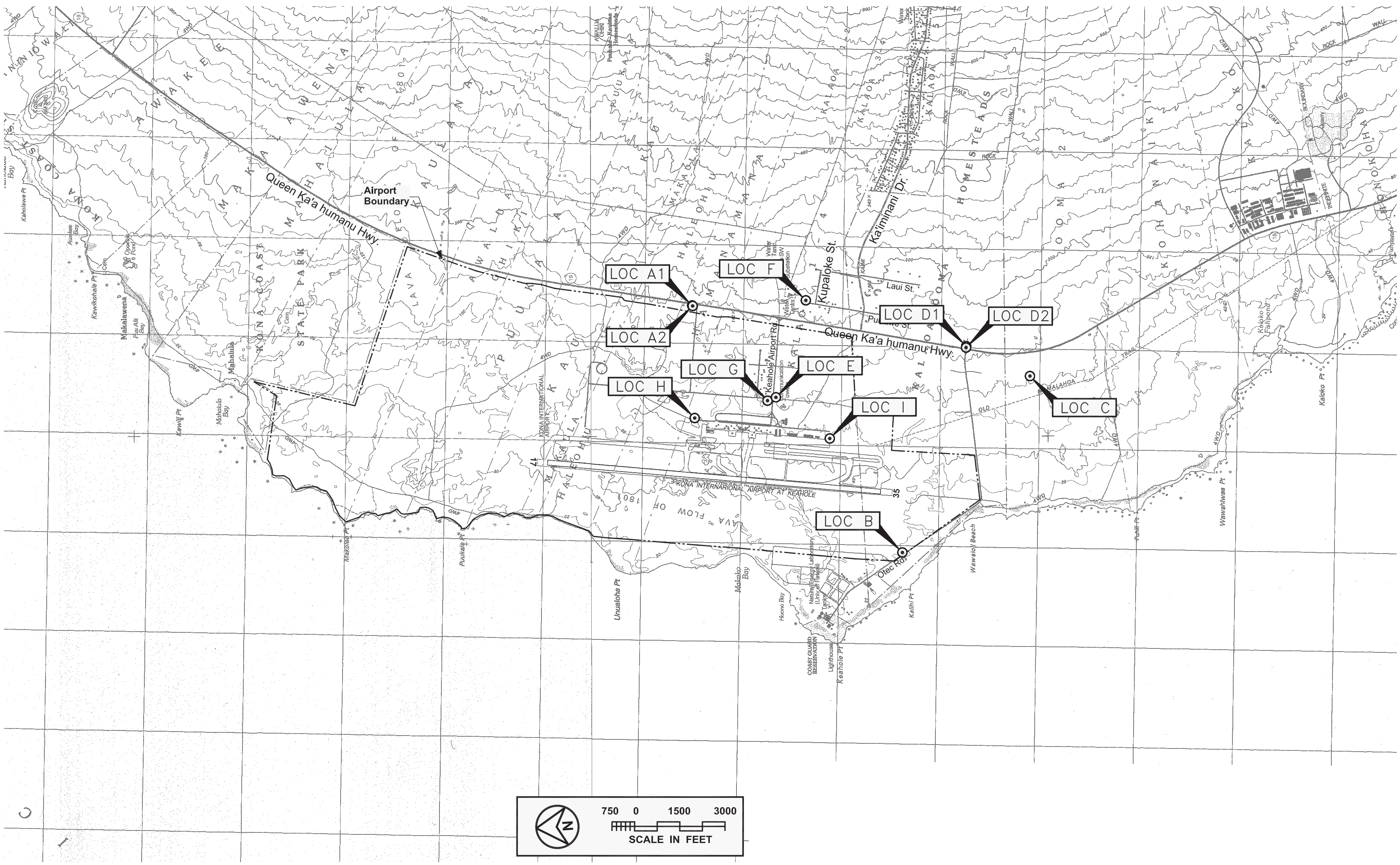
Existing traffic levels were measured at six locations in the project environs to provide a basis for calculating the traffic noise levels along the primary access roadways that service KOA: Queen Kaʻahumanu Highway and Keāhole Airport Road. Aircraft noise levels were measured at seven noise monitoring sites in the airport area (see Figure 3-10). The noise measurements were performed during April 2012.

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (DNL). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard sound level meter. The maximum A-Weighted sound level occurring while an aircraft is flying past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value." The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level," or Lse.

By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels occurring during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA.

Table 3-2 presents current federal noise standards and acceptability criteria for residential land uses. As a general rule, noise levels of 55 DNL, or less, occur in rural areas, or in areas removed from high volume roadways. In urbanized areas shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually associated with motor vehicle traffic noise. Residences fronting major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. Due to noise shielding effects from intervening structures, interior lots that are usually exposed to 3 to 10 DNL lower noise levels than the front lots that are not shielded from the traffic noise.

W:\8027-03\Planning\Graphics\Working



Source: Y. Ebisu & Associates

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

NOISE MEASUREMENT LOCATION MAP

FIGURE
3-10

TABLE 3-2
EXTERIOR NOISE EXPOSURE CLASSIFICATION
(RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL STANDARD[1]
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable[2]
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

1. Federal Housing Administration, Veterans Administration, department of Defense, and Department of Transportation.
2. FHQA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.

For the purposes of determining noise acceptability for funding assistance from federal agencies, an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration (FAA), the Department of Defense (DOD), Federal Housing Administration, Housing and Urban Development (FHA/HUD), and Veterans Administration (VA). This standard is applied nationally, including Hawai‘i.

Because of the open-living conditions in Hawai‘i, the predominant use of naturally ventilated dwellings and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. For a typical naturally ventilated structure in Hawai‘i, an exterior noise level of 55 DNL would be the limit required to achieve an interior level of approximately 45 DNL, which is considered to be the “Unconditionally Acceptable” (or “Near-Zero Risk”) level of interior noise. After considering the cost and feasibility of applying a lower exterior noise level of 55 DNL however, government agencies such as FUD/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

As a compromise for aircraft noise, DOT-A has recommended that 60 DNL be used as the common level for determining land use compatibility with respect to noise sensitive uses near its airports. Table 3-3 summarizes the recommendations for compatible land uses at various levels for aircraft noise. For those noise sensitive land uses exposed to aircraft noise greater than 55 DNL, the division recommends that disclosure of the aircraft noise levels be provided prior to any real property transactions concerning properties located within Air Installation Compatibility Use Zones (AICUZ) or located within airport noise maps developed under federal Aviation Regulation Part 150 – Airport Noise Compatibility Planning (14 CFR Part 150).

Traffic Noise: The existing traffic noise levels along Queen Ka‘ahumanu Highway in the immediate vicinity of the airport are in the “Moderate Exposure, Acceptable” and “Significant Exposure, Normally Unacceptable” categories at 107-feet setback distance from the roadway’s centerline. Existing traffic noise levels equal or exceed 65 DNL and 66 Leq at 107-feet distance from the centerline of Queen Ka‘ahumanu Highway north and south of the Keāhole Airport Road intersection.

Noise sensitive properties located in the KOA environs and closest to the roadways servicing KOA consist of five single family residences on the agricultural lots near the Queen Ka‘ahumanu Highway and Ka‘iminani Drive intersection. There are no other existing residences or noise sensitive receptors along Queen Ka‘ahumanu Highway in the vicinity of the airport or along Keāhole Airport Road, which are the primary access roadways to the airport.

Along Queen Ka‘ahumanu Highway north and south of the Keāhole Airport Road Intersection, existing traffic noise levels exceed 66 Leq(h) at setback distance of 107- to 136-feet from the roadway’s centerline. Existing traffic noise levels along Queen Ka‘ahumanu Highway are highest at the lots fronting the roadway. At the interior lots, traffic noise levels decrease due to their greater distance from the highway and the noise shielding effects of intervening structures between the highway and the interior lots. At these interior lots, local traffic or traffic along Ka‘iminani Drive may be the more dominant noise sources. Between road traffic or aircraft noise events, background noise levels drop to a range of 45 to 50 dBA, and can go below 45 dBA during calm periods. The steady background noise levels at these interior locations are controlled by distant traffic, birds, and foliage movement with the wind.

Aircraft Noise: Aircraft noise sources in the project environs are associated with fixed and rotary wing aircraft operations at KOA. The 2010 Master Plan update for the airport contains a detailed breakdown of average day operations by aircraft at KOA during 2008. Due to the available data, for the purposes of this study, aircraft operations in 2008 were assumed to be similar to those in 2011.

The only noise sensitive facility within the 60 DNL contour and outside the airport property is the West Hawai‘i Explorations Academy Public Charter School located on OTEC Road near the southwest corner of the airport property, where existing aircraft noise levels are approximately 65 DNL. On the east side of Queen Ka‘ahumanu Highway, approximately two residences are located within the 55 DNL contour.

TABLE 3-3
HAWAIʻI STATE DEPARTMENT OF TRANSPORTATION
RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBLITIY WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVELS (DNL)

TYPE OF LAND USE	**Yearly Day-Night Average Sound Level**					
	< 60	**60-65**	**65-70**	**70-75**	**75-80**	**80-85**
RESIDENTIAL						
Low density residential, resort, and hotels (outdoor facil.)	Y(a)	N(b)	N	N	N	N
Low density apartment with moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodging with limited outdoor use	Y	N(b)	N(b)	N	N	N
PUBLIC USE						
Schools, day-care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditoriums and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and office buildings serving the general public	Y	Y	Y(d)	Y(d)	N	N
Transportation and parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL AND GOVERNMENT USE						
Offices - government, business, and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale and retail - building materials, hardware and heavy equipment	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses - car rental, tours, lei stands, ticket offices, etc.	Y	Y	Y(d)	Y(d)	N	N
Retail, restaurants, shopping centers, financial institutions, etc.	Y	Y	Y(d)	Y(d)	N	N
Power plants, sewage treatment plants, and base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios without outdoor sets, broadcasting, production facilities, etc.	Y(c)	Y(c)	N	N	N	N
MANUFACTURING, PRODUCTION , AND STORAGE						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y(e)
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc.	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc.	Y	Y	N	N	N	N
Professional/resort sport facilities, locations of media events, etc.	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

*Letters in parentheses refer to notes on next page

KEY TO TABLE 3-3

Y (yes) = Land Use and related structures compatible without restriction.
N (no) = Land Use and related structures are not compatible and should be prohibited.

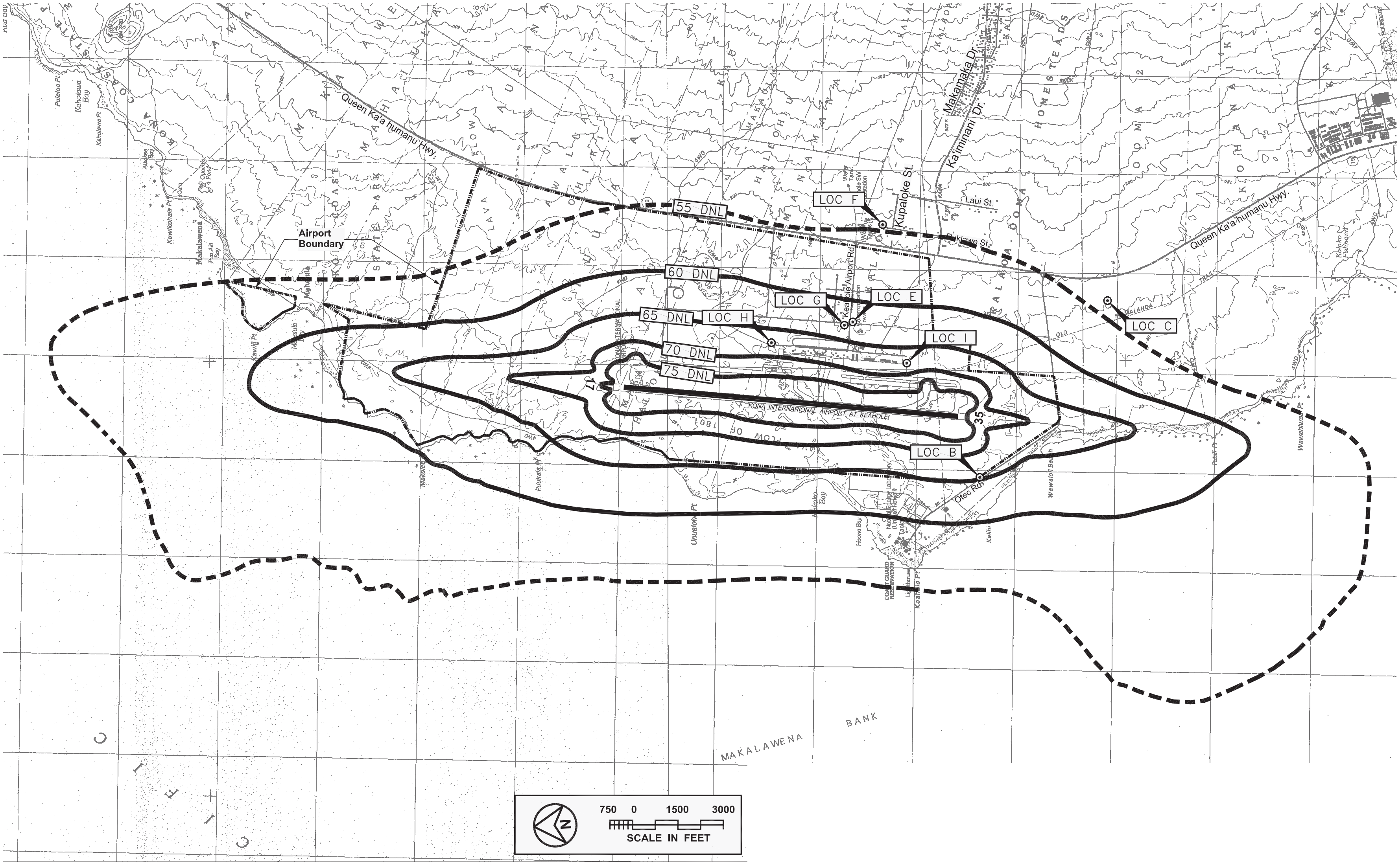
NOTES FOR TABLE 3-3

(a) A noise level of 60 DNL does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 DNL planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk level of 55 DNL and the significant risk level of 65 DNL.
(b) Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 DNL or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems.
(c) Because the DNL noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior DNL exposure level.
(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
(e) Residential buildings require NLR. Residential buildings should not be located where noise is greater than 65 DNL.
(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

Maximum jet aircraft noise levels (Lmax) were typically between 51 to 86 dBA at the measurement sites shown in Figure 3-11. Location B (LOC B), which is the existing noise sensitive charter school, lies near the 65 DNL contour. There, typical maximum noise levels associated with overseas jet aircraft were between 80 and 85 dBA and those associated with interisland jet aircraft were between 60 and 70 dBA. At LOC F, which is within the existing agricultural subdivision east of Queen Ka‘ahumanu Highway, existing maximum aircraft noise levels from jet aircraft departures are relatively low and less than 70 dBA. The louder aircraft noise events (70 to 80 dBA) occur when light fixed wing propeller and rotary wing aircraft (helicopters) fly in the vicinity of LOC F.

Those noise sensitive land uses within the 60 DNL contour are considered to be exposed to incompatible levels of aircraft noise. The degree of adverse health and welfare impacts resulting from aircraft noise depends upon the sound attenuation properties of the structures containing the noise sensitive uses. For the purposes of this study, it was assumed that all noise sensitive properties can be considered to be adversely impacted by aircraft noise if they are located within the 60 DNL aircraft noise contour and if they are not specially treated to reduce interior noise levels to 45 DNL or less. Total closure and air conditioning is generally required for structures located within the 60 DNL contour in order to achieve the 45 DNL interior noise criterion.

W:\8027-03\Planning\Graphics\Working



Source: Y. Ebisu & Associates

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

2008 NOISE EXPOSURE MAP

FIGURE 3-11

The existing noise levels at KOA are generally compatible with the surrounding land uses. Noise sensitive land uses that are located within the 60 DNL contour included the West Hawaiʻi Explorations Academy Pacific Charter School and facilities under airport control.

The charter school was not included for sound attenuation treatment within the 2010 14 CFR Part 150 Noise Compatibility Program for the airport.

Impacts and Mitigation Measures

In the short-term, unavoidable, but temporary noise impacts may occur during construction activities at KOA. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. Construction noise impacts will be mitigated by compliance with provisions of the State DOH Administrative Rules, Title 11, Chapter 46, "Community Noise Control" noise control regulations. These rules require a noise permit if noise levels from construction activities are expected to exceed the allowable range. It shall be the contractor's responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. The contractor must also adhere to the guidelines for the hours of heavy equipment operation and noise curfew times as set forth by DOH noise control regulations. In addition, these rules require a noise variance for any night work that may occur. Night work is anticipated for some project improvements, and for such work, a noise variance will be obtained.

Traffic Noise: Risks of future traffic noise impacts resulting from the proposed improvements are considered to be low due to the relatively small increases in traffic noise associated with the projects. The largest increases in traffic noise attributable to the proposed improvements are anticipated to occur along Pāoʻo Street within the airport property. The largest forecasted increase within the airport property is approximately 3 DNL from year 2011 to 2022. These changes in traffic noise levels will be very difficult to detect over the 11 year period of the proposed improvements, and risks of traffic noise impacts from KOA should be very low.

Traffic noise level increases along Queen Kaʻahumanu Highway are predicted to be 5 DNL due to non-project traffic and 0.3 DNL or less due to project traffic. Along Queen Kaʻahumanu Highway in the airport environs, risks of adverse traffic noise impacts are expected to be minimal due to the relatively small increases in traffic volumes associated with the project. Mitigation of existing or future traffic noise impacts along Queen Kaʻahumanu Highway are expected to occur during the planned widening of the highway and/or during improvements to the properties along the highway by individual property owners.

Aircraft Noise: The FAA criteria of a 1.5 DNL increase in aircraft noise levels at noise sensitive properties was used to define noise impacts resulting from increases in aircraft noise exposure associated with the forecast operations. Although this criteria was originally intended for use within the 65 DNL noise contour, the 1.5 DNL criteria was used in this study for all noise sensitive uses within the 60 DNL noise contour. In order to be consistent with the 14 CFR Part 150 Noise Compatibility Program Update and the DOT-A recommendations, the 60 DNL contour was used to identify noise levels considered to be incompatible with noise sensitive land uses (dwellings, schools, day care centers, other public use facilities, hotels, etc.). The relative degrees of noise impacts resulting from forecast aircraft operations were compared by examining the increase in noise levels at noise sensitive properties located within the 60 DNL contours.

Based on the current federal criteria for identifying aircraft noise impacts, the proposed improvements should not result in adverse noise impacts within the KOA environs. New land use incompatibilities beyond the airport boundaries should not occur as a result of the increases in airport noise levels with or without the proposed improvements. The primary reason is that adequate buffer distances exist between the airport runways and the nearest noise sensitive properties beyond the airport boundaries. Therefore, even with increasing aircraft operations at KOA, the resulting noise contours at the airport and not expected to result in new land use incompatibilities.

With the implementation of the proposed improvements, the near-term (2013) and long-term (2022) airport 60 DNL noise contours will enclose planned noise sensitive facilities within the airport boundaries. These planned facilities include the relocated Onizuka Space Center, the ARFF Regional Training Facility, and the Medical Transitional Facility. These facilities should be constructed with provisions for noise attenuation feature as they will be located within the 60 DNL noise contour.

3.8 Traffic

The project site is located west of Oueen Kaʻahumanu Highway. Access to the airport is currently provided via Keāhole Airport Road off Queen Kaʻahumanu Highway. In the vicinity of the airport, Queen Kaʻahumanu Highway is a predominantly two-lane, two-way roadway generally oriented in the north-south direction. At the signalized intersection with Keāhole Airport Road, the northbound approach of the highway, has one through lane and an exclusive right-turn lane. In addition, a southbound acceleration lane is provided along the highway to allow right-turning vehicles from Keāhole Airport Road to proceed unimpeded through the intersection. Keāhole Airport Road is a two-lane, two-way roadway generally oriented in the east-west direction that serves as the primary access for the airport. At the intersection with the highway, the Keāhole Airport Road approach has one channelized lane that serves left-turn and right-turn traffic movements. The southbound approach of the intersection is comprised of an access road. Only left-turn in and right-turn out traffic movements are allowed with both movements being yield-controlled.

West of its intersection with the highway, Keāhole Airport Road intersects Halalū Street. At this unsignalized T-intersection, the eastbound approach of the Keāhole Airport Road has one lane that serves left-turn and through traffic movements while the westbound approach has one lane that serves through and right-turn traffic movements. Halalū Street is a two-lane, two-way roadway generally oriented in the north-south direction that provides access to the rental car companies located adjacent to Aʻu Lepe Street. At the intersection with

Keāhole Airport Road, Halalū Street has one stop-controlled lane that serves left-turn and right-turn traffic movements.

Further west, Keāhole Airport Road intersects Pāoʻo Street. At this unsignalized intersection, the eastbound approach of Keāhole Airport Road has one lane that serves through traffic movements while the westbound approach has one lane that serves through and right-turn traffic movements. Eastbound left-turn traffic movements are prohibited at this intersection. Pāoʻo Street is a two-lane, two-way roadway generally oriented in the north-south direction that provides access to the rental car companies adjacent to Aʻu Lepe Street and the parking areas along its alignment. At the intersection with Keāhole Airport Road, the southbound approach of Pāoʻo Street has one lane that serves left-turn and right-turn traffic movements. The northbound approach of Pāoʻo Street is currently closed with barricades placed across the approach.

A Traffic Impact Report (TIR) was prepared for the proposed project by Wilson Okamoto Corporation in March 2012. The purpose of the TIR is to assess traffic operating conditions resulting from the proposed project, and to identify recommendations, if appropriate, that would mitigate the traffic impacts. The TIR is included in Appendix F and is summarized below.

Field investigations were conducted on October 4 and 5, 2011 and consisted of manual turning movement count surveys during the morning peak hours between 6:30 AM and 8:30 AM, and the afternoon peak hours between 3:00 PM and 6:00 PM at the intersections of Keāhole Airport Road with Queen Kaʻahumanu Highway and Halalū Street. In addition, 24-hour mechanical traffic count surveys were conducted along Keāhole Airport Road near the highway and west of Pāoʻo Street.

The highway capacity analysis performed in this TIR is based on procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Highway Capacity Software", developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS), a quantitative and qualitative assessment of traffic operations. LOS are defined by LOS "A" through "F", with LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" representing unacceptable or potentially congested traffic operating conditions.

"Volume to Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at near capacity. A v/c ratio greater than 1.00 indicated that the traffic demand exceeds the road's carry capacity.
In the vicinity of the airport, the morning peak hour of traffic generally occurs between 6:45 and 7:45 AM. In the afternoon, the peak hour of traffic generally occurs between the hours of 3:15 and 4:15 PM.

At the intersection with Keāhole Airport Road, Queen Kaʻahumanu Highway carries 778 vehicles northbound and 378 vehicles southbound during the AM peak period. During the PM peak period, the overall traffic volume is higher with 652 vehicles traveling northbound and 755 vehicles traveling southbound. The northbound left-turn traffic movement operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively, while the northbound through traffic movement operates at LOS "A" during both peak periods. On the southbound approach of the highway, the through traffic movement operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "A" during both the AM and PM peak periods. Traffic queues periodically formed on the highway approaches of the intersection with the most significant queuing occurring on the southbound approach. Average queue lengths of three to five vehicles were observed during the AM peak period and average queue lengths of six to eight vehicles were observed during the PM peak period. These queues were observed to clear the intersection after each traffic signal cycle change.

The Keāhole Airport Road approach of the intersection carries 124 vehicles and 334 vehicles eastbound during the AM and PM peak periods, respectively. This approach operates at a LOS "C" and LOS "D" during the AM and PM peak periods, respectively. Traffic queues periodically formed on this approach with average queue lengths of one to three vehicles observed during both peak periods. These queues were observed to clear after each traffic signal cycle change. The southbound approach of the intersection is comprised of an access road that carries a low volume of traffic throughout the day. No vehicles were observed on this approach during the AM peak period and only three vehicles were observed on this approach during the PM peak period.

At its intersection with Halalū Street, Keāhole Airport Road carries 130 vehicles eastbound and 245 vehicles westbound during the AM peak period. During the PM peak period, the overall traffic volume was higher with 318 vehicles traveling eastbound and 250 vehicles traveling westbound. The critical movement on the Keāhole Airport Road approaches is the eastbound approach with operates at LOS "A" during both peak periods. The Halalū Street approach of the intersection carries 29 vehicles and 80 vehicles southbound during the AM and PM peak periods, respectively. This approach operates at a LOS "B" and LOS "C" during the AM and PM peak periods, respectively. Traffic queues occasionally formed at this approach with average queue lengths of one to three vehicles observed during both peak periods.

At its intersection with Pāoʻo Street, Keāhole Airport Road carries 130 vehicles eastbound and 202 vehicles westbound during the AM peak period. During the PM peak period, traffic volumes are higher with 286 vehicles traveling eastbound and 189 vehicles traveling westbound. The Pāoʻo Street approach of the intersection carries 15 vehicles and 69 vehicles southbound during the AM and PM peak periods, respectively. The southbound approach operates at a LOS "A" and LOS "B" during the AM and PM peak periods, respectively.

Impacts and Mitigation Measures

Traffic conditions were forecast to Year 2022, the anticipated completion date of the proposed improvements. Access to the proposed project will be via the existing access road off Queen Kaʻahumanu Highway.

The proposed general aviation facilities expansion, SWAC system, Onizuka Space Center relocation, terminal expansion, hydrogen fuel storage and fueling station, and temporary DOA inspection facility are not anticipated to generate additional site-generated vehicles since these improvements are intended to serve the existing users and occupants of the airport. The new helicopter general aviation facility is also not expected to generate additional site-generated vehicles during the AM and PM peak periods since most of their operations are assumed to occur during off-peak periods. The trip generation of the ARFF Regional Training Facility was based on the maximum capacity of the classroom facility with all attendees expected to arrive during the AM peak period and depart during the PM period. As access to the airport will continue to be provided off Queen Kaʻahumanu Highway via Keāhole Airport Road, the directional distribution of all site-generated vehicles at the intersection of those roadways was assumed to remain similar to existing conditions.

The travel forecast along Queen Kaʻahumanu Highway is based upon historical traffic count data obtained by DOT, Highway Division survey stations in the vicinity of the project site. Based on historical data, an annual traffic growth rate of approximately 1.7% was obtained. However, there are a number of future developments planned within the Kona region, therefore a more conservative annual traffic growth rate of 2.0% per year was assumed along the highway.

In addition, the updated master plan anticipates an annual growth rate of approximately 2% per year for passenger arrivals. As such, traffic volumes entering and exiting the airport were assumed to increase at annual growth rate of 2% per year.

<u>Year 2022 Baseline Total Traffic Volumes</u>: The projected Year 2022 baseline AM and PM peak hour traffic volumes and operating conditions without the implementation of the proposed improvements at KOA is summarized in Table 3-4.

<table>
<tr><th colspan="7">Table 3-4
Existing and Projected Year 2022 Baseline
Traffic Operating Conditions</th></tr>
<tr><th rowspan="2">Intersection</th><th rowspan="2" colspan="2">Critical Traffic Movement</th><th colspan="2">AM</th><th colspan="2">PM</th></tr>
<tr><th>Exist</th><th>Year 2022</th><th>Exist</th><th>Year 2022</th></tr>
<tr><td rowspan="5">Queen Kaʻahumanu Hwy/ Keāhole Airport Rd*</td><td>Eastbound</td><td>LT-RT</td><td>C</td><td>C</td><td>D</td><td>D</td></tr>
<tr><td rowspan="2">Northbound</td><td>LT</td><td>A</td><td>C</td><td>B</td><td>D</td></tr>
<tr><td>TH</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td rowspan="2">Southbound</td><td>TH</td><td>A</td><td>B</td><td>B</td><td>C</td></tr>
<tr><td>RT</td><td>A</td><td>B</td><td>A</td><td>B</td></tr>
<tr><td rowspan="3">Keāhole Airport Rd/ Halalū St</td><td rowspan="2">Eastbound</td><td>LT</td><td rowspan="2">A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>TH</td><td>-</td><td rowspan="2">C</td><td>-</td></tr>
<tr><td>Southbound</td><td>LT-RT</td><td>B</td><td>B</td><td>C</td></tr>
<tr><td>Keāhole Airport Rd/ Pāoʻo St</td><td>Southbound</td><td>LT-TH-RT</td><td>A</td><td>A</td><td>B</td><td>B</td></tr>
</table>

The intersection of Keāhole Airport Road and Halalū Street is assumed to be modified to provide exclusive turning lanes along Keāhole Airport Road to accommodate the anticipated increases in traffic. The existing levels of service are provided for comparison purposes.

Traffic volumes in the vicinity of KOA are anticipated to increase significantly due to increases in passenger arrivals at the airport and ambient growth in traffic along the highway. However, traffic operations at the study intersection are anticipated to remain similar to existing conditions due to the widening of Queen Kaʻahumanu Highway and the provisions of exclusive turning lanes at the intersection of Keāhole Airport Road with Halalū Street. The traffic movements at the intersection of Queen Kaʻahumanu Highway with Keāhole Airport Road are expected to continue operating at LOS "C" or better during the AM peak period and LOS "D" or better during the PM peak period. Similarly, the critical movements at the intersection of Keāhole Airport Road with Halalū Street are expected to continue operating at LOS "B" or better during the AM peak period and LOS "C" or better during the PM peak period while those at the intersection with Pāoʻo Street are expected to continue operating at a LOS "A" and LOS "B" during the AM and PM peak periods, respectively.

<u>Year 2022 Total Traffic Volumes with Project</u>: The project Year 2022 cumulative AM and PM peak hour traffic conditions with the implementation of the proposed improvements at KOA are summarized in Table 3-5. The cumulative volumes consist of site-generated traffic superimposed over Year 2022 projected traffic demands. The projected Year 2022 baseline operating conditions are provided for comparison purposes.

Table 3-5
Projected Year 2022 Baseline and With Project
Traffic Operating Conditions

Intersection	Critical Traffic Movement		AM		PM	
			Year 2022	Year 2022 w/ Proj	Year 2022	Year 2022 w/ Proj
Queen Kaʻahumanu Hwy/ Keāhole Airport Rd*	Eastbound	LT-RT	C	C	D	D
	Northbound	LT	C	C	D	D
		TH	A	A	A	A
	Southbound	TH	B	B	C	C
		RT	B	B	B	B
Keāhole Airport Rd/ Halalū St	Eastbound	LT	A	A	A	A
	Southbound	LT-RT	B	B	C	C
Keāhole Airport Rd/ Pāoʻo St	Westbound	LT-TH-RT	-	A	-	A
	Northbound	LT-TH-RT	-	A	-	B
	Southbound	LT-TH-RT	A	B	B	C

Traffic operations in the vicinity of KOA with the implementation of the proposed improvements are generally expected to remain similar to Year 2022 baseline conditions. The westbound approach of the intersection of Keāhole Airport Road with Pāoʻo Street is anticipated to operated at LOS “A” during both peak periods while the northbound approach is anticipated to operate at LOS “A” and LOS “B” during the AM and PM peak periods, respectively. The southbound approach of the intersection is expected to operate at LOS “B” and LOS “C” during the AM and PM peak periods, respectively. The critical traffic movements at the other study intersections are expected to operate at levels of service similar to Year 2022 baseline conditions despite the addition of site-generated traffic to the surrounding roadways.

Based on the analysis of traffic data, the following are the recommendations to be implemented prior to the Year 2022.

1. Provide an exclusive eastbound left-turn lane along Keāhole Airport Road at the intersection with Halalū Street to minimize the impact of turning vehicles on the through traffic along Keāhole Airport Road. The dimensions and layout of this land should be determined during the design phase of the project.

2. Provide an exclusive westbound right-turn lane along Keāhole Airport Road at the intersection with Halalū Street to minimize the impact of turning vehicles on the through traffic along Keāhole Airport Road. The dimensions and layout of this land should be determined during the design phase of the project.

Based on the analysis of the traffic data, the following are recommendations associated with the proposed improvements:

1. Provide sufficient sight distance for motorists to safely enter and exit all project driveways/roads.

2. Provide adequate on-site loading and off-loading service areas and prohibit off-site loading operations.

3. Provide adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on-site to avoid vehicle-reversing maneuvers onto adjacent roadways.

4. Provide sufficient turning radii at all project driveways/roadways to avoid or minimize vehicle encroachments to oncoming traffic lanes.

With the implementation of the aforementioned recommendations, critical movements at the study intersections along Keāhole Airport Road are expected to continue operating at levels of service similar to Year 2022 baseline conditions. As such, the proposed improvements are not expected to have a significant impact on traffic in the vicinity.

3.9 Visual Resources

The existing KOA is surrounded by open fields of ʻaʻā and pāhoehoe lava. Eastern views from the airport present a panoramic view of Hualālai while western views from the airport are of the Kona coastline.

Impacts and Mitigation Measures

The proposed improvements are not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. The proposed improvements at KOA will be generally similar in visual character to those of the existing facilities and would be sensed as an intensification of the existing use.

3.10 Socio-Economic Characteristics

The project site is located within the Kalaoa Census Tract (CT 215.07). Demographic and other information was reviewed from the U.S. Census 2010 for the Kalaoa CT and the County of Hawaiʻi and is shown on Table 3-6.

Based upon the data shown on the table, Kalaoa CT has a slightly younger population than the County of Hawaiʻi. The median age of the population for Kalaoa CT was 39.8 versus 40.9 for the County.

By racial mix, the Kalaoa CT has a higher percentage of Whites (44.6%) and those with two or more races (2.8%) than the County (33.7% and 1.5% respectively). Kalaoa CT also has a lower percentage of Asians (13.3%) than the county (22.2%). These three races (Whites, those with two or more races, and Asians) make up the majority of the population. Native Hawaiian and other Pacific Islanders comprise a slightly lower proportion than the County as a whole, with 10.6% and 12.1%, respectively.

According to the 2010 Census, Kalaoa CT has a slightly lower occupancy rate, 79.1%, than the County, 81.5%. Housing units in this region are largely occupied by owners at 67.3%. The County data is comparable to the Kalaoa CT data in that a large proportion of housing units are occupied with owners.

Impacts and Mitigation Measures

In the short- and long-term, no significant impacts on population in the project vicinity are anticipated. The proposed improvements are to support the current and future needs of the airport and will not generate an increase in resident population. Therefore, the proposed improvements are not expected to affect the socio-economic characteristics of the area. However, in the short-term construction expenditures will provide positive benefits to the local economy. This would include creation of some construction and construction support jobs, and the purchase of material from local suppliers. In the long-term, the proposed expansion of the GA facilities offers economic opportunities for related aviation activities. The proposed ARFF Regional Training Facility can draw participants statewide to the Kona area, generating business for local establishments serving visitors and the use of Hydrogen fuels can generate associated jobs beyond traditional transportation fuels.

Table 3-6
Demographic Characteristics

Subject	CT 215.07 (Kalaoa)		Hawai‘i County	
	Number	Percent	Number	Percent
Total Population	**8,503**	**100**	**185,079**	**100**
AGE				
Under 5 years	556	6.5	11,845	33.7
5-19 years	1,528	18.0		0.6
20-64 years	5,516	64.9		0.5
65 years and over	903	10.6		22.2
Median age (years)	39.8	--	40.9	--
RACE				
White	3,792	44.6	62,348	33.7
Black or African American	45	0.5	1,020	0.6
American Indian and Alaskan Native	25	0.3	869	0.5
Asian	1,133	13.3	41,050	22.2
Native Hawaiian and other Pacific Islander	899	10.6	22,389	12.1
Two or more races	2,396	28.2	54,534	29.5
Other	213	2.5	2,868	1.5
HOUSEHOLD (BY TYPE)				
Total households	**3,012**	**100**	**67,096**	**100**
Family households (families)	2,097	69.6	44,407	66.2
Married-couple family	1,640	54.4	31,834	47.4
With own children under 18 years	624	20.7	11,141	16.6
Female householder, no husband present	285	9.5	8,258	12.3
With own children under 18 years	133	4.4	4,054	6.0
Nonfamily household	583	19.4	22,689	33.8
Average household size	2.8	--	2.7	--
HOUSING OCCUPANCY AND TENURE				
Total housing Units	**3,810**	**100**	**82,324**	**100**
Occupied Units	3,012	79.1	67,096	81.5
By owner	2,028	67.3	44,271	66.0
By renter	984	32.7	22,825	34.0
Vacant Units	798	20.9	15,228	18.5

3.11 Public Services and Facilities

3.11.1 Police Protection

KOA and the broader Kona area are served by the Hawaiʻi County Police Department's Area II Operations Bureau's Kona Patrol District. The patrol district extends from the South Kohala District at Waikoloa to the Kaʻū District at Kaulanamauna. The nearest police station to KOA is the Kona Station located approximately 4.9-miles to the south.

Impacts and Mitigation Measures

No significant impacts on the services of the County of Hawaiʻi Police Department are anticipated as a result of the proposed improvements. The proposed improvements will not generate an increase in resident population and is, therefore, not expected to affect police services provided to area residents. In the long-term, the County Police Department and other first responders will benefit from the use of the proposed ARFF Regional Training Facility.

3.11.2 Fire Protection

All certified airports are required to have an ARFF facility. The level of ARFF services required ranges from A to E and is based on the length of aircraft and scheduled daily flight frequency. KOA fall within ARFF Index D and is required to maintain a fleet of equipment and trained personnel consistent with this standard.

KOA currently has a 6,034 square foot ARFF facility that is centrally located on the airfield to the south of the existing ATCT. This facility stores and maintains one 3,000 gallon storage capacity fire fighting vehicle and two 1,500 gallon storage capacity fire fighting vehicles, as well as a chief vehicle, captain truck, a reserve 1,500 gallon Oshkosh T-series vehicle, and a mobile incident command post vehicle. In addition to the ARFF facility, an ARFF Training Facility consisting of a burn pit is located northeast of the terminal area and is used to conduct live-fire exercises.

Fire protection and related emergency services for the Kona area are provided by the County Fire Department. The nearest station to KOA is the Kailua-Kona station, located approximately 6.5-miles to the southeast. Back-up fire protection service is provided by the Waikoloa and Waimea Fire Stations as needed.

Impacts and Mitigation Measures

No significant impacts on the services of the ARFF facility or the County Fire Department are anticipated as a result of the proposed improvements. The proposed improvements will not generate an increase in passenger counts or resident population and is, therefore, not expected to affect fire protection services provided to area. Currently, the DOT-A is pursuing construction of a new ARFF Station at a different location on the north side of the terminal. The new ARFF Station will be a larger facility to meet current FAA standards for fire protection at the airport. In addition, the ARFF Regional Training Facility will benefit ARFF personnel, County Fire Department personnel, and other first responders by offering training opportunities.

3.11.3 Health Care Services

The West Hawaiʻi region is served by the Hawaiʻi Health Systems Corporation's (HHSC) Kohala Hospital and Kona Community Hospital. Kohala Hospital, located in North Kohala, is a 26-bed critical access hospital providing 24-hour emergency care, skilled nursing and intermediate care services. Kona Community Hospital, located in Kealakekua, is a 94-bed full service medical center which provides acute inpatient car and related services.

In addition to the two HHSC facilities, there is the North Hawaiʻi Community Hospital located in Waimea. This hospital is a 40-bed facility with 24-hour emergency services and is affiliated with Adventist Health, a private entity.

Impacts and Mitigation Measures

No significant impacts on medical facilities or health care services are anticipated as a result of the proposed improvements. The proposed improvements will not generate an increase in resident population and is, therefore, not expected to affect health care services provided to area residents. In the long-term, the proposed medical transitional facility will enable doctors from Honolulu to see their patients at the airport, saving valuable time and will allow them to see more patients in one visit. Also, patients who need to be transported to Honolulu for emergency care can be monitored or stabilized while awaiting transport by medivac aircraft.

3.11.4 Education

KOA falls within the State Department of Education's (DOE) Honokaʻa-Kealakehe-Kohala-Konawaena complex area. The DOE operates six public schools as well as three public charter schools in the area. While none of the schools are within the direct vicinity of the project site, Kealakehe Intermediate School and Kealakehe High School are located approximately 5-miles from the project site and serve students in Grades 6 to 8 and Grades 9-12, respectively. Also, Kealakehe Elementary School is located approximately 6-miles to the southeast of the project site and serves students from Kindergarten to Grade 5.

Impacts and Mitigation Measures

The proposed project is not anticipated to have an impact on public schools. Construction and operation of the proposed improvements will not generate an increase in resident population and is, therefore, not expected to affect student enrollment at public school facilities or the educational services provided to area residents.

3.11.5 Recreational Facilities

The nearest recreation facility is Kekaha Kai State Park located 2.6-miles north of KOA. Kekaha Kai State Park encompasses Mahaiʻula Beach, Makalawena Beach, and Kua Bay. The park is open from 9 AM to 7 PM daily except on Wednesdays. There is a paved road that leads to Kua Bay and an unpaved road leads to Mahaiʻula. The Mahaiʻula section of the park has a sand beach and dune with a picnic area. Connecting Mahaiʻula with Kua Bay is the historic coastal trail, Ala Kahakai.

The Kaloko-Honokōhau National Historical Park is also located approximately 3-miles south of KOA and falls under the jurisdiction of the U.S. National Park Service. The purpose of the park is to preserve, interpret, and perpetuate traditional native Hawaiian activities, values, and culture, and to demonstrate historic land use patterns. The park is open daily and includes a visitor's center and a book store. Adjacent to the park is the Honokōhau Small Boat Harbor which provides a launching area for traditional canoes, fishing boats, scuba diving and snorkeling tours of the area.

Impacts and Mitigation Measures

No significant impacts on the nearby outdoor recreational facilities are anticipated as a result of the proposed improvements. The proposed improvements will not generate an increase in resident population and is, therefore, not expected to increase demand for recreational facilities and parks.

3.11.6 Solid Waste Disposal

The County of Hawai'i, Department of Environmental Management, Solid Waste Division and Recycling Section operates and maintains all solid waste collection and disposal facilities in the County of Hawai'i. The facilities include two landfills and twenty two transfer stations. Refuse collected in the region is taken to the West Hawai'i (Pu'uanahulu) Landfill, located in Waikoloa, for disposal.

Impacts and Mitigation Measures

No significant impacts to solid waste disposal are anticipated from the construction and operation of the proposed project. Construction waste will be recycled or disposed of at an approved construction waste facility as determined by the selected contractor.

3.12 Infrastructure and Utilities

3.12.1 Water System

The airport's main water supply is maintained in the airport's original 0.5 million gallon tank which is connected to a newer one million gallon tank that also serves the NELHA facilities. A 12-inch municipal water main along Queen Ka'ahumanu Highway supplies the tanks. From the tanks, a 12-inch line follows the airport access road in from the highway and then extends north along the periphery road to feed the airport's distribution system. An 8-inch line extends south along U'u Street to serve the air cargo and general aviation facilities. Pressure for fire flows in the area are created by a 0.5 million gallon storage reservoir at 280-feet above mean sea level, mauka of Queen Ka'ahumanu Highway.

Impacts and Mitigation Measures

No significant impacts are anticipated on the existing potable water system as a result of the construction and operation of the proposed improvements. Extensions of the existing water lines will be required for the proposed improvements that are new facilities located in areas where there were no previously existing structures. As KOA is currently operating below their current water allocation, it is anticipated that the current water allotment is sufficient to serve the proposed improvements.

3.12.2 Wastewater System

Wastewater is collected and transferred via a collection line that runs parallel to Kūpīpī Street to an on-site wastewater treatment plant located north of the terminal area. The wastewater plant has the capacity to handle 100,000 gallons per day and is maintained under contract with a private wastewater system operator. Secondary treatment is provided through an extended aeration operation followed by clarification and chlorination. Wastewater is treated to an R-1 level and re-used for landscape irrigation along the airport access roadways. When treatment is not able to attain an R-1 classification, the effluent is disposed through 20-feet deep injection wells at an on-site lagoon.

Impacts and Mitigation Measures

No significant impacts are anticipated on the existing wastewater system as a result of the construction and operation of the proposed improvements. Extensions of the existing sewage lines will be required for the proposed improvements that are new facilities where there were no previously existing structures. However, the KOA wastewater treatment plant is currently operating only at a third of its capacity, therefore, the system is anticipated to be adequate to meet the needs of the proposed improvements.

3.12.3 Drainage System

Storm runoff in the airfield and parking areas is collected using a system of swales, ditches, and concrete bridge culverts. A system of pipelines (18-inch and 30-inch) and intake boxes provide drainage for the terminal facility. The water runoff is then injected into dry wells or porous depressions on site for disposal. This is regulated by State of Hawaiʻi Department of Health Underground Injection Control Permits.

While the airport is not located within the 100-year floodplain, during heavy downpours, short-term ponding can occur on the ramp and some gate locations. However, the present drainage system is adequate for the amount of storm runoff accumulated on site.

Impacts and Mitigation Measures

No significant impacts are anticipated on the existing storm drainage system as a result of the construction and operation of the proposed improvements.

Potential water quality impacts to surface waters and nearshore coastal waters during construction of the project will be regulated by the County grading ordinance and the NPDES permit administered by the State DOH. A NPDES Individual Permit for Storm Water Associated with Construction Activity will be required if the area of soil disturbance from activities such as clearing, grubbing, grading, and stockpiling will exceed one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

Development of the proposed improvements may result in a slight increase in storm run-off since portions of the existing undeveloped areas of the project site will be replaced with impermeable surface treatment. As the majority of the KOA property is comprised of lava fields, the proposed improvements will be designed to utilize overland drainage as much as possible, however, there is still a need for a storm drain system utilizing drywells in certain areas.

3.12.4 Electrical and Communications Systems

Electrical services is provided to the airport by Hawaiian Electric Light Company (HELCO) via two 1,247 kilovolt (kV) feeder lines from the Keāhole substation located east of Queen Ka‘ahumanu Highway. The power lines extend along Keāhole Street and enter the electrical control building located adjacent to the ATCT to the east where it is distributed to the airport facilities. A 175 kilowatt (KW) diesel engine emergency generator is located in the electrical control building, along with a 1,000-gallon diesel storage tank located adjacent to the control building. A second 23 KW diesel engine generator provides a separate emergency power to the airfield.

Hawaiian Telcom is the primary telecommunications provider within the County of Hawai‘i. The main telephone line is located in the same underground duct bank as the HELCO feeder line which is also connected to the electrical control building. In addition, a public address system is utilized in the terminal for paging and flight announcements.

Impacts and Mitigation Measures

In the short- and long-term, the proposed improvements are not anticipated to have a significant impact on electrical and communication systems at the airport. DOT-A is currently pursuing the construction of a photovoltaic (PV) array which is anticipated to begin construction at the end of 2012. The intent of the PV array is to initially construct a system that would accommodate the existing terminal power demand and can be expanded to support the airport’s future growth.

4. RELATIONSHIP TO PLANS, POLICIES, AND CONTROLS

This section discusses the State and County of Hawaiʻi land use plans, policies and controls relating to the proposed project.

4.1 State Land Use Plans and Policies

4.1.1 Hawaiʻi State Plan

The Hawaiʻi State Plan, Chapter 226, HRS, provides goals, objectives, policies, and priorities for the State. The Hawaiʻi State Plan also provides a basis for determining priorities, allocating limited resources, and improving coordination of State and County Plans, policies, programs, projects, and regulatory activities. It establishes a set of themes, goals, objectives, and policies that are meant to guide the State's long-range growth and development activities. The proposed project is consistent with the following applicable objectives and policies:

Sec. 226-6 Objectives and policies for the economy – in general.

(a) Planning for the State's economy in general shall be directed toward achievement of the following objectives:

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

(2) A steady growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.

(b) To achieve the general economic objectives, it shall be the policy of this State to:

(3) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.

(8) Encourage labor-intensive activities that are economically satisfying and which offer opportunities for upward mobility.

(9) Foster greater cooperation and coordination between the government and private sectors in developing Hawaiʻi's employment and economic growth opportunities.

(10) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.

<u>Discussion</u>: In the short-term, construction expenditures will provide positive benefits to the local economy. This would include creation of some construction and construction support jobs, and the purchase of material from local suppliers. In the long-term, the proposed expansion of the GA facilities offers economic opportunities for related aviation activities. The proposed ARFF Regional Training Facility can draw participants statewide to the Kona area, generating business for local establishments serving visitors and the use of Hydrogen fuels can generate associated jobs beyond traditional transportation fuels.

Sec. 226-8 Objectives and policies for the economy – visitor industry.

(a) Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawai'i's economy.

(b) To achieve the visitor industry objective, it shall be the policy of this State to:

(3) Improve the quality of existing visitor destination areas by utilizing Hawai'i's strengths in science and technology.

(4) Encourage cooperation and coordination between the government and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.

Discussion: The proposed improvements do not directly involve the development of visitor accommodations, but KOA is an integral part of providing air transportation facilities supporting the visitor industry. The proposed terminal improvements will more efficiently process out bound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights.

Sec. 226-11 Objectives and policies for the physical environment – land-based, shoreline, and marine resources.

(a) Planning for the State's physical environment with regard to land-based shoreline, and marine resources shall be directed towards achievement of the following objectives:

(1) Prudent use of Hawai'i's land-based, shoreline, and marine resources.

(2) Effective protection of Hawai'i's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:

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

(4) *Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*

(6) *Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.*

(8) *Pursue compatible relationships among activities, facilities, and natural resources.*

Discussion: Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed improvements will be regulated by the County's grading ordinance and the NPDES permit requirement administered by the State DOH. A NPDES Individual Permit for Storm Water Associated with Construction Activity will be required for those projects anticipating soil disturbance exceeding one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

The proposed project is not anticipated to have any long-term impacts to land-based, shoreline, and marine resources. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

Sec. 226-12 Objective and policies for the physical environment – scenic, natural beauty, and historic resources.

(a) *Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawai'i's scenic assets, natural beauty, and multi-cultural/historical resources.*

(b) *To achieve the scenic, natural beauty, and historic resources objective, it shall be the policy of this State to:*

(1) *Promote the preservation and restoration of significant natural and historic resources.*

(3) *Protect those special areas, structures, and elements that are an integral and functional part of Hawai'i's ethnic and cultural heritage.*

<u>Discussion</u>: The proposed improvements are not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. The proposed improvements at KOA will be generally similar in visual character to those of the existing facilities and would be sensed as an intensification of the existing use.

An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in April 2012. Several of the proposed short-term improvement areas are not recommended for further work, based on their location in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Expansion; the relocated Onizuka Space Center, the Terminal Modernization Phase I; the High Pressure Hydrogen Fuel Storage and Fuel Station; and the DOA Inspection Facility Site "C". A lack of finds during 100 percent coverage of the proposed ARFF Regional Training Facility, which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location.

As the proposed Road M route traverses over older lava flow areas that may contain archaeological features, it is recommended that this area be studied further. In addition, as both potential DOA Inspection Facilities are situated on the same flows, should either of these sites be selected, it is recommended that the selected site be further studied as well. While the Road M route has been subjected to past archaeological survey, features were found immediately adjacent to the corridor that were not previously documented and may be impacted by construction. Additional features may also be present. No further work is recommended for the Medical Transitional Facility, as thorough coverage of this site yielded no finds. The Helicopter General Aviation facility and KATR are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection of these improvement areas. An inventory survey was recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC system heat exchanger site will require an archaeological inventory survey, due to the discovery of previously-undocumented features in the immediate vicinity. It was recommended that the system water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be accomplished, then further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, an inventory survey will be necessary.

Should any significant pre-Contact or historic deposits (i.e. subsurface concentrations of indigenous or historic era artifacts and/or structural remnants) or human burials be encountered during the course of development of the project site, the subsurface excavation work and/or surface grading will be halted in the immediate area and the SHPD will be notified immediately.

In addition, a CIA is being prepared for the entire airport property. The study area for the CIA will include ten ahupuaʻa; ʻOʻoma, Kalaoa, Hamanamana, Haleohiu, Makaʻula, Kaʻū, Puʻukala, Awalua, Kaulana, and Mahaiʻula. Access to and use of coastal resources appears to be of primary importance. However, as the proposed improvements are located on the existing airport property and are on the mauka side of the runway, with the exception of the KATR widening and expansion, the improvements are not anticipated to affect any cultural practices and/or resources in the project vicinity. Since there is currently no existing general public access to the shoreline through the airport due to aviation safety requirements, none of the proposed improvements, including the KATR widening and expansion, will further impede such access.

Sec. 226-13 Objectives and policies for the physical environment – land, air, and water quality.

(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:

(1) Maintenance and pursuit of improved quality in Hawaiʻi's land, air, and water resources.

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:

(2) Promote the proper management of Hawaiʻi's land and water resources.

(3) Promote effective measure to achieve desired quality in Hawaiʻi's surface, ground, and coastal waters.

(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaiʻi's people.

Discussion: Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed project will be regulated by the County's grading ordinance and the NPDES permit requirement administered by the State DOH. A NPDES Individual Permit for Storm Water Associated with Construction Activity will be required for those projects anticipating soil disturbance exceeding one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

The proposed project is not anticipated to have any significant long-term impacts to land-based, shoreline, and marine resources. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

An air quality study for the proposed improvements was prepared in April 2012. Short-term direct and indirect impacts on air quality could potentially occur due to construction and operation of the proposed improvements. Potential air quality impacts during construction will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60-11.1 "Air Pollution Control." Compliance with State regulations will require adequate measures to control fugitive dust by methods such as water spraying and sprinkling of loose or exposed soil or ground surface areas and dust-generating equipment during construction. Exhaust emissions from construction vehicles are anticipated to have negligible impact on air quality in the vicinity as the emissions would be relatively small and readily dissipated.

In the long-term (Year 2022), without the proposed improvements, carbon monoxide concentrations were predicted to remain about the same or decrease slightly in the project area, and concentrations should remain within State and Federal standards. With the proposed improvements in the year 2022, carbon monoxide concentrations would remain the same or increase slightly as compared to without improvements, and concentrations would remain within State and Federal standards. Implementing mitigation measure for traffic-related air quality impacts is most likely unnecessary and unwarranted.

With or without the proposed improvements, aircraft operations are expected to increase by 2022, and the associated air pollution emissions will increase proportionally. However, the proposed improvements are not expected to affect the number or type of aircraft operations. Thus, the proposed improvements should not result in an increase in air pollution emissions from aircraft operations at the airport.

The proposed Regional ARFF Training Facility will include the use of the existing burn pit as well as a fuel spill trainer, a specialized aircraft fire trainer, and a three story-burn building. While these uses may affect air quality in the area due to the burning of fuels for training exercises, their use will be relatively infrequent and would not be permitted to exceed air quality standards as set forth in the national and State AAQS.

An Acoustic Study for the proposed improvements was conducted in June 2012. In the short-term, unavoidable, but temporary noise impacts may occur during construction activities at KOA. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. Construction noise impacts will be mitigated by compliance with provisions of the State DOH Administrative Rules, title 11, Chapter 46, "Community Noise Control" noise control regulations. These rules require a noise permit if noise levels from construction activities are expected to exceed the allowable range. It shall be the contractor's responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. The contractor must also adhere to the guidelines for the hours of heavy equipment operation and noise curfew times as set forth by DOH noise control regulations. In addition, these rules require a noise variance for any night work that may occur. Night work is anticipated for some project improvements, and for such work, a noise variance will be obtained.

In the long-term, risks of future traffic noise impacts resulting from the proposed improvements are considered to be low due to the relatively small increases in traffic noise associated with the projects. The largest increases in traffic noise attributable to the proposed improvements are anticipated to occur along Pāo‘o Street within the airport property. The largest forecasted increase within the airport property is approximately 3 DNL from year 2011 to 2022. These changes in traffic noise levels will be very difficult to detect over the 11 year period of the proposed improvements, and risks of traffic noise impacts from KOA should be very low.

Traffic noise level increases along Queen Ka‘ahumanu Highway are predicted to be 5 DNL due to non-project traffic and 0.3 DNL or less due to project traffic. Along Queen Ka‘ahumanu Highway in the airport environs, risks of adverse traffic noise impacts are expected to be minimal due to the relatively small increases in traffic volumes associated with the project. Mitigation of existing or future traffic noise impacts along Queen Ka‘ahumanu Highway are expected to occur during the planned widening of the highway and/or during improvements to the properties along the highway by individual property owners.

Based on the current federal criteria for identifying aircraft noise impacts, the proposed improvements should not result in adverse noise impacts within the KOA environs. New land use incompatibilities beyond the airport boundaries should not occur as a result of the increases in airport noise levels with or without the proposed improvements. The primary reason is that adequate buffer distances exist between the airport runways and the nearest noise sensitive properties beyond the airport boundaries. Therefore, even with increasing aircraft operations at KOA, the resulting noise contours at the airport are not expected to result in new land use incompatibilities.

With the implementation of the proposed improvements, the near-term (2013) and long-term (2022) airport 60 DNL noise contours will enclose planned noise sensitive facilities within the airport boundaries. These planned facilities include the relocated Onizuka Space Center, the ARFF Regional Training Facility, and the Medical Transitional Facility. These facilities should be constructed with provisions for noise attenuation as they will be located within the 60 DNL noise contour.

Sec. 226-16 Objective and policies for facility systems – water.

(a) Planning for the State’s facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(b) To achieve the facility systems water objective, it shall be the policy of this State to:

(3) *Reclaim and encourage the productive use of runoff water and wastewater discharges.*

Discussion: Extensions of the existing water lines will be required for the proposed improvements that are new facilities located in areas where there were no previously existing structures. These include the new GA Helicopter Facility, the ARFF Regional Training Facility, the GA Expansion Area, the Medical Transitional Facility, and the temporary alternative DOA Inspection Facility sites "A," "B," and "C." As KOA is presently operating below its current water allocation, it is anticipated that the current water allotment is sufficient to serve the proposed improvements.

KOA's existing on-site wastewater treatment plant treats collected wastewater to the R-1 level and is re-used for landscape irrigation along the airport access roadways. It is the DOT-A's intention to additionally use the R-1 wastewater to irrigate landscaped areas for the proposed improvements.

4.1.2 State Functional Plans

The Hawai'i State Plan directs appropriate State agencies to prepare Functional Plans to address Statewide needs, problems, and issues through recommended policies and actions. Fourteen Functional Plans were prepared to implement the State Plan provisions in the areas of agriculture, transportation, conservation lands, education, tourism, water resources, energy, recreation, historic preservation, health, housing, higher education, employment, and human services. The following presents a review of the Functional Plans which are applicable to the proposed project.

Tourism Functional Plan

Objective II.A: Development and maintenance of well-designed visitor facilities and related developments which are sensitive to the environment, sensitive to neighboring communities and activities, and adequately serviced by infrastructure and support services.

> *Policy II.A.1. Maintain high standards of overall quality of existing visitor destination and attraction areas.*
>
> *Policy II.A.6. Improve accessibility and arrival conditions at ports of entry.*

Discussion: The proposed improvements are in response to the present and future needs of the airport so that it can continue to provide quality facilities for Kona visitors. The terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights.

Transportation Functional Plan

Objective I.A: Expansion of the transportation system.

Policy I.A.1. Increase transportation capacity and modernize transportation infrastructure in accordance with existing master plans and laws requiring accessibility for people with disabilities.

Objective I.F: Improving and Enhancing transportation safety.

Policy I.F.1. Enhance air safety and security.

Objective I.G: Improved transportation maintenance programs.

Policy I.G.2. Conduct maintenance work to minimize disruption to the general public.

Objective II.A: Development of a transportation infrastructure that supports economic development initiatives.

Policy II.A.2. Support tourism and economic development.

Discussion: The proposed improvements are in response to the present and future needs of the airport so that it can continue to provide quality facilities for Kona visitors. The terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights.

Historic Preservation Functional Plan

Objective B: Protection of Historic Properties

Policy B.2. Establish and make available a variety of mechanisms to better protect historic properties.

Objective C: Management and Treatment of Historic Properties

Policy C.3. Explore innovative means to better manage historic properties.

Policy C.4. Encourage proper preservation techniques.

Discussion: An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in April 2012. Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Expansion; the relocated Onizuka Space Center, the Terminal Modernization Phase I; the High Pressure Hydrogen Fuel Storage and Fuel Station; and the DOA Inspection Facility Site "C". A lack of findings during 100 percent coverage of the proposed ARFF Regional Training Facility, which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location. No further work is also recommended for the Medical Transitional Facility, as thorough coverage of this site yielded no finds.

As the proposed Road M route traverses over older lava flow areas that may contain archaeological features, it is recommended that this area be studied further. In addition, as both potential DOA Inspection Facilities are situated on the same flows, should either of these sites be selected, it is recommended that the selected site be further studied as well. The Helicopter General Aviation facility and KATR are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection of these improvement areas. An inventory survey was recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC system heat exchanger site will require archaeological inventory, due to the discovery of previously-undocumented features in the immediate vicinity. It was recommended that the system water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, an inventory survey will be necessary.

Should any significant pre-Contact or historic deposits (i.e. subsurface concentrations of indigenous or historic era artifacts and/or structural remnants) or human burials be encountered during the course of development of the project site, the subsurface excavation work and/or surface grading will be halted in the immediate area and the SHPD will be notified immediately.

State Energy Functional Plan

Objective A: Moderate the growth in energy demand through conservation and energy efficiency.

> *Policy A.1. Promote and stimulate greater energy efficiency and conservation in non-transportation sectors.*

Discussion: In an effort to promote conservation and energy, the proposed SWAC system will help to reduce the electrical demand at the KOA terminal area. The construction of the Hydrogen Fueling Station will also reduce the reliance on nonrenewable resources by taking advantage of new technology using renewable energy sources. Locating the facility at KOA would not only serve residents and airport operations-related vehicles, but offer the option to visitors driving rental cars.

4.1.3 State Land Use District

The State Land Use Law, Chapter 205, HRS, is intended to preserve, protect and encourage the development of lands in the State for uses that are best suited to the public health and welfare of Hawai'i's people. Under Chapter 205, HRS all lands in the State of Hawai'i are classified by the State Land Use Commission (LUC) into four major categories referred to as

State Land Use Districts. These districts are identified as the Urban District, Agricultural District, Conservation District, and Rural District.

The LUC's Land Use District Boundary map for the Island of Hawai'i depicts the lands within the KOA property as being designated within the State Urban and Conservation Districts (see Figure 4-1). Urban lands are the most prevalent, encompassing majority of the developed portions of the airport property. Conservation land comprises the remainder of the property. The proposed improvements are consistent with the Urban District and can be permitted in the Conservation District through a Conservation District Use Permit (CDUP).

Within the Conservation District, there are five subzones as follows: Protective (P), Limited (L), Resource (R), General (G), and Special Subzone (SS). Excluding the Special Subzone, the four remaining subzones are arranged in a hierarchy of environmental sensitivity, ranging from the most environmentally sensitive (Protective) to the least sensitive (General). The objective of these subzones is to protect valuable resources in designated areas such as restricted watersheds, marine, plant, wildlife sanctuaries, significant historic, archaeological, geological, volcanological features and sites, and other designated unique areas. The new Helicopter Facility, the ARFF Regional Training Center, and the DOA Inspection Facility Site "A" are all located within the General subzone. The northern makai portion of the KATR expansion is partially located in the Protective subzone and the southern makai portion boarders the General subzone (see Figure 4-2).

The proposed improvements that lie within the Conservation District will require a CDUP pursuant to the State DLNR Administrative Rules, Title 13, Chapter 5 for lands designated in the Conservation District. Alternatively, DOT-A could petition the LUC to place the project sites located in the Conservation District into the Urban District through a Land Use District Boundary Amendment (LUDBA).

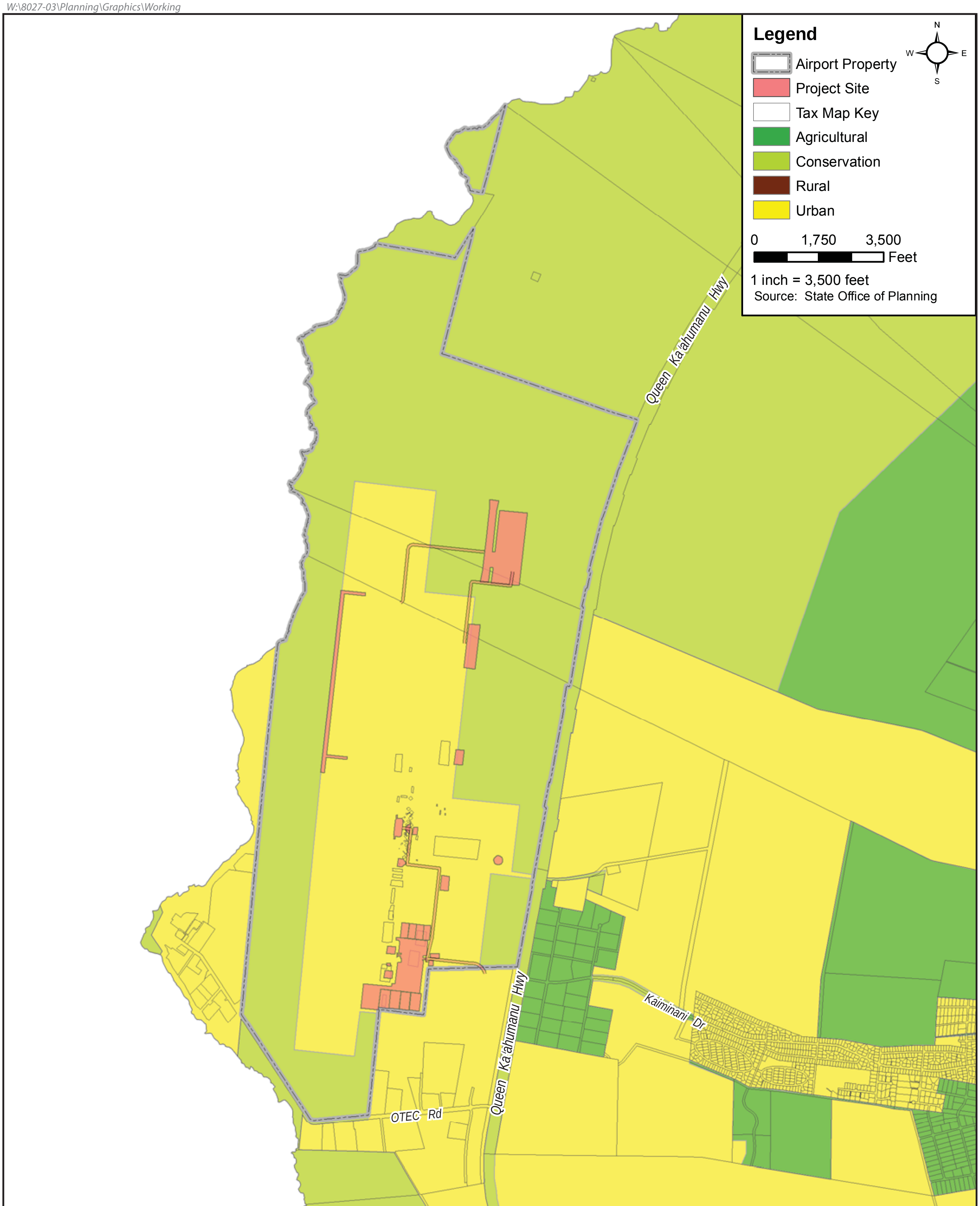
4.1.4 Chapter 344, State Environmental Policy

The purpose of the Hawai'i Revised Statutes (HRS) Chapter 344, State Environmental Policy is to "establish a state policy which will encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawai'i." This section discusses the project's consistency with the pertinent goals, policies, and guidelines described under Chapter 344, HRS.

§344-3 Environmental policy. It shall be the policy of the State, through its programs, authorities, and resources to:

(1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and

W:\8027-03\Planning\Graphics\Working



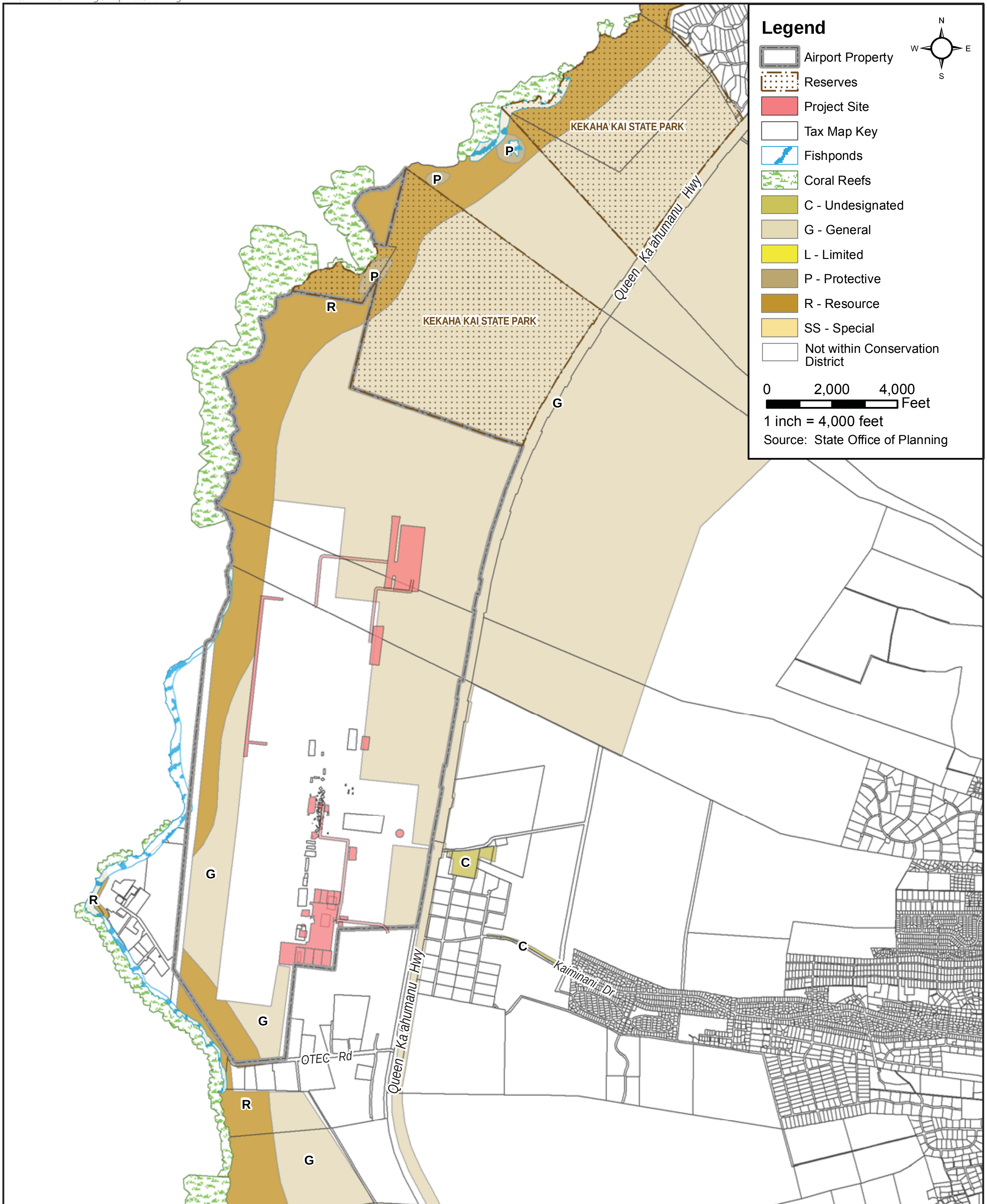
WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

STATE LAND USE DISTRICTS MAP

FIGURE 4-1

W:\8027-03\Planning\Graphics\Working



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

CONSERVATION DISTRICT SUBZONES MAP

FIGURE 4-2

fulfill the social, economic, and other requirements of the people of Hawai'i.

Discussion: The proposed improvements are necessary to meet the current and future needs of KOA as identified in the 2010 KOA Master Plan update. The proposed improvements will not have an adverse impact on natural resources or the environment, as discussed in pervious sections of this document. The improvements have been designed to minimize impacts on the land, and BMPs will be implemented during construction to control pollution and preserve natural resources.

(2) Enhance the quality of life by:

(B) Creating opportunities for the residents of Hawai'i to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments;

(D) Establishing a commitment on the part of each person to protect and enhance Hawai'i's environment and reduce the drain on nonrenewable resources.

Discussion: The proposed improvements are consistent with the above policies. In the short-term, construction expenditures will provide positive benefits to the local economy. This would include creation of some construction and construction support jobs, and the purchase of material from local suppliers. In the long-term, the proposed expansion of the GA facility offer economic opportunities for related aviation activities. The proposed ARFF Regional Training Facility can draw participants statewide to the Kona area, generating business for local establishments serving visitors and the use of hydrogen fuels can generate associated jobs beyond traditional transportation fuels.

The proposed improvements will not have an adverse impact on natural resources or the environment, as discussed in pervious sections of this document. The improvements have been designed to minimize impacts on the land, and BMPs will be implemented during construction to control pollution and preserve natural resources. In addition, the construction of the Hydrogen Fueling Station and the SWAC system will reduce the reliance on nonrenewable resources by taking advantage of new technology using renewable energy sources.

4.1.5 Hawai'i Coastal Zone Management Program

The National Coastal Zone Management (CZM) Program was created through passage of the Coastal Zone Management Act of 1972. Hawai'i's CZM Program, adopted as Chapter 205A, HRS, provides a basis for protecting, restoring and responsibly developing coastal communities and resources. The Hawai'i CZM area includes all lands within the State and the areas seaward to the extent of the State's management jurisdiction. Hence, the KOA property is located in the CZM area. A discussion of the project's consistency with the objectives and policies of the CZM Program is provided below.

(1) Recreational Resources

Objective:
Provide coastal recreational opportunities accessible to the public.

Policies:
(A) Improve coordination and funding of coastal recreational planning and management; and
- *(i) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by: Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
- *(ii) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;*
- *(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
- *(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
- *(v) Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*
- *(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters.*
- *(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*
- *(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.*

Due to aviation safety requirements there is no general public access to the shoreline through the KOA airfield. The nearest public shoreline access is located at the Kekaha Kai State Park, north of KOA.

During construction of the various improvements, storm water runoff may carry increased amounts of sediment into the storm drain system due to erosion from soils exposed during excavation and grading activities. This runoff could potentially impact the water quality of coastal waters in the area. However, excavation and grading activities associated with the construction of the proposed project will be regulated by the County's grading ordinance. In addition, for those improvements anticipating an area of soil disturbance greater than one acre, an NPDES Individual Permit for Storm Water Associated with Construction Activity, administered by the State DOH, will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

(2) *Historic Resources*

Objective:

(A) Protect, preserve and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

(A) Identify and analyze significant archaeological resources;
(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and
(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in April 2012. Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Expansion; the relocated Onizuka Space Center, the Terminal Modernization Phase I; the High Pressure Hydrogen Fuel Storage and Fuel Station; and the DOA Inspection Facility Site "C". A lack of findings during 100 percent coverage of the proposed ARFF Regional Training Facility, which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location. No further work is also recommended for the Medical Transitional Facility, as thorough coverage of this site yielded no finds.

As the proposed Road M route traverses over older lava flow areas that may contain archaeological features, it is recommended that this area be studied further. In addition, as both potential DOA Inspection Facilities are situated on the same flows, should either of these sites be selected, it is recommended that the selected site be further studied as well. The Helicopter General Aviation facility and KATR are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection of these improvement areas. An inventory survey was recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC system heat exchanger site will require archaeological inventory, due to the discovery of previously-undocumented features in the immediate vicinity. It was recommended that the system water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, an inventory survey will be necessary.

Should any significant pre-Contact or historic deposits (i.e. subsurface concentrations of indigenous or historic era artifacts and/or structural remnants) or human burials be encountered during the course of development of the project site, the subsurface excavation work and/or surface grading will be halted in the immediate area and the SHPD will be notified immediately.

(3) Scenic and Open Space Resources

Objective:

(A) Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(A) Identify valued scenic resources in the coastal zone management area;
(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;
(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and
(D) Encourage those developments which are not coastal dependent to locate in inland areas.

The proposed improvements are not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. The proposed improvements at KOA will be generally similar in visual character to those of the existing facilities and would be sensed as an intensification of the existing use.

(4) Coastal Ecosystems

Objective:

(A) Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;
(B) Improve the technical basis for natural resource management;
(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(D) *Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and*

(E) *Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Due to aviation safety requirements there is no general public access to the shoreline through the KOA airfield. The nearest shoreline access is located at the Kekaha Kai State Park, north of KOA.

During construction of the various improvements, storm water runoff may carry increased amounts of sediment into the storm drain system due to erosion from soils exposed during excavation and grading activities. This runoff could potentially impact the water quality of coastal waters in the area. However, excavation and grading activities associated with the construction of the proposed project will be regulated by the County's grading ordinance. In addition, for those improvements anticipating an area of soil disturbance greater than one acre, an NPDES Individual Permit for Storm Water Associated with Construction Activity, administered by the State DOH, will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

(5) *Economic Uses*

Objective:

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

Policies:

(A) *Concentrate coastal dependent development in appropriate areas;*

(B) *Ensure that coastal dependent developments such as harbors and ports, and coastal related development such as visitor facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and*

(C) *Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:*

(i) *Use of presently designated locations is not feasible;*

(ii) *Adverse environmental effects are minimized; and*

(iii) *The development is important to the State's economy.*

KOA is an existing airport that is appropriately located on the coast to minimize over flight of developed lands for public safety and to minimize aircraft noise impacts. The proposed improvements are associated with the existing airport.

(6) *Coastal Hazards*

Objectives:

(A) *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

Policies:

(A) *Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;*
(B) *Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;*
(B) *Ensure that developments comply with requirements of the Federal Flood Insurance Program;*
(C) *Prevent coastal flooding from inland projects.*

According to the Flood Insurance Rate Map (FIRM) (Community Panel Numbers 1551660466C, 1551660468C, 1551660681C and 1551660683C, Effective Date: September 16, 1988 prepared by the Federal Emergency Management Agency (FEMA)), the project site is located within Zone "X", defined as "Areas determined to be outside the 0.2% annual chance floodplain." The project site is located outside of the tsunami inundation zone. Construction and operation of the proposed project are not anticipated to increase flood risks or cause any adverse flood-related impacts at the project site or lower elevation properties.

The entire island of Hawaiʻi is designated Seismic Zone 4, the highest rating among the major Hawaiian Islands. The proposed improvements will be designed and built to Seismic Zone 4 standards of the International Building Code (IBC) to ensure that potential seismic activities do not adversely affect the project buildings.

(7) *Managing Development*

Objective:

(A) *Improve the development review process, communication, and public participation in the management of coastal resource and hazards.*

Policies:

(A) *Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;*
(B) *Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and*
(C) *Communicate the potential short- and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.*

The Hawaiʻi State environmental review process, HRS 343, requires project review by government agencies and affords the public the opportunity to provide comments on the proposed project. The proposed improvements are also subject to the Special Management Area (SMA) permit process as discussed in Section 4.2.5. Applicable State and County requirement will be adhered to in the design and construction phases of the proposed improvements.

(8) *Public Participation*

Objective:

(A) *Stimulate public awareness, education, and participation in coastal management.*

Policies:

(A) *Promote public involvement in coastal zone management processes;*

(B) *Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and*

(C) *Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.*

The Hawaiʻi State environmental review process, Chapter 343, HRS, requires project review by government agencies and affords organizations and the general public the opportunity to provide comments on the proposed project. The proposed improvements are also subject to the SMA permit process as discussed in Section 4.2.5, which includes public notification and a public hearing.

A public informational meeting was held on February 9, 2012 to apprise the public of the proposed improvements and to solicit verbal and written comments from the community at-large. A summary of the meeting can be found in Appendix G.

(9) *Beach Protection*

Objective:

(A) *Protect beaches for public use and recreation.*

Policies:

(A) *Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;*

(B) *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*

(C) *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

The proposed improvements do not involve the construction of improvements in the shoreline setback nor require any shoreline erosion-protection structures.

(10) *Marine Resources*

Objective:

(A) *Promote the protection, use, and development of marine and coastal resources to assure their sustainability.*

Policies:

(D) *Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*

(E) *Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*

(F) *Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*

(G) *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*

(H) *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

The proposed improvements do not involve construction or development within coastal waters and are, therefore, not anticipated to have any direct impacts on marine and coastal resources. Potential water quality impacts to nearshore coastal waters during construction of the improvements will be mitigated by adherence to State water quality regulations governing grading, excavation and stockpiling. In addition, for those improvements anticipating an area of soil disturbance greater than one acre, an NPDES Individual Permit for Storm Water Associated with Construction Activity, administered by the State DOH, will be required to control storm water discharges. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

4.2 Hawaiʻi County Land Use Plans and Policies

4.2.1 Hawaiʻi County General Plan

Hawaiʻi County last updated its General Plan in February of 2005. This plan serves as a policy document outlining long range comprehensive development on the island of Hawaiʻi, providing broad goals, objectives, policies, and implementing actions that portray the desired direction of the County's future. Purposes of the General Plan include:

(A) Guide the pattern of future development in this County based on long-term goals;

(B) Identify the visions, values and priorities important to the people of this County; and

(C) Effect political and technical coordination in community improvement and development.

In addition to the goals and policies outlined in the General Plan, the Land Use Pattern Allocation Guide (LUPAG) Map, which is included in the plan, identifies areas where development should occur. The LUPAG, as shown on Figure 4-3, designates the majority of the KOA property as "Industrial." However, the project sites for Road M and the Hydrogen Fuel Station lie in areas designated "Conservation." The LUPAG "Conservation" designation of Road M and the Hydrogen Fuel Station are inconsistent with the State Land Use District for the area, which is designated Urban. Furthermore, the LUPAG "Conservation" designation is also inconsistent with the County Zoning which designates the majority of Road M and the Hydrogen Fuel Station as "Industrial." However, as the area has been previously developed, the State Land Use District and County zoning designations supersede the LUPAG designation.

The proposed project is consistent with the following applicable goals, objectives, policies, and actions of the *Hawai'i County General Plan*:

Economic

Goals:

(a) Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawai'i.

(b) Strive for diversification of the economy by strengthening existing industries and attracting new endeavors.

Policies:

(a) Encourage the development of a visitor industry that is in harmony with the social, physical, and economic goals of the residents of the County.

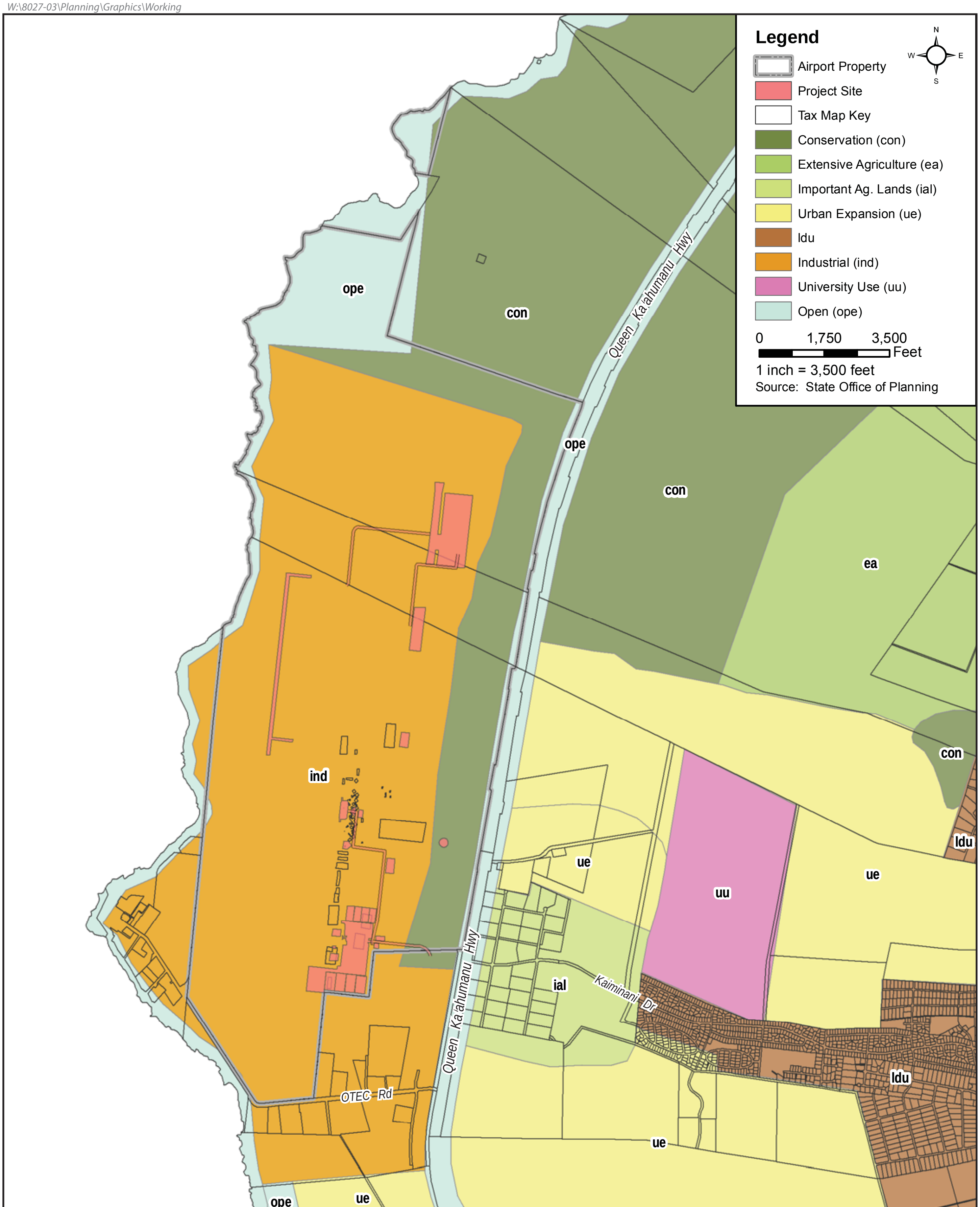
(b) Capital improvements program shall improve the quality of existing commercial and industrial areas.

Discussion: The proposed improvements do not directly involve the development of visitor accommodations, but KOA is an integral part of providing air transportation facilities supporting the visitor industry. The proposed terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights.

Energy

Goals:

(a) Strive towards energy self-sufficiency.



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

LAND USE PATTERN ALLOCATION GUIDE MAP

FIGURE 4-3

(b) Establish the Big Island as a demonstration community for the development and use of natural energy resources.

Policies:

(a) Encourage the development of alternate energy resources

(b) Ensure a proper balance between the development of alternative energy resources and the preservation of environmental fitness and ecologically significant areas.

(c) Strive to diversify the energy supply and minimize the environmental impacts associated with energy use.

The proposed SWAC system will help to reduce the electrical demand at the KOA terminal area. The construction of the Hydrogen Fueling Station will also reduce the reliance on nonrenewable resources by taking advantage of new technology using renewable energy sources. Locating the facility at KOA would not only serve residents and airport-operations related vehicles, but offer the option to visitors driving rental cars.

Land Use

Goals:

(a) Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural and physical environments of the County.

Policies:

(a) Encourage urban development within existing zoned areas already served by basic infrastructure, or close to such areas, instead of scattered development.

Discussion: The developed portions of KOA are zoned "MG-1a, General Industrial District" while the undeveloped portions are zoned "Open." Most of the proposed improvements lie within the MG District. Permitted uses in the MG district include airfields, heliports and private landing strips as well as public uses and structures. The proposed Medical Transitional Facility is not an allowable use under the MG designation and may require a zone variance from the County.

Improvements proposed within the Open district include the new GA Helicopter Facility, the ARFF Regional Training Center, the DOA Inspection Facility Site A, and a portion of Road M. The Open District allows for public uses and structures. Thus, the proposed improvements are allowable uses within both the MG and Open Districts.

The proposed improvements identified as public uses and structure will need to get a plan approval from the County Planning Department prior to construction in order to be in compliance with County zoning districts.

In addition, several of the proposed improvements are located within the State Conservation District. The new Helicopter Facility, the ARFF Regional Training Center, and the DOA Inspection Facility Site "A" are all located within the General subzone. The northern makai portion of the KATR expansion is partially located in the Protective subzone and the southern makai portion boarders the General subzone.

The proposed improvements that lie with the Conservation District will require a CDUP pursuant to DLNR's Administrative Rules, Title 13, Chapter 5 for lands designated in the Conservation District. Alternatively, DOT-A could petition the LUC to place the project sites located in the Conservation District into the Urban District through a Land Use District Boundary Amendment (LUDBA).

Public Facilities

Goal:

(a) Encourage the provision of public facilities that effectively service community and visitor needs and seek ways of improving public service through better and more functional facilities in keeping with the environmental and aesthetic concerns of the community.

Policy:

(a) Continue to seek ways of improving public services through coordination of service and maximizing the use of personnel and facilities.

Discussion: The proposed improvements are in response to the present and future needs of the airport so that it can continue to provide quality facilities for its visitors. The terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights.

Transportation – Transportation: Airports and Harbors

Goal:

(a) Provide transportation terminals and related facilities for the safe, efficient, and comfortable movement of people and goods.

Policies:

(a) Encourage the programmed improvement of existing terminals, including adequate provisions for control of pollution and appropriate and adequate covered storage facilities for agricultural products.
(b) The State Department of Transportation should continue to implement its plans for transportation terminals and related facilities to promote and influence desired land use policies
(c) Transportation terminals should be developed in conjunction with the different elements of the overall transportation system.
(d) Encourage maximum use of the island's airport and harbor facilities.

Discussion: The proposed improvements are in response to the present and future needs of the airport so that it can continue to provide quality facilities for its visitors. The terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights.

North/South Kona Courses of Action:

Policies:

(a) *Future land uses in the vicinity of the Kona International Airport at Keāhole should be compatible with the anticipated aircraft noise exposure levels for that vicinity.*

(b) *The State Department of Transportation should continue to improve and expand the Kona International Airport at Keāhole in accordance with the recommendations of the Keāhole-Kona International Airport Master Plan Update Study.*

Discussion: The existing and future aircraft noise contours for KOA developed during the 2010 14 CFR Part 150 Noise Compatibility Program Update were used to describe potential aircraft noise impacts associated with existing and future KOA operations. The expansion of the GA Facilities, the new Helicopter Facility, and the expansion and widening of the KATR were included in the noise modeling efforts and contours developed during the 2010 14 CFR Part 150 Noise Compatibility Program Update. However, the aircraft noise contours associated with the 2013 and Long Range (beyond 2022) forecast periods developed for KOA assumed that a new parallel runway would be in operation during the Long Range forecast period. Therefore, the Acoustic Study prepared for the proposed improvements in June 2012, included a new set of Long Range noise contours developed for conditions without the new parallel runway. The Long Range aircraft operations assumed in the 2010 14 CFR Part 150 Noise Compatibility Program Update were retained, but with all the operations remaining on the exiting runway, the KATR, and the new Helicopter runway.

Based on the current federal criteria for identifying aircraft noise impacts, the proposed improvements should not result in adverse noise impacts within the KOA environs. New land use incompatibilities beyond the airport boundaries should not occur as a result of the increases in airport noise levels with or without the proposed improvements. The primary reason is that adequate buffer distances exist between the airport runways and the nearest noise sensitive properties beyond the airport boundaries. Therefore, even with increasing aircraft operations at KOA, the resulting noise contours at the airport are not expected to result in new land use incompatibilities.

With the implementation of the proposed improvements, the near-term (2013) and long-term (2022) airport 60 DNL noise contours will enclose planned noise sensitive facilities within the airport boundaries. These planned facilities include the relocated Onizuka Space Center, the ARFF Regional Training Facility, and the Medical Transitional Facility. These facilities should be constructed with provisions for noise attenuation as they will be located within the 60 DNL noise contour.

The proposed improvements being assessed within this EA are in accordance with the recommendations of the 2010 Master Plan update. The major proposed improvements are based on recommendations from the Master Plan's short-term improvements list while the smaller improvements offer opportunities in the near-term.

4.2.2 Kona Community Development Plan

The County of Hawai‘i General Plan calls for the preparation of community development plans (CDPs) “to translate the broad General Plan statement to specific actions as they apply to specific geographical areas.” The Kona CDP is one of nine CDPs for Hawai‘i County. The purpose of the Kona CDP is to:

- Articulate Kona’s residents’ vision for the planning area;
- Guide regional development in accordance with that vision, accommodating future growth while preserving valued assets;
- Provide a feasible infrastructure financing plan to improve existing deficiencies and proactively support the needs of future growth;
- Direct growth to appropriate areas;
- Create a plan of action where government and the people work in partnership to improve the quality of life in Kona for those who live, work, and visit; and
- Provide a framework for monitoring the progress and effectiveness of the plan and to make changes and update it, if necessary.

The proposed project is consistent with the following applicable guiding principles, objectives and policies of the Kona CDP:

<u>Transportation</u>

Guiding Principles

2. Provide connectivity and transportation choices.

6. Provide infrastructure and essential facilities concurrent with growth.

8. Promote effective governance.

<u>Discussion</u>: KOA is an integral part of providing air transportation facilities supporting the visitor industry. The proposed improvements are in response to the present and future needs of the airport so that it can continue to provide quality facilities for its visitors. The terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights

<u>Environmental Resources</u>

Guiding Principles

1. Protect Kona’s natural resources and culture.

Objectives and Policies

1. *In order to minimize impacts on the land, make use of best management planning practices for any land-based endeavor by balancing public and private rights, and taking advantage of an ever improving knowledge of resource sensitivity and natural processes.*

2. *To develop a networked system of appropriate access to all significant open space resources that enhances opportunities for residents and visitors for recreational, educational, subsistence, or gathering purposes.*

Discussion: Construction activities will involve land-disturbing activities, such as grubbing, clearing, grading, and excavation that may result in some soil erosion and potential construction-related impacts to the quality of surface and coastal waters in the greater project vicinity. Various mitigative measures will be incorporated into the project's construction plan to minimize soil disturbances and potential short-term erosion impacts during construction activities. Excavation and grading activities associated with construction of the proposed project will be regulated by the County's grading ordinance and the NPDES permit requirement administered by the State DOH. A NPDES Individual Permit for Storm Water Associated with Construction Activity will be required for those projects anticipating soil disturbance exceeding one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

The proposed project is not anticipated to have any long-term impacts to land-based, shoreline, and marine resources. Following construction, exposed soils at the project site will have been built over, paved over, or re-vegetated to control erosion.

The proposed improvements are not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. The proposed improvements at KOA will be generally similar in visual character to those of the existing facilities and would be sensed as an intensification of the existing use.

Cultural Resources

Guiding Principles

1. *Protect Kona's natural resources and culture.*

Objectives and Policies

1. *Ensure that our Kanaka Maoli and island values and cultures are preserved and perpetuated.*

<u>Discussion</u>: An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in April 2012. Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Expansion; the relocated Onizuka Space Center, the Terminal Modernization Phase I; the High Pressure Hydrogen Fuel Storage and Fuel Station; and the DOA Inspection Facility Site "C". A lack of findings during 100 percent coverage of the proposed ARFF Regional Training Facility, which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location. No further work is also recommended for the Medical Transitional Facility, as thorough coverage of this site yielded no finds.

As the proposed Road M route traverses over older lava flow areas that may contain archaeological features, it is recommended that this area be studied further. In addition, as both potential DOA Inspection Facilities are situated on the same flows, should either of these sites be selected, it is recommended that the selected site be further studied as well. The Helicopter General Aviation facility and KATR are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection of these improvement areas. An inventory survey was recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC system heat exchanger site will require archaeological inventory, due to the discovery of previously-undocumented features in the immediate vicinity. It was recommended that the system water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, an inventory survey will be necessary.

Should any significant pre-Contact or historic deposits (i.e. subsurface concentrations of indigenous or historic era artifacts and/or structural remnants) or human burials be encountered during the course of development of the project site, the subsurface excavation work and/or surface grading will be halted in the immediate area and the SHPD will be notified immediately.

In addition, a CIA is being prepared for the entire airport property. The study area for the CIA will include ten ahupua'a; 'O'oma, Kalaoa, Hamanamana, Haleohiu, Maka'ula, Ka'ū, Pu'ukala, Awalua, Kaulana, and Mahai'ula. Access to and use of coastal resources appears to be of primary importance. However, as the proposed improvements are located on the existing airport property and are on the mauka side of the runway, with the exception of the KATR widening and expansion, the improvements are not anticipated to affect any cultural practices and/or resources in the project vicinity. Since there is currently no existing general public access to the shoreline through the airport due to aviation safety requirements, none of the proposed improvements, including the KATR widening and expansion, will further impeded such access.

Public Facilities, Infrastructure, and Services

Guiding Principles

1. *Protect Kona's natural resources and culture.*

2. *Provide connectivity and transportation choices.*

6. *Provide infrastructure and essential facilities concurrent with growth.*

7. *Encourage a diverse and vibrant economy emphasizing agriculture and sustainable economies.*

8. *Promote effective governance.*

Objectives and Policies

1. *To ensure access to healthcare and promote a healthy lifestyle.*

2. *To maximize recycling, reuse, and reduction.*

Discussion: KOA is an integral part of providing air transportation facilities supporting the visitor industry. The proposed improvements are in response to the present and future needs of the airport so that it can continue to provide quality facilities for Kona visitors. The terminal improvements will more efficiently process outbound passengers while the proposed commuter terminal at the renovated former ARFF Station will enhance passenger experience for commuter flights

The proposed SWAC system will help to reduce the electrical demand at the KOA terminal area. The construction of the Hydrogen Fueling Station will also reduce the reliance on nonrenewable resources by taking advantage of new technology using renewable energy sources. Locating the facility at KOA would not only serve residents and airport operations related vehicles, but offer the option to visitors driving rental cars.

Energy

Guiding Principles

1. *Protect Kona's natural resources and culture.*

2. *Provide connectivity and transportation choices.*

6. *Provide infrastructure and essential facilities concurrent with growth.*

7. *Encourage a diverse and vibrant economy emphasizing agriculture and sustainable economies.*

Objectives and Policies

1. *To provide a multi-prong framework, including standards, innovations, incentives, and education to reduce the dependency on imported fossil fuels through energy efficiency and renewable energy generation.*

Discussion: The proposed SWAC system will help to reduce the electrical demand at the KOA terminal area. The construction of the Hydrogen Fueling Station will also reduce the reliance on nonrenewable resources by taking advantage of new technology using renewable energy sources. Locating the facility at KOA would not only serve residents and airport operations related vehicles, but offer the option to visitors driving rental cars.

4.2.3 Kona International Airport at Keāhole Airport Master Plan

As stated in Chapter 1 of this document, the DOT-A recently completed the Master Plan Update for KOA (October 2010). The purpose of the update was to evaluate the airport's capabilities and role, to review forecasts of future aviation demand, and to plan for the timely development of new or expanded facilities that may be required to meet that demand. The ultimate goal of the master plan update is to provide systematic guidelines for the airport's overall development, maintenance, and operations for the next 20 years.

The proposed improvements being assessed within this EA are primarily from the Master Plan's short-term improvements list. In addition, a few smaller improvements that DOT-A is pursuing in the near-term. The improvements that are proposed in conjunction with the recommendations of the Master Plan are:

- Expansion of the GA Facilities;
- Construction of a new Helicopter Facility;
- Extension and Widening of the KATR;
- Construction of Road M;
- Relocation of the Onizuka Space Center;
- Construction of the Terminal Modernization Phase I;
- Construction of a Regional ARFF Training Facility; and,
- Interior renovations of the existing ARFF Station for a new Commuter Terminal.

It should be noted that the ultimate location of the Onizuka Space Center has changed since the Master Plan was prepared, however, the intent is to remove the Space Center from the terminal area to accommodate the terminal modernization. The other smaller improvements, while not specifically identified in the Master Plan, are consistent with the overall recommended Master Plan concept. The Hydrogen Fuel Station would be located at the existing Ground Transportation area and could be considered as an accessory use. The Medical Transitional Facility would be located in an area designated for aviation support facilities. And while the alignment of the SWAC line is not depicted on the master plan, the the Heat Exchanger Site was identified. Site "A" for the temporary DOA inspection Facility would be located in an area designated for a fuel farm while Site "B" would be located within an area designated for aviation support facilities. Site "C" would be located in the GA

Expansion area, but in an area shown as a lease lot. The permanent DOA facility would be built in conjunction with the new air cargo facility that is planned as a long-term improvement and designated in the Master Plan.

4.2.4 County of Hawaiʻi Zoning

Chapter 25 of the Hawaiʻi County Code regulates land use in accordance with adopted land use policies and it is also often referred to as the zoning ordinance. The County Code presents permitted uses and structures, development standards, and height controls for each zoning district.

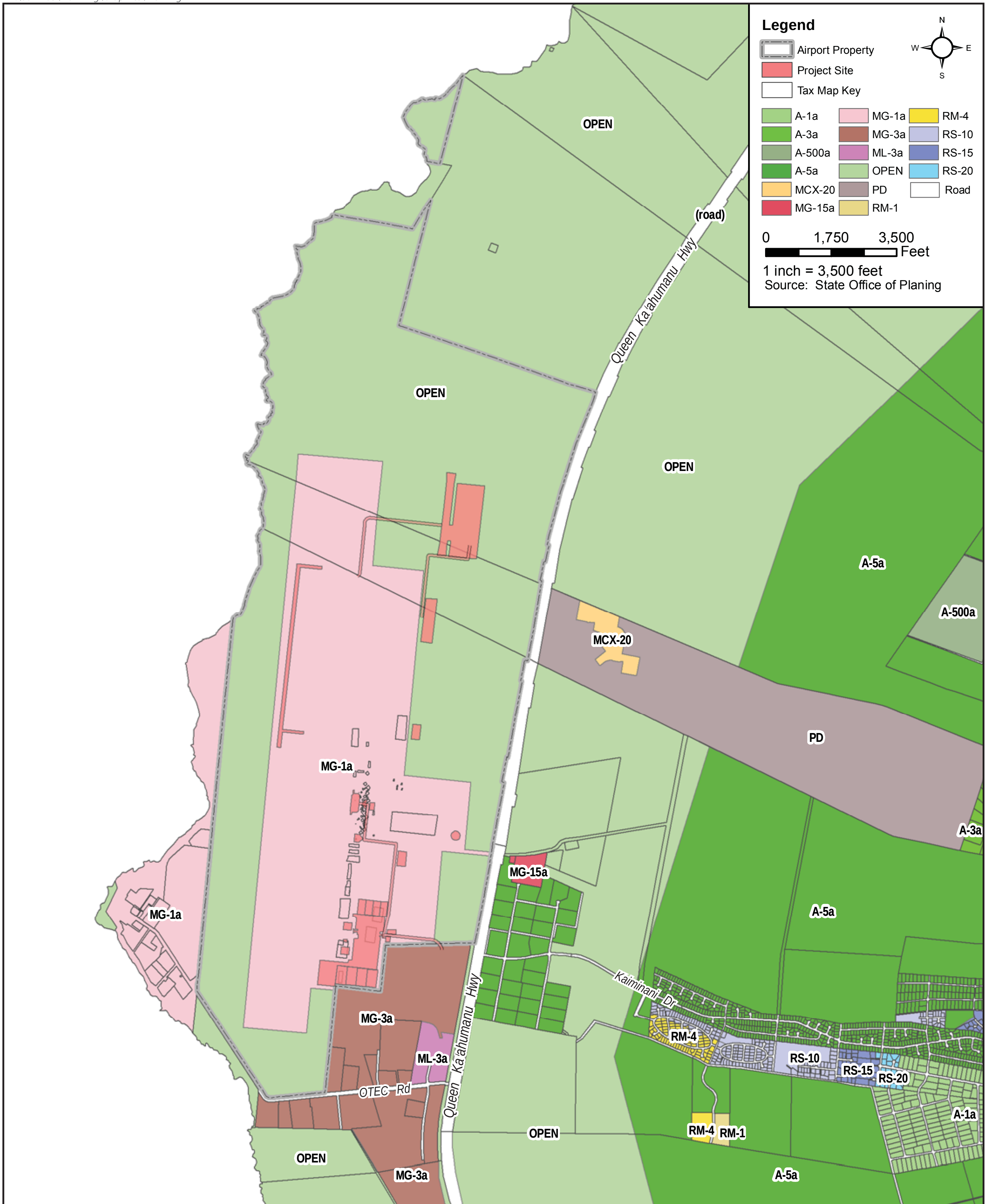
The zoning designations for the existing KOA development and the proposed improvements are shown in Figure 4-4. The developed portions of KOA are zoned "MG-1a, General Industrial District" while the undeveloped portions are zoned "Open". Proposed improvements located within the MG District include the expansion of the GA Facility, the extension and widening of the KATR, the majority of Road M, the SWAC system, the Onizuka Space Center, the Terminal Modernization Phase I, the Hydrogen Fuel Storage and Fueling Station, the Medical Transitional Facility, and the alternative DOA Inspection Facility Sites B and C. According to Section 25-5-150 of the County Code, "the MG district applies to areas for uses that are generally considered to be offensive or have some element of danger." The "-1a" following the MG designation indicates that the minimum number of acres required for each building site is 1-acre. The permitted uses for the MG district are listed in section 25-5-152. Permitted uses in the MG district include airfields, heliports and private landing strips as well as public uses and structures. The proposed Medical Transitional Facility is not an allowable use under the MG designation and may require a zoning variance from the County.

According to Section 25-5-160 of the County Code, "the Open district applies to areas that contribute to the general welfare, the full enjoyment, or the economic well-being of open land type use which has been established, or is proposed. The objective of this district is to encourage development around it such as a golf course and park, and to protect investments which have been or shall be made in reliance upon the retention of such open type use, to buffer an otherwise incompatible land use or district, to preserve a valuable scenic vista or an area of special historical significance, or to protect and preserve submerged land, fishing ponds, and lakes (natural or artificial tide lands)." Improvements proposed within the Open district include the new GA Helicopter Facility, the ARFF Regional Training Center, the DOA Inspection Facility Site A, and a portion of Road M. As the proposed improvements are public uses and structures, they are allowable in the Open district.

The proposed improvements identified as public uses and structures will need to get a plan approval from the County Planning Department before construction in order to be in compliance with the County zoning districts.

4.2.5 County of Hawaiʻi Special Management Area

Pursuant to the Hawaiʻi CZM Program, Chapter 205A, HRS, the counties have enacted ordinances establishing Special Management Areas (SMA). Any "development" within the



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

COUNTY OF HAWAII ZONING MAP

FIGURE 4-4

SMA requires an SMA Use permit administered by the County of Hawaiʻi Planning Department. Through the SMA permit system, the County assesses and regulates developments proposed for areas located within the SMA and the proposed developments are evaluated for compliance with the CZM objectives and policies and SMA guidelines set forth in Chapter 205A, HRS. Figure 4-5 shows that the entire KOA property is located within the SMA. The proposed improvements are consistent with the CZM objectives and policies as described in Section 4.1.5 of this document.

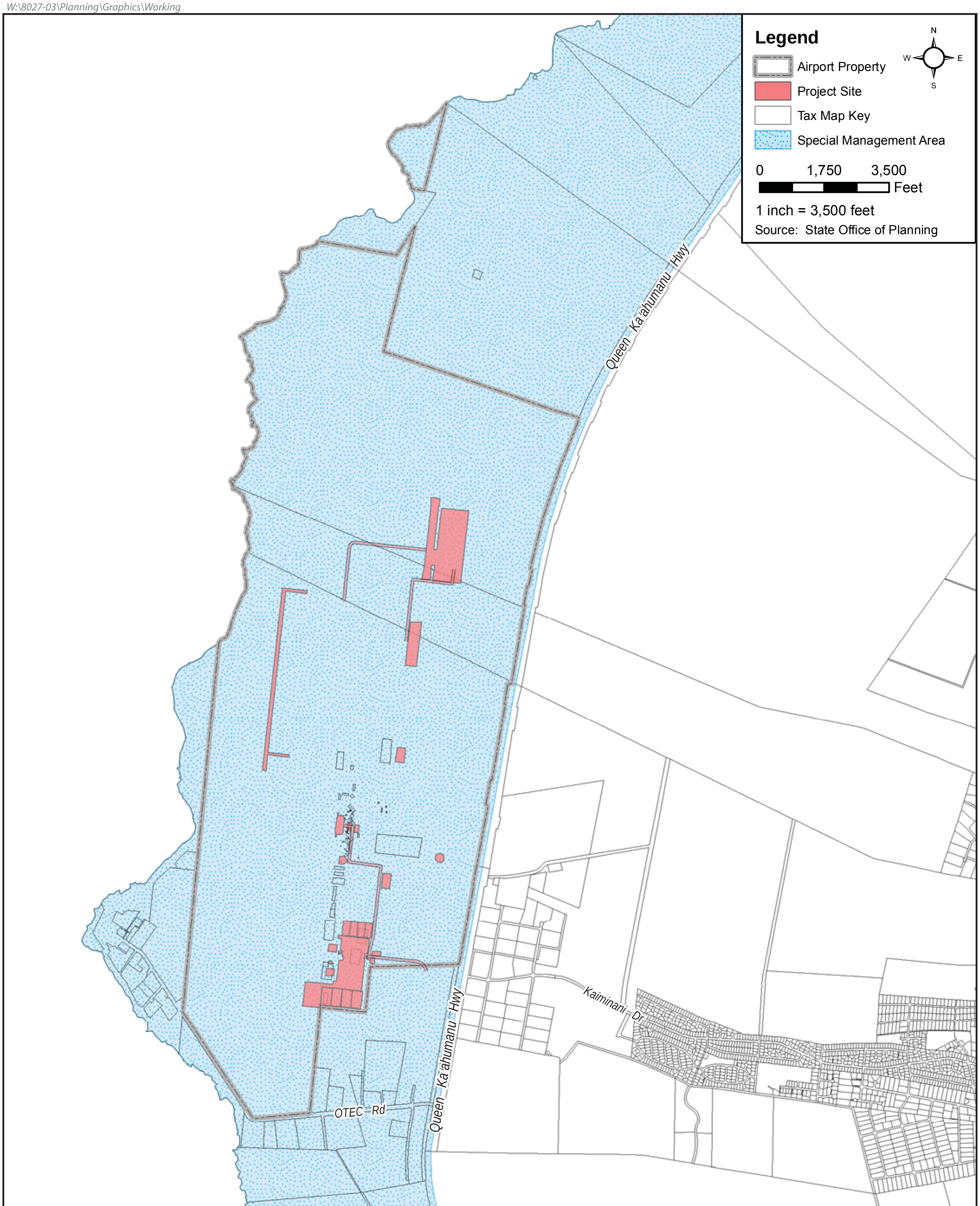
There is an existing SMA Use Permit (No. 325) that was approved by the County Planning Department in December 1991 for the airport based on improvements identified in the 1987 KOA Master Plan and on the 1991 Airport Layout Plan (ALP). Figure 4-6 shows the 1991 ALP with the currently proposed improvements overlayed to determine the differences in uses and/or structures that were approved to what is currently being proposed. Table 4-1 also identifies these differences.

TABLE 4-1
Comparison of Proposed Improvements with
SMA No. 325 Approved Improvements

	Proposed Use	**SMA No. 325 Approved Uses (1991 Airport Layout Plan)**	**Facility List No.**
1	Expansion of the GA Facilities	GA Area and Future Lease Lots	1 & 2
2	New Helicopter Facility	**Not Approved**	
3	Extension and Widening of the KATR	Future Taxiway	22
4	Road M	**Not Approved**	
5	SWAC System	Heliport Facilities	3
6	Ellison S. Onizuka Space Center	Existing Public Parking	8
7	Terminal Modernization	Existing Interisland Apron	10
8	Hydrogen Fuel Storage and Fueling Station	Ground Transportation Area	19
9	ARFF Regional Training Facility	Existing ARFF Training Facility	17
10	Medical Transitional Facility	Heliport Facilities	3
11	Temporary DOA Inspection Facility		
	Site A	**Not Approved**	
	Site B	Heliport Facilities	3
	Site C	Future Lease Lots	1
12	New Commuter Air Terminal	Existing ARFF Station	N/A

Based on Figure 4-6 and Table 4-1, the new Helicopter Facility, Road M, and the temporary DOA Inspection Facility Site A are not approved uses and would, therefore, require an amendment to the current SMA No. 325 to accommodate these specific projects.

The other proposed improvements are associated with previously approved projects. DOT-A will continue to work with the Department of Planning to determine which improvements will require an amendment to the existing SMA.



WILSON OKAMOTO CORPORATION
ENGINEERS ● PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

SPECIAL MANAGEMENT AREA MAP

FIGURE 4-5

4.3 Permits and Approvals

The following is a list of permits, approvals, and reviews that may be required prior to construction and operation of the proposed project.

Federal

Federal Aviation Administration
- National Environmental Policy Act (NEPA) Environmental Assessment

State Historic Preservation Officer
- National Historic Preservation Act, Section 106 Consultation

U.S. Fish and Wildlife Service
- Endangered Species Act, Section 7 Consultation

State of Hawai'i

Department of Health
- Noise Variance Permit
- National Pollutant Discharge Elimination System (NPDES) Individual Permit for Storm Water Associated with Construction Activity
- Underground Injection Control (UIC) Permit

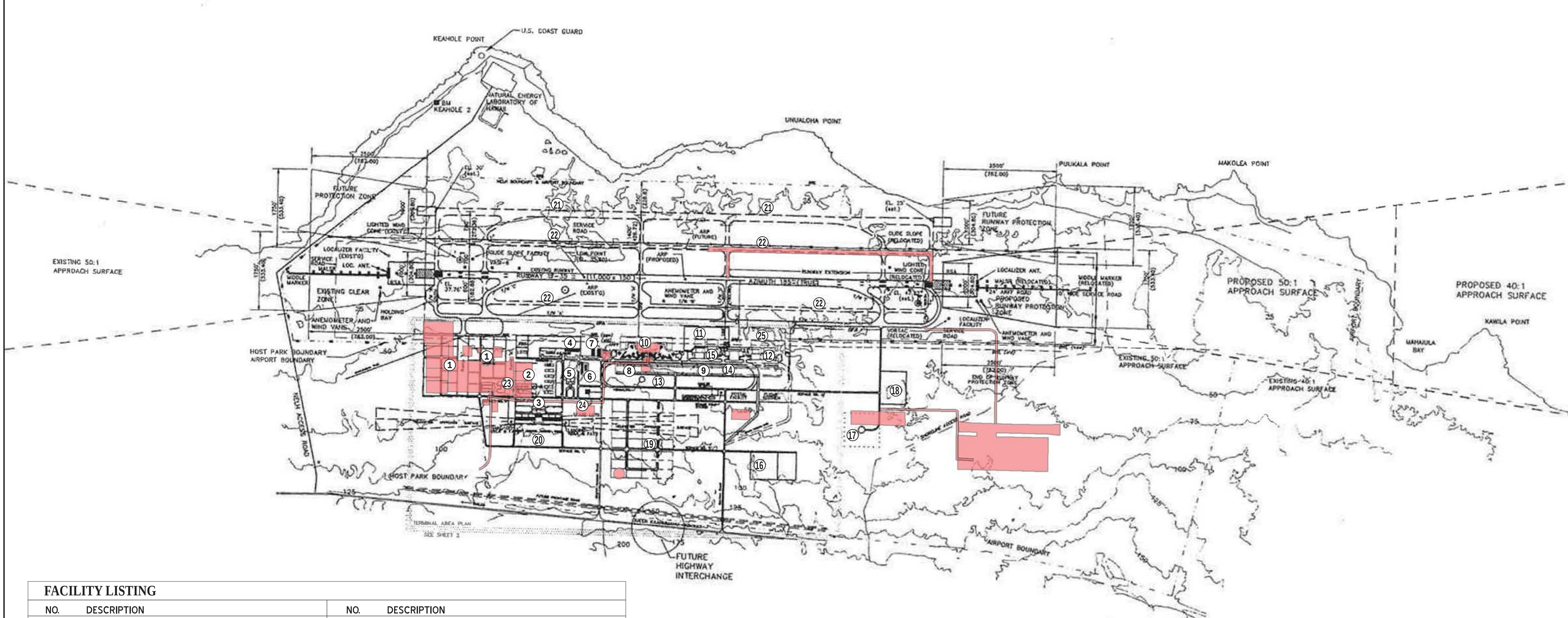
Department of Land and Natural Resources
- Chapter 6E, HRS, State Historic Preservation Law
- Conservation District Use Permit

Office of Planning
- Coastal Zone Management (CZM) Federal Consistency Certification

State Land Use Commission
- Land Use District Boundary Amendment

County of Hawai'i

Planning Department
- Special Management Area Use Permit
- Plan Approval
- Zoning Variance
- Grading/Grubbing Permit
- Building Permit



FACILITY LISTING

NO.	DESCRIPTION	NO.	DESCRIPTION
1	FBO LEASE LOTS	16	FUEL STORAGE AREA
2	GENERAL AVIATION AREA	17	ARF TRAINING FACILITY
3	HELIPORT FACILITIES	18	WASTEWATER TREATMENT PLANT
4	CARGO APRON	19	GROUND TRANSPORTATION AREA
5	FUEL STORAGE AREA	20	RESERVED FOR FUTURE HELIPORT EXPANSION
6	MAINTENANCE AREA	21	FUTURE RUNWAY
7	CONTAINER AND EQUIP. STORAGE	22	FUTURE TAXIWAY
8	EXTG. PUBLIC PARKING	23	COMMUTED TERMINAL
9	PARKING LOT EXPANSION	24	FAA RTR FACILITY
10	INTERISLAND APRON	25	FUTURE TERMINAL BUILDINGS
11	OVERSEAS APRON		PROPOSED PROJECT SITES
12	TAXI, BUS, LIMO PARKING		
13	ONIZUKA MEMORIAL		
14	GROUND TRANSPORTATION READY BLDG		
15	NEW OVERSEAS TERMINAL		

Source: Keahole Airport Master Plan, 1991

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS

Airfield, Terminal and Facility Improvements for the Kona International Airport at Keāhole

PROPOSED USES AND SMA NO.325 APPROVED USES

FIGURE 4-6

5. ALTERNATIVES

5.1 No Action Alternative

Under the no action alternative, the proposed improvements at KOA would not be pursued. Environmental impacts would be avoided, construction costs spared, and the need for permits precluded. The GA facilities would continue to be congested and lack the needed storage and hangar space. The continued mixing of rotary and fixed-wing aircraft would continue, thus posing a possible safety hazard as aviation activity increases for both types of aircraft. The KATR would be unable to act as an emergency and alternate runway, limiting its use to the Air Force. The terminal area would remain at its current design and continue to be divided by the Onizuka Space Center. The DOA inspections would continue to be conducted under a tent near the International Arrivals area. The Commuter Air Terminal would remain where it is and continue to deteriorate. The ARFF Regional Training Center, the Medical Transitional Facility, the SWAC System, the Hydrogen Fuel Storage and Fueling Station, and Road M would not be realized.

5.2 Alternative 1: Other Master Plan Alternatives

The following proposed improvements were identified in the Master Plan update:

- Expansion of the GA Facilities;
- Construction of a new Helicopter Facility;
- Extension and Widening of the KATR;
- Construction of Road M;
- Relocation of the Onizuka Space Center;
- Construction of the Terminal Modernization;
- Construction of an ARFF Regional Training Facility; and
- Interior renovations of the existing ARFF Station for a new Commuter Terminal.

The Master Plan examined alternative facilities, development concepts and locations for each of these proposed improvements. These alternatives are summarized below:

<u>GA and Helicopter Facilities</u>: The Master Plan examined various concepts for the GA and Helicopter facilities, including separate and combined locations. In general, the alternative GA facility expansion configurations were adjacent to its current location. The helicopter (rotary wing) operations co-located with the fixed-wing operations included combinations where the helicopter facilities were located to the north and east of the fixed-wing GA facility. Locations for a separate rotary-wing facility included the currently proposed location, as well as a site located mauka of Pāoʻo Street. All of the concepts that located the helicopter facility near the GA facility were dismissed due to visibility issues from the ATCT. The proposed separation was evaluated to be optimal as the continued mixing of helicopters (rotary wing) and fixed-wing aircraft poses a potential safety hazard.

<u>Road M</u>: Alternative alignments for Road M were evaluated in the context of broader transportation circulation alternatives. The preferred transportation circulation concept determined the location of the proposed Road M.

Onizuka Space Center: The master plan recommended relocating the Onizuka Space Center near the ground transportation area, adjacent to the intersection of Keāhole Street and Halalū Street. However, since that site has State Land Use Conservation designation, a Conservation District Use Application (CDUA) would need to be approved for a previously undeveloped site. The proposed site is in an existing developed area near the Space Center's existing location, is designated Urban and zoned Industrial (MG-1a). This site is closer to pedestrian passenger movement, where it could attract more visitors. Moreover, there are existing utility connections that can be easily extended to service the relocated facility.

Terminal Modernization: Different configurations for modernizing the terminal area were considered. Several concepts left the terminal as is (two terminals with the Onizuka Space Center between them) and building an international terminal either to the north or south of the existing terminal area. These concepts were dismissed as they would incur high costs to relocate existing uses, demolish existing facilities, and construct new facilities. The proposed improvement only relocates the Onizuka Space Center. This is more cost efficient and allows the two terminal areas to be connected with a centralized check-in and ticketing area, thus streamlining the process for the travelling public.

ARFF Regional Training Facility: KOA is one of two locations being considered for the ARFF Regional Training Facility. The other location being considered is Kalaeloa on the island of O'ahu. However, KOA is the preferred site as there are no residential communities and schools in the immediate vicinity, and KOA has an exiting burn pit that can be utilized.

Commuter Terminal: In conjunction with the GA facility concepts, different locations for the Commuter Terminal were also considered. These include sites immediately west of the GA facility. However, since the existing ARFF Station building will be vacated, it would be more cost efficient to renovate an existing building than constructing a new structure. In addition, the location of the existing ARFF Station is ideal as it has direct access to the tarmac and is closer to the terminal area, making it more convenient for passengers walking between them.

5.3 Alternative 2: Other Location Alternatives for Improvements not Included in the Master Plan

Hydrogen Storage and Fueling Station: Alternative and additional locations for the Hydrogen Storage and Fueling Station were and are still being considered, such as near the fuel farm for the airport operations related vehicles. However, as a part of the proposed hydrogen highway project, locating the proposed fueling station near the car rental facilities has the advantage of serving the airport, residents, and visitors.

SWAC System: Alternate routes for the SWAC seawater lines were considered. However, based on the archaeological literature review and field inspection prepared for the airport property, DOT-A has determined that proposed route for the seawater lines would have the least potential for affecting archaeological sites if they followed existing roadways.

Medical Transitional Facility: The concept of the Medical Transitional Facility is that it be located on airport property or as near to the airport as possible. This would minimize time spent in transit for doctors and patients. For doctors, it would minimize the time spent between the passenger terminal and the clinic where they see the patients. For patients, ti would minimize the time spent without medical support facilities and boarding a plane to take them to their destination medical facility. The location selected in the aviation support area is appropriate as it is situated near the airline terminal, the commuter terminal, and the GA facility.

(This page intentionally left blank)

6. ANTICIPATED DETERMINATION OF FONSI

The proposed project involves the following improvements:

Potential impacts of the proposed improvements have been evaluated in accordance with the significance criteria of Section 11-200-12 of the Department of Health's Administrative Rules. Discussion of the project's conformance to the criteria is presented as follows:

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

The proposed improvements have been designed to avoid impacts to archaeological resources in the project vicinity. An Archaeological Literature Review and Field Inspection for the project site was conducted for the property in April 2012. Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Expansion; the relocated Onizuka Space Center, the Terminal Modernization Phase I; the High Pressure Hydrogen Fuel Storage and Fuel Station; and the DOA Inspection Facility Site "C". A lack of findings during 100 percent coverage of the proposed ARFF Regional Training Facility, which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location. No further work is also recommended for the Medical Transitional Facility, as thorough coverage of this site yielded no finds.

Given their situation over older lava flow areas containing archaeological features, the proposed Road M route and the DOA Inspection Facility Sites "A" and "B" are recommended for further study. The Helicopter General Aviation facility and KATR are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection of these improvement areas. An inventory survey was recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC system heat exchanger site will require archaeological inventory, due to the discovery of previously-undocumented features in the immediate vicinity. It was recommended that the system water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, an inventory survey will be necessary.

Should any significant pre-Contact or historic deposits (i.e. subsurface concentrations of indigenous or historic era artifacts and/or structural remnants) or human burials be encountered during the course of development of the project site, the subsurface excavation work and/or surface grading will be halted in the immediate area and the SHPD will be notified immediately.

There will be no destruction or loss of any significant, endangered, or threatened botanical, faunal, geological, or other natural resources. None of the plant or animal species identified within the project site are threatened or endangered, or are a species of concern. There is no federally delineated Critical Habitat within or close to the project site, thus construction and operation of the proposed improvements will not result in any impacts to federally designated Critical Habitat.

To mitigate impacts to seabirds, it was recommended that if nighttime construction activity or equipment maintenance is proposed during the construction phase of the improvements, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground. It was further recommended that any streetlights, security, and/or facility lighting installed in conjunction with the proposed improvements be shielded. This minimization measure would serve the dual purpose of minimizing the threat of disorientation and downing of Hawaiian Petrels and Newell's Shearwaters, while at the same time complying with the Hawai'i County Code §14-50 et seq. which requires the shielding of exterior lights so as to lower the ambient glare caused by unshielded lightening to the astronomical observatories located on Mauna Kea.

(2) Curtails the range of beneficial uses of the environment;

The proposed project will not curtail the beneficial uses of the environment. Use of the project site for the proposed project would be consistent with its current use as an airport.

(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's relationship to the environmental policies or goals and guidelines as expressed in Chapter 344 HRS, is discussed in Section 4.1.4 of this document.

(4) Substantially affects the economic or social welfare of the community or state;

In the short term, the proposed improvements will confer positive benefits in the local economy. Direct economic benefits will result from construction expenditures both through the purchase of material from local suppliers and through the employment of local labor, thereby stimulating that sector of the economy. Indirect economic benefits may include benefits to local retailing businesses resulting from construction activities. In the long-term, the proposed expansion of the GA facilities offers economic opportunities for related aviation activities. The proposed ARFF Regional Training Facility can draw participants statewide to the Kona area, generating business for local establishments serving visitors and the use of Hydrogen fuels can generate associated jobs beyond traditional transportation fuels.

There are no significant adverse long-term socio-economic impacts anticipated with the proposed improvements. The improvements to the airport are not expected to induce growth beyond that which is predicted for the airport.

(5) Substantially affects public health;

No significant adverse long-term impacts on public health are anticipated as a result of implementing the proposed improvements.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities;

No secondary effects are anticipated with the construction or operation of the proposed improvements. The improvements, in and of themselves, are not anticipated to affect the population of the Kona District. Rather, the proposed improvements are meant to meet the current and future needs at the airport resulting from growth of population and visitor industry in West Hawaiʻi.

(7) Involves a substantial degradation of environmental quality;

The proposed project is not anticipated to involve a substantial degradation of environmental quality.

Construction activities associated with the proposed improvements will create some adverse short-term impacts such as unavoidable noise impacts and air quality impacts from soil excavation and other ground disturbance activities. Unavoidable construction noise impacts on nearby land uses in the immediate vicinity of the proposed project will be mitigated to some degree by complying with the provisions of the State DOH Administrative Rules, Title 11, Chapter 46, Community Noise Control. Potential air quality impacts during construction of the proposed project will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60, Air Pollution Control.

Potential water quality impacts to surface and near shore coastal waters during construction of the proposed improvements will be mitigated by adherence to State and County water quality regulations governing grading, excavation, and stockpiling. An NPDES Individual Permit for Storm Water Associated with Construction Activity will be required for those projects anticipating soil disturbance exceeding one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

In the long-term, no significant air quality, noise, or water quality impacts are anticipated from the operation of the proposed project.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

The project site is currently and will continue to be used as an airport facility. Construction and operation of the proposed improvements continues as a commitment to that use.

(9) Substantially affects a rare, threatened, or endangered species, or its habitat;

No listed, candidate, or proposed rare, threatened, or endangered species of flora or fauna under either the Federal or State endangered species statutes nor any critical habitat units will be disturbed as a result of the proposed improvements.

To mitigate impacts to seabirds, it was recommended that if nighttime construction activity or equipment maintenance is proposed during the construction phase of the improvements, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground. It was further recommended that any streetlights, security, and/or facility lighting installed in conjunction with the proposed improvements be shielded. This minimization measure would minimize the threat of disorientation and downing of Hawaiian Petrels and Newell's Shearwaters.

(10) Detrimentally affects air or water quality or ambient noise levels;

No long-term significant impacts to air quality within the project site are anticipated with the construction of the proposed project.

An air quality study for the proposed improvements was prepared in April 2012. Short-term direct and indirect impacts on air quality could potentially occur due to construction and operation of the proposed improvements. Potential air quality impacts during construction will be mitigated by complying with the State DOH Administrative Rules, Title 11, Chapter 60-11.1 "Air Pollution Control." Compliance with State regulations will require adequate measures to control fugitive dust by methods such as water spraying and sprinkling of loose or exposed soil or ground surface areas and dust-generating equipment during construction. Exhaust emissions from construction vehicles are anticipated to have negligible impact on air quality in the vicinity as the emissions would be relatively small and readily dissipated.

In the long-term (Year 2022), without the proposed improvements, carbon monoxide concentrations were predicted to remain about the same or decrease slightly in the project area, and concentrations should remain within State and Federal standards. With the proposed improvements in the Year 2022, carbon monoxide concentrations would remain the same or increase slightly compared to without improvements, and concentrations would remain within State and Federal standards. Implementing mitigation measure for traffic-related air quality impacts is most likely unnecessary and unwarranted.

With or without the proposed improvements, aircraft operations are expected to increase by 2022, and the associated air pollution emissions will increase proportionally. However, the proposed improvements are not expected to affect the number or type of aircraft operations. Thus, the proposed improvements should not result in an increase in air pollution emissions form aircraft operations at the airport.

The proposed Regional ARFF Training Facility will include the use of the existing burn pit as well as a fuel spill trainer, a specialized aircraft fire trainer, and a three story-burn building. While these uses may affect air quality in the area due to the burning of fuels for training exercises, their use will be relatively infrequent and would not be permitted to exceed air quality standards as set forth in the national and State AAQS.

In the short term, potential water quality impacts to surface and near shore coastal waters during construction of the project will be mitigated by adherence to State and County water quality regulations governing grading, excavation, and stockpiling. An NPDES Individual Permit for Storm Water Associated with Construction Activity will be required for those projects anticipating soil disturbance exceeding one acre. Mitigation measures will be instituted in accordance with site-specific assessments, incorporating appropriate structural and/or non-structural BMPs such as minimizing time of exposure between construction and landscaping, and implementing erosion control measures such as silt fences and sediment basins. Following the associated construction activity, the excavated areas will be paved over or backfilled to its graded contours or re-vegetated to control erosion.

Construction activities are not likely to introduce to, nor release from the soil any materials which could adversely affect groundwater. Construction material wastes will be appropriately disposed of and must also be prevented from leaching into receiving bodies of water. Dewatering activity is not anticipated for this project.

An acoustic study for the proposed improvements was conducted in June 2012. In the short-term, unavoidable, but temporary noise impacts may occur during construction activities at KOA. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. Construction noise impacts will be mitigated by compliance with provisions of the State DOH Administrative Rules, Title 11, Chapter 46, “Community Noise Control” noise control regulations. These rules require a noise permit if noise levels from construction activities are expected to exceed the allowable range. It shall be the contractor’s responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment, and to maintain noise levels within regulatory limits. The contractor must also adhere to the guidelines for the hours of heavy equipment operation and noise curfew times as set forth by DOH noise control regulations. In addition, these rules require a noise variance for any night work that may occur. Night work is anticipated for some project improvements, and for such work, a noise variance will be obtained.

In the long-term, risks of future traffic noise impacts resulting form the proposed improvements are considered to be low due to the relatively small increases in traffic noise associated with the projects. The largest increases in traffic noise attributable to the proposed improvements are anticipated to occur along Pāoʻo Street within the airport property. The largest forecasted increase within the airport property is approximately 3 DNL from year 2011 to 2022. These changes in traffic noise levels will be very difficult to detect over the 11 year period of the proposed improvements, and risks of traffic noise impacts from KOA should be very low.

Traffic noise level increases along Queen Kaʻahumanu Highway are predicted to be 5 DNL due to non-project traffic and 0.3 DNL or less due to project traffic. Along Queen

Ka‘ahumanu Highway in the airport environs, risks of adverse traffic noise impacts are expected to be minimal due to the relatively small increases in traffic volumes associated with the project. Mitigation of existing or future traffic noise impacts along Queen Ka‘ahumanu Highway are expected to occur during the planned widening of the highway and/or during improvements to the properties along the highway by individual property owners.

Based on the current federal criteria for identifying aircraft noise impacts, the proposed improvements should not result in adverse noise impacts within the KOA environs. New land use incompatibilities beyond the airport boundaries should not occur as a result of the increases in airport noise levels with or without the proposed improvements. The primary reason is that adequate buffer distances exist between the airport runways and the nearest noise sensitive properties beyond the airport boundaries. Therefore, even with increasing aircraft operations at KOA, the resulting noise contours at the airport are not expected to result in new land use incompatibilities.

With the implementation of the proposed improvements, the near-term (2013) and long-term (2022) airport 60 DNL noise contours will enclose planned noise sensitive facilities within the airport boundaries. These planned facilities include the relocated Onizuka Space Center, the ARFF Regional Training Facility, and the Medical Transitional Facility. These facilities should be constructed with provisions for noise attenuation as they will be located within the 60 DNL noise contour.

(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, fresh water, or coastal waters;

No short or long-term significant impacts are anticipated as KOA is not located within an environmentally sensitive area.

According to the Flood Insurance Rate Map (FIRM) (Community Panel Numbers 1551660466C, 1551660468C, 1551660681C and 1551660683C, Effective Date: September 16, 1988 prepared by the Federal Emergency Management Agency (FEMA)), the project site is located within Zone “X”, defined as “Areas determined to be outside the 0.2% annual chance floodplain.” The project site is located outside of the tsunami inundation zone.

Construction and operation of the proposed improvements are not anticipated to increase flood risks or cause any adverse flood-related impacts at the project site or lower elevation properties.

Earthquakes in the Hawaiian Islands are primarily associated with volcanic eruptions from the expansion or shrinkage of magma reservoirs. Earthquakes are fairly common on the island of Hawai‘i where active volcanism at Kīlauea is a source of significant seismicity. The UBC designates the entire island of Hawai‘i as a Seismic Zone 4, the highest rating among the major Hawaiian Islands. The proposed improvements will be designed and built to Seismic Zone 4 standards of the UBC to ensure that potential seismic activities do not adversely affect the project buildings.

(12) Substantially affects scenic vistas and viewplanes identified in county or state plans or studies; or,

The proposed improvements are not anticipated to have significant impacts on notable view planes nor adversely affect important public viewing points or visual resources. The proposed improvements at KOA will be generally similar in visual character to those of the existing facilities and would be sensed as an intensification of the existing use.

(13) Requires substantial energy consumption.

Operation of the proposed project will not result in a significant increase in energy consumption. The DOT-A has recently installed a photo voltaic array that can be expanded to meet the airports current and future needs for electricity. In addition, the installation of the SWAC system will also help to reduce the airport's energy consumption.

(This page intentionally left blank)

7. CONSULTATION

7.1 Pre-Assessment Consultation

The following agencies and organization were consulted during the preparation of the Draft EA. Of the 68 parties that formally replied during the pre-assessment period, some had no comments while others provided substantive comments as indicated by the ✓ and ✓✓, respectively. All written comments are reproduced in Appendix H.

Federal Agencies

U.S. Army Corps of Engineers (COE)
✓✓ COE, Civil Works Technical Branch
✓✓ COE, Regulatory Branch
U.S. Coast Guard
U.S. Department of Agriculture (DOA)
U.S. Department of Homeland Security (DHS)
DHS, Customs and Border Protection
DHS, Transportation Security Administration
U.S. Environmental Protection Agency
✓✓ Federal Aviation Administration
Federal Highway Administration
✓✓ U.S. Fish and Wildlife Service
✓ U.S. Geological Survey
U.S. Natural Resources Conservation Service (NRCS)
National Oceanic and Atmospheric Administration (NOAA)
✓✓ NOAA, Habitat Conservation Division
✓✓ NOAA, National Marine Fisheries Service (NMFS)
U.S. Postal Service

State Agencies

Department of Agriculture
✓ Department of Accounting and General Services
Department of Business, Economic Development and Tourism (DBEDT)
DBEDT, Hawaiʻi Housing Finance and Development Corporation
DBEDT, Hawaiʻi State Energy Office
DBEDT, Hawaiʻi Tourism Authority
DBEDT, Office of Planning
✓✓ Department of Defense
Department of Education
✓ Department of Hawaiian Home Lands
Department of Health (DOH)
✓✓ DOH, Clear Air Branch
✓✓ DOH, Clean Water Branch
Department of Human Services
✓ Department of Labor and Industrial Relations
Department of Land and Natural Resources (DLNR)

State Agencies (Continued)

✓ DLNR, Aquatics Division
✓✓ DLNR, Office of Conservation and Coastal Lands
DLNR, State Historic Preservation Division
✓✓ Natural Energy Laboratory of Hawaiʻi Authority
✓✓ Office of Hawaiian Affairs
University of Hawaiʻi Environmental Center
✓✓ Department of Transportation (DOT)
DOT, Highways Division
✓ DOT, Harbors Division
DOT, Statewide Transportation Planning Office

County of Hawaiʻi Agencies

✓ Department of Environmental Management
✓✓ Department of Planning
Department of Parks and Recreation
Department of Public Works
Department of Transportation
Department of Water Supply
Police Department
✓✓ Fire Department
Office of the Mayor

Elected Officials

Senator Josh Green
Senator J. Kalani English
Representative Cindy Evans
Representative Joseph Souki
Governor's Representative – West Hawaiʻi
Hawaiʻi County Council Chair Dominic Yagong,

Other Interested Parties and Individuals

Big Island Visitors Bureau
✓✓ Greeters of Hawaiʻi
Hawaiʻi Leeward Planning Conference
Hokulia
✓✓ Kohala Coast Resort Association
Kona-Kohala Chamber of Commerce
✓✓ West Hawaiʻi Regional Board
✓✓ Mr. Bob Ward
Ms. Hannah Springer

7.2 Draft Environmental Consultation

The following agencies and organization will be consulted during the public review period of the Draft EA:

Federal Agencies

- U.S. Air Force
- U.S. Army Corps of Engineers (COE)
  - COE, Civil Works Technical Branch
  - COE, Regulatory Branch
- U.S. Coast Guard
- U.S. Department of Agriculture (DOA)
- U.S. Department of Homeland Security (DHS)
  - DHS, Customs and Border Protection
  - DHS, Transportation Security Administration
- U.S. Environmental Protection Agency
- Federal Aviation Administration
- Federal Highway Administration
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- U.S. Natural Resources Conservation Service (NRCS)
- National Oceanic and Atmospheric Administration (NOAA)
  - NOAA, Habitat Conservation Division
  - NOAA, National Marine Fisheries Service (NMFS)
- U.S. Postal Service

State Agencies

- Department of Agriculture
- Department of Accounting and General Services
- Department of Business, Economic Development and Tourism (DBEDT)
  - DBEDT, Hawai‘i Housing Finance and Development Corporation
  - DBEDT, Hawai‘i State Energy Office
  - DBEDT, Hawai‘i Tourism Authority
  - DBEDT, Office of Planning
- Department of Defense
- Department of Education
- Department of Hawaiian Home Lands
- Department of Health (DOH)
  - DOH, Clear Air Branch
  - DOH, Clean Water Branch
- Department of Human Services
- Department of Labor and Industrial Relations
- Department of Land and Natural Resources (DLNR)
  - DLNR, Aquatics Division
  - DLNR, Office of Conservation and Coastal Lands
  - DLNR, State Historic Preservation Division
- Natural Energy Laboratory of Hawai‘i Authority
- Office of Hawaiian Affairs
- University of Hawai‘i Environmental Center
- Department of Transportation (DOT)
  - DOT, Highways Division

State Agencies (Continued)

DOT, Harbors Division
DOT, Statewide Transportation Planning Office

County of Hawai'i Agencies

Department of Environmental Management
Department of Planning
Department of Parks and Recreation
Department of Public Works
Department of Transportation
Department of Water Supply
Police Department
Fire Department
Office of the Mayor

Elected Officials

Senator Josh Green
Senator J. Kalani English
Representative Cindy Evans
Representative Joseph Souki
Governor's Representative – West Hawai'i
Hawai'i County Council Chair Dominic Yagong,

Other Interested Parties and Individuals

Big Island Visitors Bureau
Greeters of Hawai'i
Hawai'i Leeward Planning Conference
Hokulia
Kohala Coast Resort Association
Kona-Kohala Chamber of Commerce
Onizuka Memorial Committee
West Hawai'i Regional Board
Mr. Bob Ward
Ms. Hannah Springer

7.3 Public Information Meeting

A public information meeting was held on February 9, 2012 at Kealakehe Elementary School. A copy of the meeting notes is included in Appendix G.

The purpose of the meeting was to apprise the community of the project and solicit verbal and written comments from the community at-large. The meeting format included a power point presentation of the proposed improvements, followed by questions and comments from the meeting attendees.

A summary of the questions and comments received at the meeting is included below.

1. Transportation Improvements:

   - Has an agreement in principal, memorandum of agreement, or memorandum of understanding been reached with Natural Energy Laboratory of Hawaiʻi Authority (NELHA) regarding Road M? Is there a timetable for the implementation construction?
   - I understand that NELHA will conduct an Environmental Assessment for various improvements to its facilities, would it be possible for DOT-A to work with collectively NELHA to have the improvements to Road M incorporated uniformly into both EA's. It would seem that this would facilitate development/construction.
   - How do these improvements fit within the community, and how are they aligned with the Kona Community Development Plan (CDP)? It looks like access with NELHA is well underway, and the tying in with the Kaʻiminani Drive intersection, which is being done in conjunction with the Queen Kaʻahumanu Highway widening. What is the timeframe for the completion of the second major access point (Further north, intersecting with University Drive)? How far off will this be?
   - How do these improvements fit in with Transit? – it was nice to see the inclusion of a hydrogen storage fueling facility. Are there plans along with the infrastructure and new economic development opportunities to expand with transit, in conjunction with the county's transportation service? Are there plans to incorporate additional mass-transit?
   - This deals with an expansion of discussion on transit – this Airport is either the number 1 or number 2 daily destination – the Kona CDP contains a shared use pathway/coastal route – how will pedestrians and bicyclists be integrated/aligned with existing plans?

   Response: *DOT-A currently has no formal agreement with NELHA regarding the design and construction of Road M, however, DOT-A will continue to coordinate with NELHA as the project moves forward. Presently, there is no time table for the construction of Road M.*

   The time frame for the developing a second major access point to the airport is currently unknown and falls outside of the timeframe of this EA, however, it remains a part of the airport's long-range plan. There are no formal plans for incorporating County transit service to KOA at this time, however, DOT-A has had informal discussions with the County, which is exploring the implementation of transit services to and from Palamanui and the University of Hawaiʻi, West Hawaiʻi Campus, as well as to major resort areas.

   While there are also no formalized plans for a shared use pathway and/or coastal route, the open-air architecture and nature of the KOA lends itself to the integration of pedestrians and bicyclists. It is possible that a scenic pedestrian trail mauka of the Kūpīpī Street parking lot could be developed to facilitate accessibility to nearby cultural resources.

2. <u>Terminal Improvements</u>:

- Could you provide more details regarding the terminal area expansion?
- Regarding "Jetways", I understand that there is a legitimate argument for them (incorporation of Jet ways into facility design), but are measures being taken to mitigate their visual impact? Do you have any renderings?
- To clarify, will the proposed terminal improvements result in a multilevel structure? Could measures be taken (in terms of design), to reduce the height/visual impact of the proposed changes?

Response: *The purpose of the terminal modernization project is to improve efficiency and technological integration. To proceed with this project, the Onizuka Space Center will need to be relocated. The proposed project in its place includes the construction of a centralized passenger and baggage check-in and TSA checkpoint, a centralized baggage handling system, and a communication system including a new flight information system (FIDS), a baggage information system (BIDS), and a gate information system (GIDS). DOT-A wishes to clarify that "jetways" are not included among the currently proposed terminal improvements and the proposed building is a single-story structure with a sub-grade baggage transport system.*

DOT-A intends to maintain the architectural presence and character of the existing terminal buildings. The design of the terminal modernization project is still in the conceptual development, therefore, there are presently no renderings. Aircraft dimensions will dictate the design parameters, however, building height will be taken into consideration.

DOT-A has, and will continue to emphasize the existing aesthetic character and atmosphere of KOA throughout the design and planning process for the terminal modernization project. As the project moves forward, DOT-A will arrange stakeholder meetings to provide an opportunity for the interested community to discuss and share their input regarding possible design plans.

3. <u>Other Proposed Facilities</u>:

- Is there a timeframe for implementation (of the Medical Transitional Facility)?

Response: *Currently, there is no definite timeframe. The proposed Medical Transitional Facility is still being conceptually developed; however, its development is anticipated to fall within a 5-10 year timeframe for implementation.*

8. REFERENCES

County of Hawaiʻi. *County of Hawaiʻi General Plan*. February 2005

County of Hawaiʻi. *Kona Community Development Plan*. September 2008.

Federal Emergency Management Agency, Flood Insurance Rate Map. *County of Hawaiʻi, Map Number 1*1551660466C. Revised September 16, 1988.

Federal Emergency Management Agency, Flood Insurance Rate Map. *County of Hawaiʻi, Map Number* 1551660468C. Revised September 16, 1988.

Federal Emergency Management Agency, Flood Insurance Rate Map. *County of Hawaiʻi, Map Number* 1551660681C. Revised September 16, 1988.

Federal Emergency Management Agency, Flood Insurance Rate Map. *County of Hawaiʻi, Map Number* 1551660683C. Revised September 16, 1988.

International Code Council, Inc. *International Building Code*. January 2006.

Keāhole Associates, Inc. *Kona International Airport at Keāhole Master Plan Update, Keāhole, North Kona, Hawaiʻi.* November 2000.

Kober, Hanssen, Mitchell Architects. *Kona International Airport at Keāhole, Keāhole North Kona, Hawaiʻi, Airport Master Plan.* October 2010.

Office of Conservation and Coastal Lands, State Department of Land and Natural Resources: http://www.hawaii.gov/dlnr/occl/subzone.php

State of Hawaii, Department of Transportation Airport's Division. *14 CFR Part 150 Noise Compatibility Study, Noise Exposure Maps Update, Kona International Airport at Keāhole, Hawaiʻi.* April 2009

U.S. Census Bureau American FactFinder: http://factfinder2.census.gov

United States Department of Agriculture Natural Resource Conservation Service. *Web Soil Survey*. Internet. Available at: http://websoilsurvey.nrcs.usda.gov/app/.

United States Department of Agriculture Natural Resource Conservation Service. *Soil Classification*. Internet. Available at: http://soils.usda.gov/technical/classification/

(This page intentionally left blank)

APPENDIX A

Kona International Airport at Keāhole Botanical Survey
State Project No. AH2011-05 (EA Pre-Assessment)

Palmer & Associates Consulting

2012

Kona International Airport at Keahole

Botanical Survey

State Project No. AH2011-05 (EA Pre-Assessment)

2012

Wilson Okamoto
Corporation

Prepared by

Palmer & Associates Consulting
P. O. Box 637
Pahoa, HI 96778

Table of Contents

Executive Summary

A botanical survey of the Kona International Airport at Keahole (KOA) property was carried out in December, 2011 and January, 2012 as part of an Environmental Assessment for the expansion of certain airport facilities. Two hundred and one (201) vascular plant species were found on the airport property. Of these, 12.5% were native plants, 3.5% were polynesian introductions, and 84% were introduced alien species.

No federal or state listed threatened or endangered plant species were found. Two U. S. Fish and Wildlife "species of concern" plant species were found: maiapilo (*Capparis sandwichiana* DC) and a diminutive sedge-like native plant (*Fimbristylis hawaiiensis* Hillebr.). Maiapilo is also considered by the State of Hawai'i a "species of conservation need". The lava flow pioneer plant community on the 1801 lava flow is formed by the two species of concern together with a few other native plants. Neither of these species of concern legally requires further planning consideration.

Other botanical resources found on the airport property include a small anchialine pond and small tidal pools and associated vegetation in the southwest corner of the property. Also occurring in the southwest corner of the property is a small stand (approximately one hectare) of Coastal Dry Forest, consisting of native and alien plants.

Patches of Coastal Strand vegetation occur on the airport property along the coast of the 1801 lava flow in sites where sand or other fine material has accumulated, and also in the southwest corner of the property adjacent to the public beach.

In addition to the overall botanical survey of the airport property, fourteen sites where new facilities are proposed were examined for botanical resources. Most of the sites are disturbed and occupied by alien plants. The remaining sites are on largely barren pahoehoe lava. A small number of individual *Fimbristylis hawaiiensis* and maiapilo plants might be affected on these lava flow sites. However, no listed threatened or endangered plants or other significant botanical resources would be affected by the proposed facilities.

It is recommended that the present practice of using native Hawaiian plants in the cultivated landscape of the airport be continued for all new construction.

Introduction

A botanical survey of the Kona International Airport at Keahole (KOA), North Kona, Hawai'i was carried out to document botanical resources present on airport property and to locate any federal or state listed threatened or endangered plant species or other botanical resources requiring planning consideration. The botanical survey included airport lands not considered in previous botanical studies. The botanical survey also documented botanical resources at the sites of proposed new facilities.

Figure 1 shows the location of the study area and the airport property. The botanical survey included the majority of the airport property, consisting of about 3,412 acres. Portions of the property not included in previous surveys include the 1801 lava flow between the airport and Kekaha Kai State Park, including the coastal strip of the flow west of the present airport protection fence, and undeveloped lands between the airport and Queen Ka'ahumanu Highway. The undeveloped airport property between the south end of the existing runways and the OTEC road was also surveyed.

Previous studies

Char (2000) conducted a botanical survey of the KOA property "urban-designated lands", approximately 1,300 acres. Of the 67 plant species recorded, 52 were introduced, 2 were Polynesian introductions, and 13 were native. Linney (1987) surveyed the area now occupied by the present airfield, perimeter fencing, and associated structures. He found some 47 plant species, both native and introduced. Both authors found maiapilo (*Capparis sandwichiana* DC) and *Fimbristylis hawaiiensis* (both species of concern, see below). Neither found any federal or state listed threatened or endangered plant species.

Botanical surveys of the Natural Energy Laboratory of Hawai'i (NELH) and the Hawai'i Ocean Science and Technology (HOST) Park (Char, 1985), and of the O'oma II project area (Char, 1986) found similar vegetation to that of the airport property. No listed threatened or endangered species were found in either area. A botanical survey of the proposed O'oma Seaside Village project (Terry and Hart, 2006), immediately south of the airport property, also found no threatened or endangered plants.

Although several species of USFWS listed endangered plants are known from the west slope of Hualalai (USFWS 2007), most of these species are components of the Lowland Dry Forest or Lowland Mesic Forest, both of which occur mauka (up slope) of Queen Ka'ahumanu Highway and the airport property. The airport property is lower in elevation than most known locations for any of these species (Palmer and Paul 2005; Palmer, 2005).

Survey Methods

Field surveys were conducted by Rex Palmer, Ph.D. and field assistants. Field visits were conducted on December 1, 5, 8, and 13, 2011, and on January 10, 2012. Previous botanical studies, maps, and air photos were consulted before fieldwork was begun to determine areas that might be botanically important, and to plan field days.

A complete list of all vascular plant species encountered on the airport property is presented at the end of this report. Nomenclature of native and naturalized plant species follows Wagner, Herbst, and Sohmer (1999). Nomenclature of cultivated or landscape plants follows Staples and Herbst (2005), Neal (1965), and Uhl and Dransfeld (1987). Certain nomenclature has been updated to conform to Kew (2010) and Wagner, et al (2012). U. S. Fish and Wildlife Service designations follow USFWS (2007).

The field team carried out a visual survey, on foot, of the airport property. In the field, a "timed meander" (Nelson, 1987, Palmer, et al 1987) walk-through survey method was used, with starting points located randomly from access roads. Plants were identified in the field. Any material not so identifiable was collected for later determination.

The entire airport property (Figure 1) was surveyed for botanical resources. The property extends from OTEC Road on the south to the Kekaha Kai State Park road on the north and encompasses most of the lands from Queen Ka'ahumanu Highway to the ocean (Figure 1). Special attention was paid to the sites of proposed new facilities discussed in the present Environmental Assessment. We also noted landscape plants used around the existing terminal and other facilities.

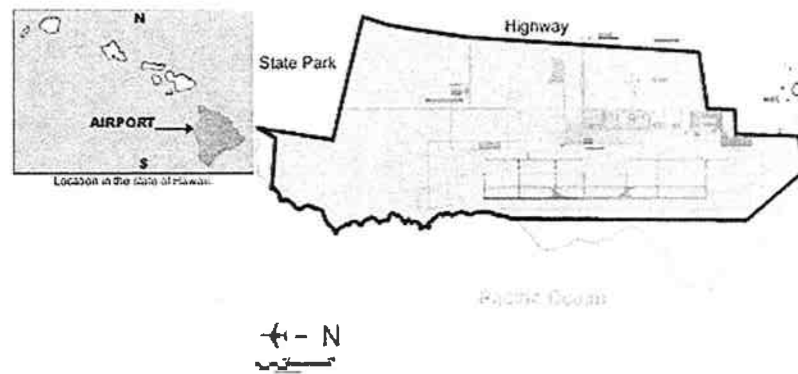


Figure 1. Location of the Kona International Airport at Keahole showing the airport property and the area surveyed (shaded) for this report.

Physical Environment

Climate of the Kona area is uniformly warm and dry, with average temperatures ranging from about 72 degrees F. in January to about 77 degrees F. in August. Average precipitation in Kona is about 25 inches annually (County of Hawai'i Data Book 2006).

Geologically, the airport property is comprised of a series of lava flows. In volcanic terrain botanical features are often correlated with lava flow age and type. Older, weathered lava flows generally support higher plant cover than more recent flows. Recent lava flows in the dry climate of Kona have remained nearly barren with only a few pioneering plant species for hundreds of years.

The lava flow history of the general area of the airport property has recently been summarized by Lockwood and Garcia (2004) in a study of the HELCO Keahole Generating Station site. Other geologic descriptions of the airport area include Moore and Clague (1991) and Wolfe and Morris (1996).

As described by Lockwood and Garcia (2004) four lava flow sequences from Hualalai volcano make up the airport property (Figure 2). On the north, the 1801 lava flow occupies roughly a third of the property. Further south, the Keahole Point lava flow (approximately 2,140 years bp) comprises most of the remainder of the property, with a few included areas of much older flows (greater than 5,000 years bp). A small portion of the Kohanaiki lava flow (approximately 3,000 years bp) is included in the southwestern portion of the airport property.

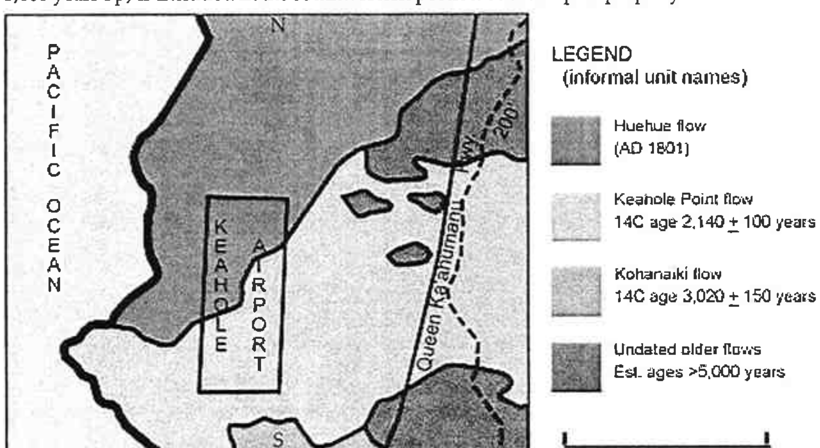


Figure 2. Geology of the Kona International Airport at Keahole property, showing various lava flow ages (redrawn from Lockwood and Garcia, 2004).

Results

Description of the Vegetation

Figure 3 is a generalized vegetation map for the airport property. The most obvious feature is the lava flow of 1801 (Figure 4). Although the flow is largely barren, unweathered pahoehoe lava, a sparse pioneer plant community is present. This community consists of a few scattered maiapilo (*Capparis sandwichiana*) and *Fimbristylis hawaiiensis*, both U. S. Fish and Wildlife Species of concern, and the ferns *Nephrolepis* and *Doryopteris*. Fountain grass (*Pennisetum setaceum*), an introduced invasive grass from Africa, is colonizing various parts of the 1801 lava flow, particularly where bulldozing or other land disturbance has occurred.

Coastal Strand vegetation occurs along the coast of the 1801 lava flow in scattered sites where sand or other fine material has accumulated, and also in the southwest corner of the property adjacent to the public beach (Figure 3, Figure 7).

A small stand (approximately 1 hectare) of Coastal Dry Forest (Gagne and Cuddihy 1990) occurs in the southwest corner of the property between OTEC Road and the airport south access road (Figure 9). This consists of a mixture of native and introduced plants. Kiawe (*Prosopis pallida)* makes up most of the tree canopy, with shrubs of naio (*Myoporum sandwicense),* naupaka (*Scaevola taccada),* Christmas berry (*Schinus terebinthifolius*), klu (*Acacia farnesiana),* and noni (*Morinda citrifolia)* also present.

Most of the remainder of the property is "disturbed/ ruderal and fountain grass scrub" (Figure 3, Figure 19). Land disturbance of varying amounts has occurred over most of the airport property. In very heavily disturbed sites ruderal species (i. e. alien weeds) occur, with fountain grass as the primary component. In disturbed sites adjacent to irrigated landscapes numerous alien species occur. Older lava flow areas (mostly on the Keahole Point flow) are mostly disturbed and either barren with only a few pioneer species, or are occupied by fountain grass and a mix of other species such as 'uhaloa (*Waltheria indica),* tridax (*Tridax procumbens),* pluchea (*Pluchea carolinensis),* maiapilo (*Capparis sandwichiana),* and occasionally, noni (*Morinda citrifolia).*

Patches of relatively old lava flow (undated flows probably > 5,000 years bp) can be seen in Figure 2. Generally, the older and more weathered the geologic surface, the more vegetation cover. These patches of older, weathered lava support dense fountain grass grassland (Figures 3 and 6). The historical combination of feral goats, fountain grass, and past fires long ago resulted in the destruction of the native shrub community that may have been originally present on these old lava flow areas. These sites are now densely covered with fountain grass to the exclusion of nearly all other plant species.

An anchialine pond supporting opae 'ula (*Halocaridina rubra* - Hawaiian shrimp) occurs between the Coastal Dry Forest patch and the airport fence. Stands of the native sedge mau'u

Existing Vegetation
2012
Kona International Airport at Keahole

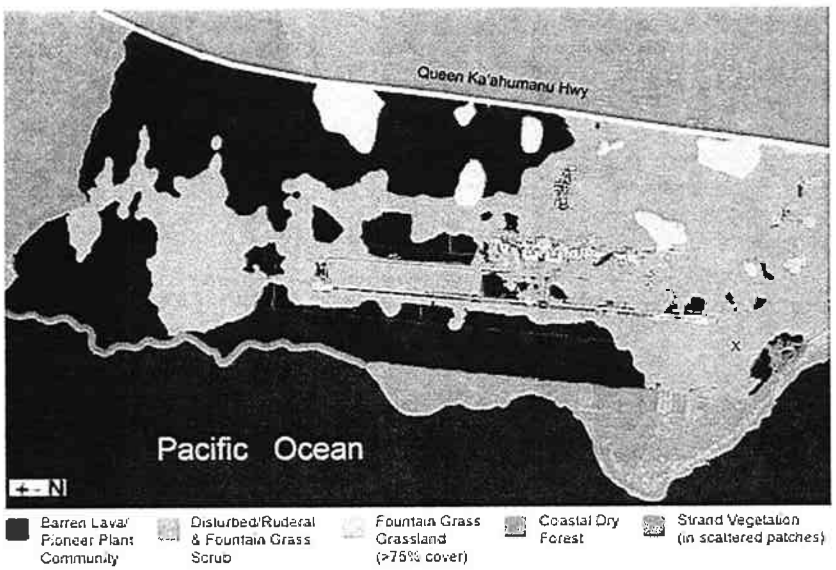


Figure 3. Generalized vegetation map of the spontaneously occurring vegetation at Kona International Airport at Keahole existing in January 2012. Cultivated, irrigated, and landscaped areas are associated with existing structures and roads and are not shown separately. The x marks the approximate location of an anchialine pond.

'aki 'aki *(Fimbristylis cymosa)* occur around the pond (Figure 10).

Other vegetation on the airport property consists of ruderal or weedy vegetation and landscaping in developed areas. Cultivated plants observed in the landscaped areas are included in the species list at the end of this report. Coconut *(Cocos nucifera)*, kou *(Cordia subcordata)*, monkey pod *(Samanea saman)*, be still tree *(Cascabela thevetia)*, Tahitian gardenia *(Gardenia taitensis)*, and other cultivated species are used in the landscape as well as several natives including naupaka *(Scaevola taccada)*, 'akia *(Wikstroemia uva-ursi)*, and 'ilima *(Sida fallax)*.

Previous botanical surveys on the airport property identified a few moist site plant species such as *Plectranthus hawaiiensis* that occurred in collapsed parts of a large lava tube system near the south end of the runway area (Char, 2000). This site is now given over to general aviation and the lava tube has been covered over with concrete paving. The plants that occurred at the cave overhangs are no longer present. We have noted their occurrence on the airport property as historical locations.

USFWS Designated Species

No USFWS listed threatened or endangered plants were found on the airport property. Two species designated by USFWS as species of concern were found: maiapilo (*Capparis sandwichiana)* and *Fimbristylis hawaiiensis*. The designation of species of concern generally means that there is insufficient information to determine the relative endangerment or rarity of a particular species. Both species are known to be common in the Kona area and both are also found in Hawai'i Volcanoes National Park where they are protected. Neither species legally requires further planning consideration.

Figure 4. 1801 lava flow, habitat for *Fimbristylis hawaiiensis.*

Figure 5. *Fimbristylis hawaiiensis* on the 1801 lava flow.

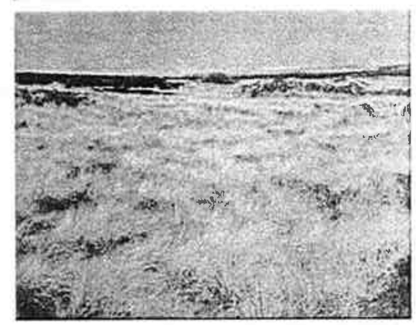


Figure 6. Dense fountain grass *(Pennisetum setaceum)* grassland on ancient lava flow.

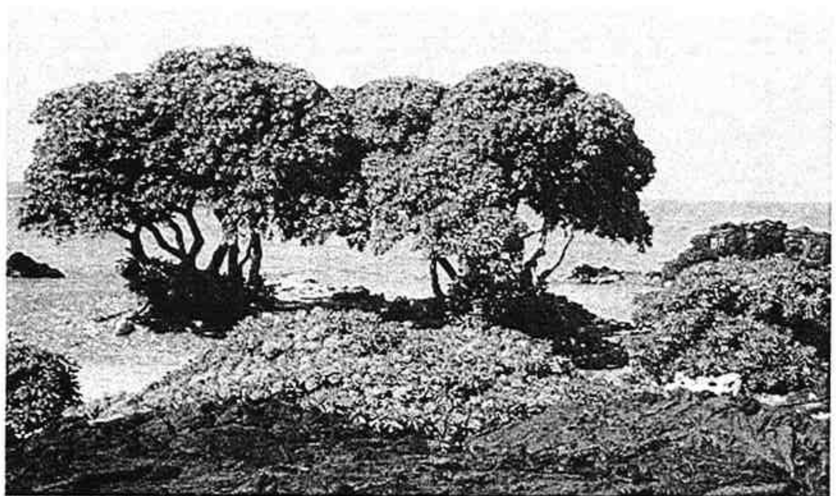


Figure 7. Coastal vegetation on the 1801 lava flow. The tree on the right is kou *(Cordia subcordata)*, on the left tree heliotrope *(Tournefortia argentea)*.

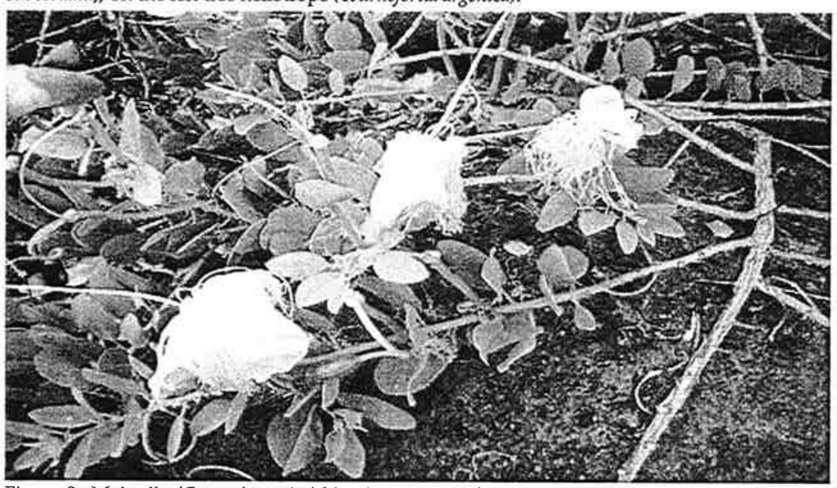


Figure 8. Maiapilo *(Capparis sandwichiana)*, a species of concern.

Figure 9. Coastal Dry Forest in southwest corner of the airport property consisting of native and alien plants.

Figure 10. Mau'u 'aki 'aki *(Fimbristylis cymosa)* growing next to anchialine pond (in lava crack) with native shrimp.

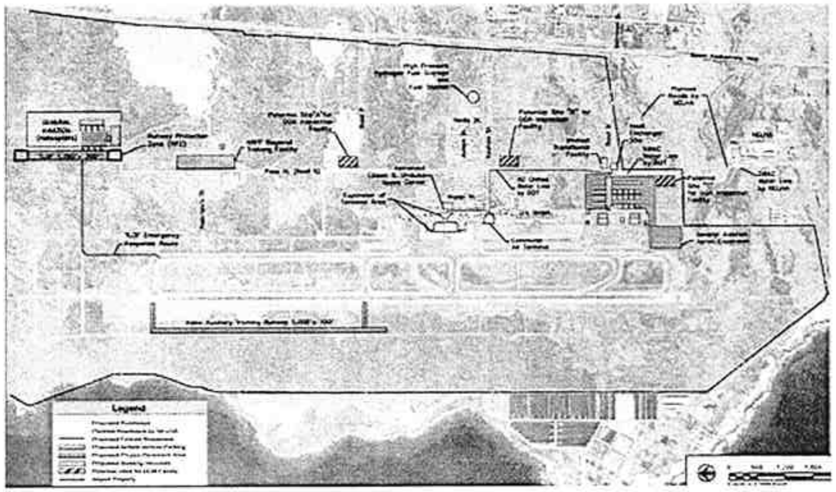


Figure 11. General site plan showing proposed new facilities (Wilson Okamoto Corporation).

Botanical features of proposed new facility sites.

Figure 11 shows the site plan for locations of sites at the airport where new facilities are proposed for purposes of the present Environmental Assessment. Each site was surveyed for botanical resources. No botanical resources requiring further planning consideration were found on any of the sites. The vegetation is described below for each proposed facility site:

General aviation facilities expansion area

This site is presently used for general aviation and is mostly paved. Additional lands on the east side of Pao'o Street that would be used for the new facility have previously been bulldozed and very little plant cover remains (Figure 12). The only native plant observed at this location was 'uhaloa *(Waltheria indica)*. No botanical resource issues are present at this site.

Pao'o Street Dept. Medical Transition Facility

Barren pahoehoe lava with patches of fountain grass, and a few other ruderal weed species characterize the vegetation south of Keahole St. including this site (Figure 13). The lava flow here is the Keahole Pt. flow (Figure 2), around 2,000 years old. This site has been previously heavily disturbed. No botanical resource issues occur at this site.

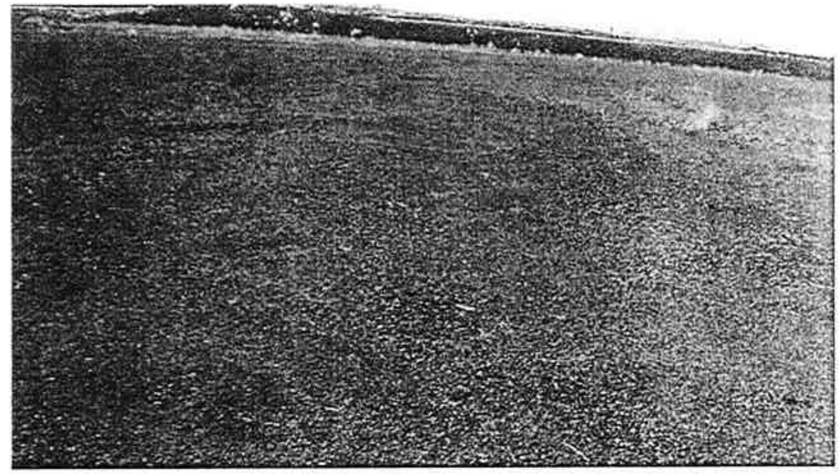


Figure 12. South portion of general aviation expansion area. Previously bulldozed.

Figure 13. Medical transition facility site. Vegetation here is disturbed ruderal and fountain grass scrub.

New helicopter general aviation facility

The helicopter general aviation facility site would be located on an extension of Pao'o Street to the north (Figure 14). This area is located on the 1801 lava flow. Most of the proposed site has been previously bulldozed. The remainder of the area supports sparse fountain grass and an occasional maiapilo. A few individuals of *Fimbristylis hawaiiensis* occur at this site. Otherwise the site is barren. No botanical resources requiring further planning consideration occur at this site.

Widening and extension of Kona auxiliary training runway

Figure 15 shows the route of the proposed extension of the Kona auxiliary training runway along the existing access road. Very little vegetation is present at this location. A few clumps of fountain grass occur along the road. As in other parts of the 1801 lava flow, a few individuals of *Fimbristylis hawaiiensis* occur in scattered locations. No botanical resource issues are present at this site.

Pao'o Street extension and Road M.

These roads would extend east and south from Pao'o Street opposite the proposed new general aviation facility. Portions of these roads already exist as gravel roads. The remainder of the road routes pass through disturbed fountain grass scrub. The same suite of plant species found on other parts of the Keahole Pt. lava flow occurs including a few maiapilo and *Fimbristylis hawaiiensis,* as well as 'uhaloa, noni, and a few introduced weeds. No significant botanical resources were found.

Sea water air conditioning (SWAC) system pipeline and heat exchanger

The proposed pipeline would be buried under existing portions of Pao'o Street, the proposed Pao'o Street extension, and under developed areas near the terminal building and would not affect botanical resources. The heat exchanger site is in a highly disturbed area with the general vegetation of the site barren lava and scattered fountain grass. A small number of maiapilo occur as well as 'uhaloa and noni. No botanical resource issues are present at this site.

Astronaut Ellison S. Onizuka Space Center

The proposed new site of the space center is in an existing landscaped and developed area. No botanical resource issues are present. However, we recommend continued and expanded use of Hawaiian native plants in the landscape. The landscaping of the museum could even incorporate some educational features for visitors regarding native plants.

Terminal modernization (Phase I)

Construction would occur in already developed areas. No natural habitat or botanical resource issues are present. We again recommend continued use of Hawaiian native plants.

Figure 14. Helicopter general aviation facility expansion area. This site, on barren lava, has been previously bulldozed and flattened.

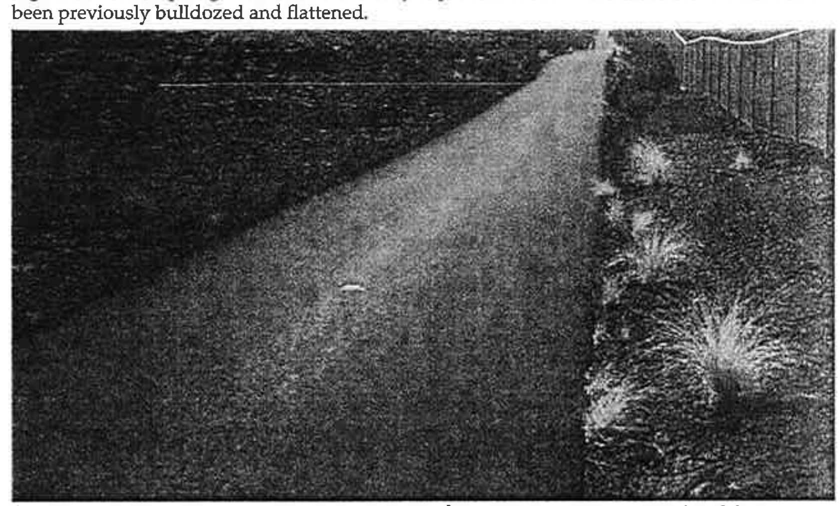


Figure 15. Kona auxiliary training runway site, showing existing access road and fence.

Hydrogen fuel station

The proposed hydrogen fuel station site is located on the north side of Keahole St. on the east side of the present car rental area (Figure 16). Vegetation is a mosaic of barren lava and patches of fountain grass. No botanical resource issues are present.

Pao'o Street Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility

The proposed ARFF Regional Training Facility is on the northern portion of the existing Pao'o Street. Figure 17 shows the condition of the site: largely barren pahoehoe lava with a few scattered fountain grass patches. Some of the site has been previously bulldozed. No botanical resource issues are present on this site.

Figure 16. Hydrogen fuel station site. No botanical issues occur at this site.

Pao'o Street Dept. of Agriculture facility potential site A

This site occurs on a portion of an old lava flow (>5000 years). This site may have supported a native plant community in the past but it is now entirely occupied by dense stands of fountain grass (Figure 18). Abundant goat droppings and evidence of past fires are present on the site, both factors that would have caused the disappearance of native woody vegetation. No botanical resource issues occur on this site.

Pao'o Street Dept. of Agriculture facility potential site B

Most of the proposed site has been disturbed (Figure 19). However, a few native plants are still present, including small numbers of both the species of concern, maiapilo and *Fimbristylis hawaiiensis*. Also present are a few scattered 'a'ali'i *(Dodonea)*. No botanical issues requiring further planning consideration are present.

Pao'o Street Dept. of Agriculture facility potential site C

This site has been previously bulldozed and graded. A few 'uhaloa have colonized the gravel, otherwise the site is barren. No botanical resource issues are present.

Figure 17. Pao'o Street ARFF Regional Training Facility expansion area. This site is mostly pahoehoe lava with fountain grass in disturbed areas.

Figure 18. Pao'o Street Dept. of Agriculture facility potential site A. This site is dense fountain grass grassland on a portion of old lava flow.

Figure 19. East side of Pao'o Street showing general area of Dept. of Agriculture facility potential site B. Vegetation is disturbed/ruderal and fountain grass scrub.

Conclusions and Recommendations

Two hundred and one species of flowering plants and ferns were found on the airport property. No federal or state listed threatened or endangered plants were found. Two plant species considered by U. S. Fish and Wildlife Service as "species of concern" were found: maiapilo *(Capparis sandwichiana)* and *Fimbristylis hawaiiensis* (some *Fimbristylis* species are called "fimbry" but there is no generally used Hawaiian name for this species). At the present time, neither species is considered by botanists as likely to become listed endangered.

Maiapilo is generally distributed around the Kona area but is being reduced in numbers as more development occurs. However, the species occurs on all the main Hawaiian islands and on Midway Atoll, Pearl and Hermes Atoll, and Laysan and is in little danger of extinction. The species may actually be part of a widespread pacific species *Capparis cordifolia* (*C. mariana* - Wagner, et al 1999).

Fimbristylis hawaiiensis is a diminutive sedge-like plant (Figure 5) that typically forms small, dry clumps in scattered sites on relatively new, unweathered lava. It is known from recent lava flows in the Kona area and on recent lava flows in Hawai'i Volcanoes National Park and Ka'u Desert (Wagner, et al 1999). Although relatively uncommon, the species is protected in the national park and is unlikely to become extinct as long as new lava flows are being produced.

Both of the species of concern were found on the 1801 lava flow and on the Keahole Point lava flow in a few scattered sites. On the coast of the 1801 lava flow, a strand vegetation of native and introduced plants has developed. A small stand of Coastal Dry Forest occurs in the southwest corner of the airport property. Other than these features, most of the property is nearly barren lava or fountain grass grassland, or disturbed areas with ruderal vegetation. The remainder is developed and landscaped. No significant botanical resources were found in any of these areas.

We recommend the continued use of Hawaiian native plants in the landscape. Maiapilo is already in the landscape in several areas (Figure 20) and pohinahina *(Vitex)* is used extensively, as is milo *(Thespesia)* and 'akia *(Wikstroemia)*.

Figure 20. Maiapilo in the exising landscape, Kona International Airport at Keahole (KOA).

References

Char, W. P. 2000. Botanical survey, Kona International Airport at Keahole, North Kona, Hawai'i.

Char, W. P. 1986. Biological survey, proposed 'O'oma II project, North Kona, island of Hawai'i. Report prepared for Helber, Hastert, van Horn & Kimura.

Char, W. P. 1985. Vegetation and terrestrial fauna at NELH/HOST Park. Traverse Group, Inc.

County of Hawai'i, Department of Research and Development. 2006. County of Hawai'i Data Book.

Gagne, W. C. and L. W. Cuddihy. 1990. Vegetation in Wagner, W. L., Herbst, D. L., & Sohmer, S. H. 1999. Manual of the Flowering Plants of Hawai'i: Revised Edition. University of Hawai'i Press. Honolulu, HI. 1919p.

Lockwood, J. P. and Michael O. Garcia. 2004. Volcanic hazards at the HELCO Keahole generating station, North Kona, Hawai'i. FEIS, Keahole Generating Station and airport substation urban reclassification.

Moore, R. B. and Clague, D. A. 1991. Geologic map of Hualalai Volcano, Hawai'i: U. S. Geological Survey Miscellaneous Investigations Series Map I-2213.

Neal, M. C. 1965. "In Gardens of Hawai'i." B.M.S.P. 50 2nd ed. Bishop Museum Press. Honolulu, HI. 924p.

Nelson, J. 1987. Rare Plant Surveys: Techniques for Impact Assessment. in Elias, T. S. and J. Nelson (eds.) Conservation and Management of Rare and Endangered Plants. Publ. by the California Native Plant Society.

Palmer, D. D. 2003. Hawai'i's Fern and Fern Allies. University of Hawai'i Press. Honolulu, HI. 324p.

Palmer, Rexford, et al. 1987. Ecology and Distribution of Poa marcida in Northwestern Oregon. Ibid.

Palmer, Rexford and David Paul. 2005. Botanical Survey of TMK: 7-3-08:47, North Kona District, Island of Hawai'i. Palmer & Associates Consulting.

Palmer, Rexford. 2005. Botanical Survey Hina Lani St. Reservoir Site. Palmer & Associates Consulting.

Royal Botanical Gardens at Kew & Missouri Botanical Garden. 2010. "The Plant List." Version 1. Published on the Internet; http://www.theplantlist.org/

Staples, G. W. & Herbst, D. R. 2005. A Tropical Garden Flora. Bishop Museum Press. Honolulu, HI. 908p.

Uhl, N. W. and Dransfield, J. 1987. "Genera Palmarum." Allen Press. Lawrence, KS. 610p.

USFWS. 2007. U. S. Fish and Wildlife Service Species List (Listed and Candidate Species, as Designated Under the U. S. Endangered Species Act) Updated January 8, 2007. USFWS Pacific Islands Office. Honolulu, HI. 55pp.

Wagner, W. L., D. R. Herbst, and D. H. Lorence. 2005-. Flora of the Hawaiian Islands web site. http://botany.si.edu/pacificislandbiodiversity/hawaiianflora/index.htm [February, 2012]

Wagner, W. L., Herbst, D. L., and Sohmer, S. H. 1999. Manual of the Flowering Plants of Hawai'i: Revised Edition. University of Hawai'i Press. Honolulu, HI. 1919p.

Wolfe, E. W. and Jean Morris. 1996. Geologic Map of the Island of Hawai'i. U. S. Geological Survey Miscellaneous Investigations Series Map 1-2524-A

VASCULAR PLANT SPECIES
of
KONA INTERNATIONAL AIRPORT AT KEAHOLE

2012

VASCULAR PLANT SPECIES
of
KONA INTERNATIONAL AIRPORT AT KEAHOLE

The following plant list represents vascular plants found during Dec. 2011, and Jan. 2012, on the airport property. The list includes native plants, landscape plants and introduced alien weeds.

FAMILY Genus / species	Common Name	Distribution*
PTERIDOPHYTES (Ferns and Fern Allies)		
NEPHROLEPIDACEAE	Boston Fern Family	
Nephrolepis multiflora (Roxb.) C. Morton	sword fern	A
POLYPODIACEAE	Polypod Fern Family	
Microsorum scolopendria (Burm. f.) Copel.	laua'e	I
PSILOTACEAE	Whisk Fern Family	
Psilotum nudum (L.) P. Beauv.	moa	I
PTERIDACEAE	Wire Fern Family	
Doryopteris decora Brack.	'iwa'iwa	E
Pteris vittata L.	ladder brake	A
GYMNOSPERMS (Plants that lack flowers.)		
ZAMIACEAE	Coontie Family	
Zamia furfuracea L. f.	cardboard palm	A

DICOTYLEDONS

ACANTHACEAE	Acanthus Family	
Pseuderanthemum carruthersii var. *carruthersii* (Seem.) Guillmn.	pseuderanthemum	A
Ruellia sp.	red ruellia	A
AIZOACEAE	Ice Plant Family	
Aptenia cordifolia (L.f.) Schwantes	hearts & flowers	A
Carpobrotus edulis L. N.E. Br.	ice plant	A
AMARANTHACEAE	Amaranth Family	
Amaranthus blitum subsp. *oleraceus* (L.) Costea syn. A. lividus L.	amaranth	A
ANACARDIACEAE	Mango Family	
Schinus terebinthifolius Raddi	Christmas berry	A
APIACEAE	Parsley Family	
Centella asiatica (L.) Urb.	gotu kola	A
APOCYNACEAE	Dogbane Family	
Allamanda cathartica L.	buttercup vine	A
Cascabela thevetia (L.) Lippold	be still tree	A
Nerium oleander L.	oleander	A
Plumeria obtusa L.	Singapore plumeria	A
Plumeria rubra L.	plumeria	A
Stemmadenia litoralis (Kunth) L. Allorge	lechoso	A
ASCLEPIADACEAE	Milkweed Family	
Calotropis procera (Aiton) Dryand.	crownflower	A
Gomphocarpus physocarpus E. Mey.	balloon plant	A

ASTERACEAE	Sunflower Family	
Ageratum houstonianum Mill.	maile hohono	A
Bidens pilosa L.	ki nehe	A
Calyptocarpus vialis Less.	calyptocarpus	A
Conyza bonariensis (L.) Cronq.	hairy horseweed	A
Conyza canadensis (L.) Cronq.	horseweed	A
Emilia fosbergii Nicolson	Flora's paintbrush	A
Emilia sonchifolia (L.) DC	Flora's paintbrush	A
Parthenium hysterophorus L.	false ragweed	A
Pluchea carolinensis (Jacq.) G. Don.	sourbush	A
Senecio madagascariensis Poir.	groundsel	A
Sonchus asper (L.) J. Hill	prickly sow thistle	A
Sonchus oleraceus L.	sow thistle	A
Tridax procumbens L.	coat buttons	A
Vernonia cineria (L.) Less.	little ironweed	A
Youngia japonica (L.) DC	hawksbeard	A
BIGNONIACEAE	Jacaranda Family	
Crescentia cujete L.	calabash tree	A
BORAGINACEAE	Borage Family	
Cordia subcordata Lam.	kou	P
Heliotropium curassavicum L.	nena	I
Heliotropium procumbens Mill.	seaside heliotrope	A
Tournefortia argentea L. f.	tree heliotrope	A
BRASSICACEAE	Mustard Family	
Descurainia sophia (L.) Webb ex Prantl	tansy mustard	A
Lepidium virginicum L.	pepperwort	A
CACTACEAE	Cactus Family	
Opuntia ficus-indica (L.) Mill.	prickly pear	A
CAPPARACEAE	Caper Family	
Capparis sandwichiana DC	maiapilo	E
CARICACEAE	Papaya Family	
Carica papaya L.	papaya	A

CARYOPHYLLACEAE	Pink Family	
Sagina decumbens subsp. *occidentalis* (S. Wats.) Crow	pearlwort	A
Spergularia marina (L.) Griseb.	sand spurry	A
CHENOPODIACEAE	Goosefoot Family	
Atriplex suberecta Verd.	Saltbush	A
Chenopodium murale L.	'aheahea / goosefoot	A
CLUSIACEAE	Clusia Family	
Calophyllum inophyllum L.	kamani	P
Clusia rosea Jacq.	autograph tree	A
COMBRETACEAE	Indian Almond Family	
Bucida molineti (Gomez) Alwan & Stace	dwarf geometry tree	A
CONVOLVULACEAE	Morning Glory Family	
Ipomoea indica (J. Burm.) Merr.	koali	I
Ipomoea obscura (L.) Ker-Gawl.	bindweed	A
Ipomoea pes-caprae subsp. *brasiliensis* (L.) Ooststr.	pohuehue / beach morning glory	I
Jacquemontia ovalifolia subsp. *sandwicensis* (A. Gray) K. Robertson	pa'uohi'iaka	E
CRASSULACEAE	Stonecrop Family	
Bryophyllum pinnatum (Lam.) Oken	air plant	A
CUCURBITACEAE	Cucumber Family	
Coccinia grandis (L.) Voight	scarlet gourd	A
Momordica charantia L.	bitter melon	A
EUPHORBIACEAE	Spurge Family	
Chamaesyce hirta (L.) Millsp.	hairy spurge	A
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	A
Chamaesyce prostrata (Aiton) Small	prostrate spurge	A
Codiaeum variegatum (L.) Blume	croton	A
Euphorbia lactea Haworth	candlestick tree	A

Euphorbia tirucalli L.	pencil tree	A
Phyllanthus debilis Klein ex Willd.	niruri	A
Phyllanthus tenellus Roxb.	phyllanthus	A
Ricinus communis L.	castor bean	A
FABACEAE	Bean Family	
Acacia confusa Merr.	Formosan koa	A
Acacia farnesiana (L.) Willd.	klu	A
Alysicarpus vaginalis (L.) DC	alyce clover	A
Caesalpinia pulcherrima (L.) Swartz	dwarf poinciana	A
Chamaecrista nictitans (L.) Moench	partridge pea	A
Crotalaria pallida Aiton	smooth rattlepod	A
Delonix regia (Hook.) Rafins.	royal poinciana	A
Desmanthus virgatus (L.) Willd.	slender mimosa	A
Desmodium intortum (Mill.) Urb.	beggar's tick	A
Desmodium tortuosum (Sw.) DC	Florida beggarweed	A
Desmodium triflorum (L.) DC	tick clover	A
Indigofera suffruticosa Mill.	indigo	A
Leucaena leucocephala (Lam.) de Wit	haole koa	A
Macroptilium atropurpureum (DC) Urb.	trailing cow pea	A
Macroptilium lathyroides (L.) Urb.	cow pea	A
Medicago lupulina L.	black medick	A
Melilotus officinalis (L.) Pall.	white sweet clover	A
Prosopis pallida (Willd.) Kunth	kiawe	A
Samanea saman (Jacq.) Merr.	monkey pod	A
GOODENIACEAE	Half-Flower Family	
Scaevola taccada (Gaertn.) Roxb.	naupaka	I
LAMIACEAE	Mint Family	
Hyptis pectinata (L.) Poit.	comb hyptis	A
Leonotis nepetifolia (L.) R. Br.	lion's tail	A
MALVACEAE	Hibiscus Family	
Hibiscus rosa-sinensis L.	Chinese hibiscus	A
Hibiscus x	hibiscus cultivars	A
Malvastrum coromandelianum (L.) Garcke	false mallow	A
Sida fallax Walp.	ʻilima	I

Sida rhombifolia L.	false ʻilima	A
Thespesia populnea (L.) Correa	milo	I
MORACEAE	Fig Family	
Ficus benjamina L.	weeping fig	A
Ficus microcarpa L. f.	Chinese banyan	A
Ficus sp.	fig	A
MYOPORACEAE	Myoporum Family	
Myoporum sandwicense subsp. *sandwicense* Webster**	naio	E
MYRTACEAE	Myrtle Family	
Eucalyptus saligna Sm.	Sydney blue gum	A
Metrosideros polymorpha subsp. *polymorpha* (Gaud.) Rock	ʻohiʻa	E
Psidium guajava L.	guava	A
NYCTAGINACEAE	Four-O'clock Family	
Boerhavia coccinea Mill.	false alena	A
Boerhavia repens L.	ʻalena	I
Bougainvillea x buttiana Holt. & Stand.	bougainvillea	A
Bougainvillea glabra Choisy	bougainvillea	A
Bougainvillea spectabilis Willd.	bougainvillea	A
OLEACEAE	Olive Family	
Jasminum sambac (L.) Aiton 'Grand Duke of Tuscany'	pikake jasmine	A
OXALIDACEAE	Wood Sorrel Family	
Oxalis corniculata L.	ʻihi	P
PLUMBAGINACEAE	Plumbago Family	
Plumbago auriculata Lam.	blue plumbago	A
POLYGALACEAE	Milkwort Family	
Polygala paniculata L.	milkwort	A

POLYGONACEAE	Buckwheat Family	
Coccoloba uvifera (L.) L.	sea grape	A
PORTULACACEAE	Purslane Family	
Portulaca grandiflora Hook.	moss-rose	A
Portulaca oleracea L.	purslane	A
Portulaca pilosa L.	hairy portulaca	A
Talinum triangulare (Jacq.) Willd.	fame flower	A
PRIMULACEAE	Primrose Family	
Anagalis arvensis L.	scarlet pimpernel	A
PROTEACEAE	Protea Family	
Grevillea robusta R. Brown	silver oak	A
ROSACEAE	Rose Family	
Rhaphiolepis umbellata (Thunb.) Makino	kokutan	A
RUBIACEAE	Coffee Family	
Gardenia taitensis DC	tiare / Tahitian gardenia	A
Ixora chinensis Lam.	Chinese ixora	A
Morinda citrifolia L.	noni	P
Oldenlandia corymbosa L.)	diamond flower	A
Paederia foetida L.	pilau maile	A
Richardia brasiliensis Gomes	buttonweed	A
SAPINDACEAE	Soapberry Family	
Dodonaea viscosa Jacq.	ʻaʻaliʻi	I
SCROPHULARIACEAE	Snap Dragon Family	
Buddleja asiatica Lour.	dog tail	A
SOLANACEAE	Nightshade Family	
Nicotiana glauca R.C. Graham	tree tobacco	A
Physalis sp.	ground cherry	A
Solanum americanum Mill.	popolo / nightshade	I
Solanum lycopersicum var. *cerasiforme* (Dunal) Spooner, Anderson, & Jansen	currant tomato	A

STERCULIACEAE	Cacao Family	
Waltheria indica L.	ʻuhaloa	I
THYMELACEAE	ʻAkia Family	
Wikstroemia uva-ursi var. *uva-ursi* A. Gray	ʻakia	E
URTICACEAE	Nettle Family	
Pilea microphylla (L.) Liebm.	artillery plant	A
VERBENACEAE	Verbena Family	
Lantana camara L.	lantana	A
Stachytarpheta urticifolia (Salisb.) Sims	blue vervain	A
Vitex rotundifolia L. f.	pohinahina / beach vitex	I
ZYGOPHYLLACEAE	Creosote Bush Family	
Tribulus terrestris L.	puncture vine	A

MONOCOTYLEDONS

AGAVACEAE	Agave Family	
Agave attenuate Salm-Dyke	dragon tail	A
Beaucarnea recurvata Lem.	ponytail	A
Cordyline fruticosa (L.) A. Chev.	ti / ki	P
Dracaena marginata Lam.	money tree	A
Dracaena reflexa Lam.	ʻSong of Indiaʼ dracaena	A
Furcraea foetida (L.) Haw.	Mauritius hemp	A
ARACEAE	Taro Family	
Aglaonema commutatum Schott	ʻSnow Queenʼ aglaonema	A
Syngonium podophyllum Schott	nephytis	A
ARECACEAE	Palm Family	
Adonidia merrillii (Becc.) Becc.	Manila palm	A
Archontophoenix alexandrae (F. Muell.) H. Wendl. & Drude	king palm	A

Areca triandra Roxb. ex Buch.-Ham.	triandra palm	A
Caryota mitis Lour.	fishtail palm	A
Cocos nucifera L.	coconut / niu	P
Dypsis lutescens (H. Wendl.) Beentje & J. Dransf.	gold palm	
Livistonia chinensis (Jacq.) Mart.	Chinese fan palm	A
Phoenix dactylifera L.	date palm	A
Pritchardia pacifica Seem. & Wendl.	Fiji fan palm	A
Pritchardia thurstonii Muell. & Drude	Fiji fan palm	A
Roystonea regia (Kunth) O.F. Cook	royal palm	A
Rhapis excels (Thunb.) Henry	lady palm	A
Wodyetia bifurcata A.K. Irvine	foxtail palm	A
COMMELINACEAE	Dayflower Family	
Tradescantia spathacea Sw.	oyster plant	A
CYPERACEAE	Sedge Family	
Fimbristylis cymosa subsp. *spathacea* (Roth) T. Koyama	mau'u 'aki'aki	I
Fimbristylis hawaiiensis Hillebr.	"Hawaiian fimbry"	E
Kyllinga brevifolia Rottb.	kili'o'opu	A
Kyllinga nemoralis (J. Forst. & G. Forst.) Hutch. & Dal.	white kyllinga	A
Pycreus polystacyos subsp. *polystacyos* (Rottb.) P. Beauv.	Hawaiian nutsedge	I
HELICONIACEAE	Heliconia Family	
Heliconia psittacorum L. f.	parrot's beak	A
LILIACEAE	Lily Family	
Aloe vera (L.) Burm.f.	aloe	A
Asparagus densiflorus (Kunth) Jessop	Sprenger's asparagus	A
Crinum asiaticum var. *asiaticum* L.	white spider lily	A
Crinum asiaticum var. *procerum* L.	red spider lily	A
Ophiopogon japonicus (L. f.) Ker Gawl	mondo grass	A
PANDANACEAE	Screwpine Family	
Pandanus baptistii Misonne	variegated hala	A

Pandanus tectorius Parkinson ex Du Roi	hala	I
POACEAE	Grass Family	
Andropogon virginicus L.	bluestem	A
Axonopus fissifolius (Raddi) Kuhlm.	carpetgrass	A
Brachiaria mutica (Forssk.) Stapf	California grass	A
Cenchrus ciliaris L.	buffelgrass	A
Cenchrus echinatus L.	sandbur	A
Chloris divaricata R. Br.	stargrass	A
Chloris virgata Sw.	feather fingergrass	A
Cymbopogon citratus (DC) Stapf	lemon grass	A
Cynodon dactylon (L.) Pers.	manienie / Bermuda grass	A
Digitaria ciliaris (Retz.) Koeler	crabgrass / kukaepua'a	A
Digitaria violascens Link	violet crabgrass	A
Eleusine indica (L.) Gaertn.	wiregrass	A
Eragrostis amabilis (L.) Wight & Arn.	lovegrass	A
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	pili grass	I
Melinis minutiflora P. Beauv.	molasses grass	A
Paspalum conjugatum Bergius	Hilo grass	A
Pennisetum clandestinum Chiov.	kikuyu grass	A
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	A
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	A
Saccharum officinarum L.	sugarcane	P
Sporobolus indicus (L.) R. Br.	smutgrass	A
Sporobolus virginicus (L.) Kunth	'aki'aki	I
Stenotaphrum secundatum (Walter) Kuntze	buffalo grass	A
Vulpia bromoides (L.) S.F. Gray	brome fescue	A
STRELITZIACEAE	Bird of Paradise Family	
Strelitzia reginae Banks ex Aiton	bird of paradise	A
ZINGIBERACEAE	Ginger Family	
Alpinia purpurata (Vieill.) K. Schum.	red ginger	A

*Key

Family - Group of related plants.

Genus / species - Binomial / Botanical term for a plant.

Common Name - Locally used term for a plant.

Distribution - Geographical origin of a plant in Hawai'i

E = Endemic; occurring only in Hawai'i.

I = Indigenous; native to Hawai'i and elsewhere.

P = Polynesian; introduced to Hawai'i prior to 1778.

A = Alien; introduced to Hawai'i after 1778.

**Wagner, et al (2012) place *Myoporum* in the Scrophulariaceae.

APPENDIX B

Avian and Terrestrial Mammalian Survey Conducted for the Kona International Airport at Keāhole Airport Master Plan, North Kona District, Island of Hawai‘i

Rana Biological Consulting, Inc.

January 2012

Avian and Terrestrial Mammalian Surveys Conducted for the Kona International Airport at Keāhole Airport Master Plan, North Kona District, Island of Hawai'i

Prepared by:

Reginald E. David
Rana Biological Consulting, Inc.
P.O. Box 1371
Kailua-Kona, Hawai'i 96745

Prepared for:

Wilson Okamoto Corporation
1907 South Beretania Street,
Suite 400
Honolulu, Hawai'i 96826

January 31, 2012

Table of Contents

Introduction and Background

The State of Hawai'i Department of Transportation (DOT), Airports Division is proposing various improvements at the Kona International Airport located in Keāhole, North Kona, Hawai'i. The airport is situated on approximately 3,450-acres located within a larger 20,797-acre parcel identified as Tax Map Key (TMK) (3) 7-3-043: 003.

The primary purpose of the surveys was to determine if there are any avian or mammalian species currently listed, or proposed for listing under either federal or State of Hawai'i endangered species statutes within or adjacent to the Airport property. The federal and State of Hawai'i listed species status follows species identified in the following referenced documents, (Department of Land and Natural Resources (DLNR) 1998; U. S. Fish & Wildlife Service (USFWS) 2005a, 2005b, 2011). Fieldwork was conducted on December 8, 9 and 12 2011. Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.

General Project and Site Descriptions

The DOT is proposing to make the following improvements, which are based on an updated master plan done for the airport in October 2010 (Figure 1).

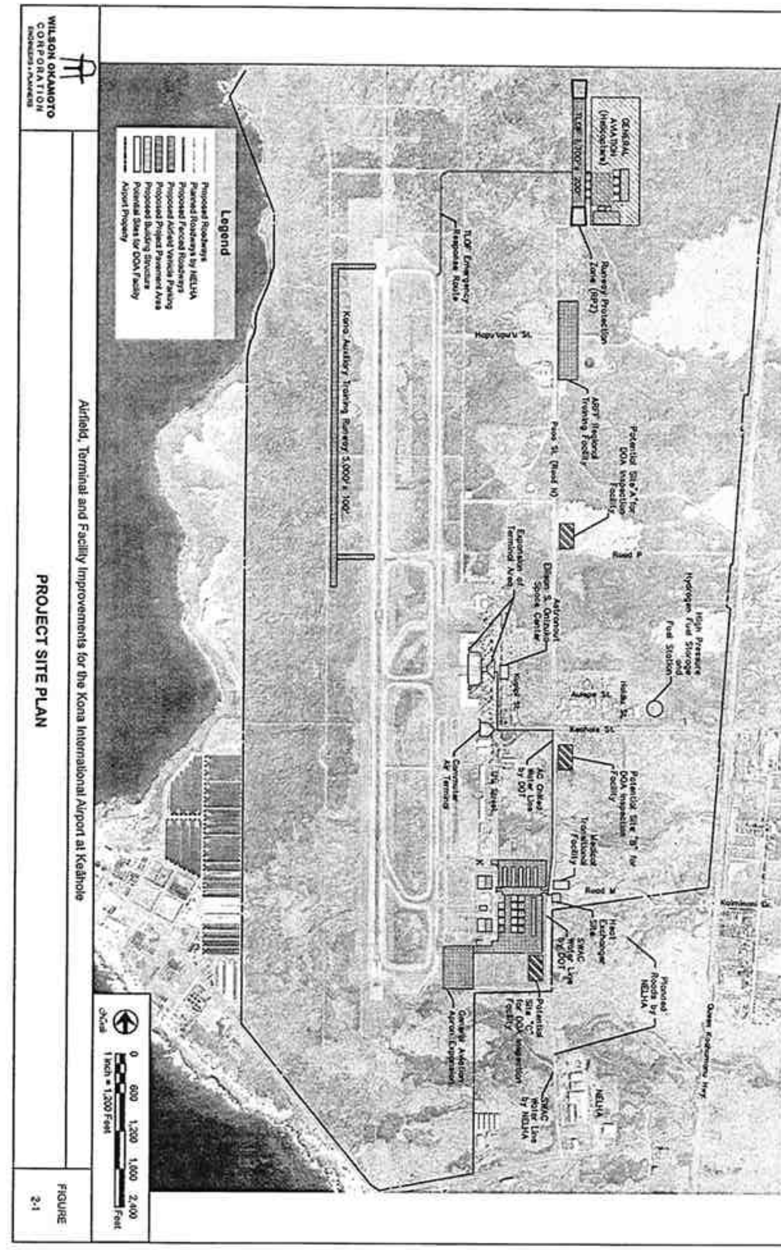
1. Expand General Aviation facilities: The portion of the south ramp used for general aviation will be expanded for use by non-carrier fixed-wing aircraft to relieve congestion. Proposed improvements in the south ramp general aviation area include the following:

   - Establishing a new area for general aviation facilities between Pao'o Road (Road N) and U'u Street. Comprising approximately 22 acres, this area will be developed to include additional ramp space for staging aircraft, hangars, maintenance and storage facilities, aircraft parking areas, an aircraft wash rack and lighting. Road M will bisect this area, providing vehicular access and parking.

   - Extending the existing aircraft parking apron, over a previously graded area of approximately 10 acres. The apron extension will include ramp lighting and approximately 20 aircraft tie-down anchors.

   - Extending two existing taxiways, K and L, to the east, each to a finished size of approximately 150-feet wide and 850 feet long. The extended taxiways will provide access between the runway and the previously described new area for general aviation facilities.

2. Construct a new helicopter general aviation facility: A new helicopter general aviation facility will be developed to address safety concerns regarding separation of the helicopter operations from the fixed-wing commercial and general aviation aircraft. The proposed facility will be located approximately 3,000 feet *mauka* of the



north end of the existing runway. Encompassing approximately 34 acres, the helicopter facility will include a new helicopter runway (approximately 200 feet wide and 1,700 feet long), a touchdown and lift-off facility (TLOF), hover pads, parking apron, taxi lanes, associated vehicle parking, an area for maintenance and storage facilities and tenant improvements. Pao'o Street will be extended 2,560-feet to access the new facility. In addition, an emergency response road approximately 1,940-feet long will be extended from the airfield to the facility to facilitate access by airport rescue fire fighting personnel.

3. Construct an interim secondary emergency runway by extending and widening the planned Kona Auxiliary Training Runway (KATR): The U.S. Air Force will soon begin construction of the KATR for flight training, primarily "touch and go" exercises. The DOT-A proposes to lengthen and widen the KATR from its initially planned size of by 4,250 feet long by 90 feet wide to 5,000 feet long by 100-feet wide. This expansion will allow the runway to be used as an interim secondary emergency runway until construction of the planned parallel runway can be completed.

4. Construct a new road (Road M): Road M is planned to be a two-lane, two-way road providing public access from Queen Ka'ahumanu Highway to the airport's south ramp area and intersect with existing and planned north-south roads within and extending beyond the airport. The proposed initial construction of Road M will extend eastward, approximately 850-feet from its intersection with Pao'o Street (Road N). This is opposite the portion of Road M that will be constructed in conjunction with the previously described new general aviation facilities area. Its eastern end will eventually connect with a roadway that the neighboring Natural Energy Laboratory of Hawai'i Authority (NELHA) plans to build on its property.
   - NELHA plans to construct the unnamed continuation of Road M, extending from the aforementioned eastern end of DOT-A's proposed Road M to its intersection with Queen Ka'ahumanu Highway, opposite Kaiminani Drive, where it will form a cross intersection.
   - NELHA also plans to construct a two-lane, two-way road from its main facility to connect with the airport's Pao'o Street (Road N). Pao'o Street is the airport's primary north-south road, extending 1.86 miles from the airport's south ramp general aviation area northward to the wastewater treatment plant. As described in item 2, Pao'o Street is proposed to be extended even further north to the proposed helicopter general aviation facility. It intersects and crosses, Keahole Street, which is the airport's primary access road from Queen Ka'ahumanu Highway.

5. Construct a sea water air conditioning (SWAC) system: The SWAC system would pipe cold seawater recovered at NELHA to the airport, where a heat exchange facility will chill fresh water that will, in turn, be piped to and circulated within the terminal and other buildings for air-conditioning.

6. Relocate the Onizuka Museum: The Onizuka Museum, which is located between the two terminal areas, will be relocated across the terminal to the former ground transportation area. This will allow the terminal area to be expanded.

7. Expand the terminal area: The relocation of the Onizuka Museum would allow the terminal areas to be connected by a single new building structure housing a centralized check-in area and in-line baggage handling system. The expanded terminal will improve passenger and baggage processing for the airlines.

8. Construct a high pressure hydrogen fuel storage and fueling station: In an effort to reduce dependence on petroleum-based fuels, the DOT-A proposes to offer a hydrogen fueling station in close proximity to the ground transportation operations.

9. Construct an Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility: The ARFF regional training facility will be located on the north side of the airport property, adjacent to the existing burn pit area. The training facility would be utilized two to three times a week, initially by airport ARFF personnel and County of Hawai'i fire fighting personnel and would eventually be opened up to all First Responders for training. The training center is comprised of a fuel spill trainer, a specialized air craft fire trainer (SAFT), a two-story control tower and classroom facility, a fuel farm, water storage tanks, a water recycling plant, and a three-story burn building.

10. Construct a medical transitional facility: The proposed medical transitional facility would be constructed on a four to six acre site to address the unmet need in Kona for doctors' services, especially those in specialized fields. The medical transitional facility would house an emergency room where patients could be received and stabilized prior to being transported by air to Honolulu or other off-island hospital for further treatment. It would also house an out-patient clinic where doctors from Honolulu, and even the mainland, could see patients from Kona during periodic visits. Having the clinic at the airport would significantly reduce ground travel time for doctors who would otherwise need to drive 40 miles to the North Hawai'i Community Hospital in Waimea or 20 miles to the Kona Community Hospital. This would allow more patients to be seen while the doctors are in Kona.

11. Construct a temporary State of Hawai'i Department of Agriculture (DOA) inspection facility. The proposed DOA inspection facility would be built on an approximately one to two acre site located at one of three possible locations:
    - On the east side of Pao'o Street adjacent to the proposed AARF station;
    - On the east side of Pao'o Street, between Keahole Street and Road M; or, the area directly south of the general aviation facility. In ten to twenty years, a permanent facility will be constructed in conjunction with a new cargo building.

12. Interior renovations of the existing ARFF Station for a new Commuter Terminal: DOT-A is currently pursuing the construction of a new ARFF Station into which the existing ARFF operations will be relocated. After the new ARFF Station is occupied, DOT-A plans to renovate the existing ARFF Station building to be used as a new Commuter Terminal Building.

The study site is bound to the east by Queen Ka'ahumanu Highway, to the south by the NELHA entrance road, to the north by Kahakai State Park and to the west by NELHA and the Pacific Ocean. The bulk of the site is comprised of *pāhoehoe* flows disgorged by Mount Hualālai. The flows on the northern half of the site date back to 1800-1801, these flows lay atop flows dating back between 3,000 and 10,000 years ago, areas south of the runway are flows dating back between 3,000- 5000 years ago [Wolfe and Morris 1996].

The Airport is within an extremely dry climatic zone, and this fact combined with the young ages of a goodly proportion of the lava flows that created the land surface here, limits the vegetation types that occur. Vegetation on the site runs the full gamut from almost none on portions of the 1801 flow, (Figure 2) to sparse fountain grass (*Pennisetum setaceum*), grassland on the 1,500 hundred to 3,000 year old flows (Figure 3), to fairly dense, though low stature fountain grass grassland on the southern flow which dates back between 3, 000 and 5,000 years. Areas within the airport terminal and along the entrance road are landscaped and maintained with ornamental plants, grasses, shrubs and trees (Figure 4).

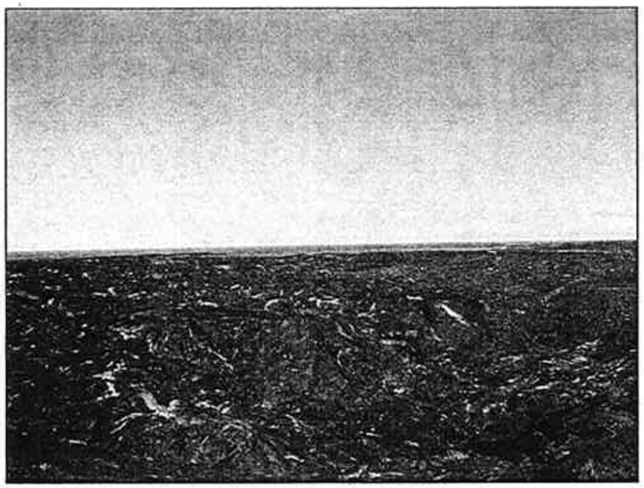


Figure 2 – Bare *pāhoehoe* flows west of the runway – typical of west and north end of site

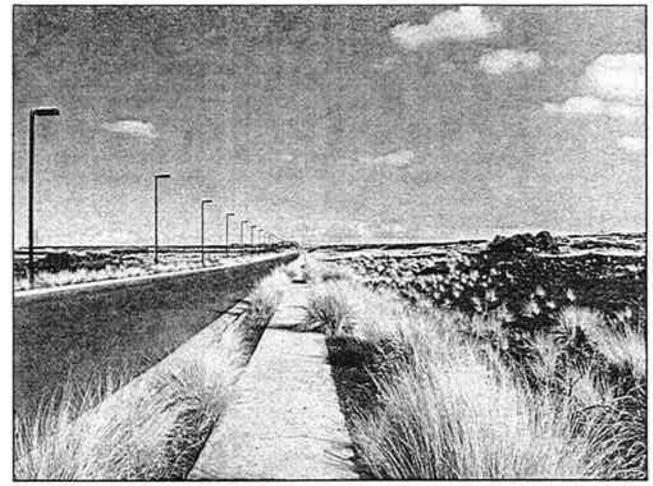


Figure 3 – ʻAʻā flow on eastern northeastern side of site, showing fountain grass along Paoʻo Street

Figure 4 – Airport entrance showing manicured ornamental planting

Methods

Plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner *et al.*, 1990, 1999) for native and naturalized flowering plants. The avian phylogenetic order and nomenclature used in this report follows the *AOU Check-List of North American Birds* (American Ornithologists' Union, 1998), and the 42nd through the 51st supplements to the Check-List (American Ornithologists' Union, 2000; Banks et al., 2002, 2003, 2004, 2005, 2006, 2007, 2008; Chesser *et al.*, 2009, 2010, 2011). Mammal scientific names follow (Tomich, 1986). Place names follow *Place Names of Hawaii* (Pukui *et al.*, 1974).

Avian Survey Methods

Thirty avian count stations were sited equidistant from each other within the study site. A single 6-minute avian point count was made at each of the 30 count stations. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. The counts were conducted between 7:00 am and 10:00 am. Time not spent counting the point count stations was used to search the remainder of the site for species and habitats not detected during the point counts. Weather conditions were ideal, with no rain, unlimited visibility on the site, and winds of between 1 and 8 kilometers an hour.

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *'ōpe'ape'a* as it is known locally, all terrestrial mammals currently found on the Island of Hawai'i are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial vertebrate mammalian species detected within the study site. The mammalian survey was conducted concurrently with the avian surveys on December 8, 9, and 12, 2011.

Results

Avian Surveys

A total of 184 individual birds of 15 species, representing 11 separate families, were recorded during the station counts. All but two of these avian species recorded during the course of this survey are considered to be alien to the Hawaiian Islands (Table 1). The two native species recorded were Pacific Golden-Plover (*Pluvialis fulva*) and Ruddy Turnstone (*Arenaria interpres*). Both are indigenous migratory shorebird species that nest in the high Arctic, and winter in Hawai'i and the Tropical Pacific.

No avian species currently protected or proposed for protection under either the federal or State of Hawai'i endangered species programs were detected during the course of this survey (DLNR, 1998; USFWS, 2005a, 2005b, 2011).

Avian diversity and densities were extremely low, though in keeping with the xeric habitat present on the site. At 47 percent of the 30 count stations (n~14), no birds were recorded. Bird numbers and densities were highest around the landscaped and watered areas within the main terminal complex and along the airport entrance road (Figure 4).

Three species, Common Myna (*Acridotheres tristis*), Japanese White-eye (*Zosterops japonicus*) and House Finch (*Carpodacus mexicanus*) accounted for slightly more than 45 percent of all birds recorded during the station counts. Common Myna was the most frequently recorded species accounting for 18 percent of the total number of birds counted.

Table 1 – Avian Species Detected Within the Kona International Airport - 2011

Common Name	Scientific Name	ST	RA
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Grey Francolin	*Francolinus pondicerianus*	A	0.27
	CHARADRIIFORMES		
	CHARADRIIDAE - Lapwings & Plovers		
	Charadriinae - Plovers		
Pacific Golden-Plover	*Pluvialis fulva*	IM	0.20
	SCOLOPACIDAE - Sandpipers, Phalaropes & Allies		
	Scolopacinae - Sandpipers & Allies		
Ruddy Turnstone	*Arenaria interpres*	IM	0.03
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	0.23
Zebra Dove	*Geopelia striata*	A	0.60
	PASSERIFORMES		
	ZOSTEROPIDAE - White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	0.97
	STURNIDAE - Starlings		
Common Myna	*Acridotheres tristis*	A	1.10
	EMBERIZIDAE - Emberizids		
Saffron Finch	*Sicalis flaveola*	A	0.23
Yellow-billed Cardinal	*Paroaria capitata*	A	0.13
	CARDINALIDAE - Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	0.70
	FRINGILLIDAE - Fringilline and Carduleline Finches & Allies		
	Carduelinae - Carduline Finches		
House Finch	*Carpodacus mexicanus*	A	0.60
	PASSERIDAE - Old World Sparrows		

Table 1 (continued)

Common Name	Scientific Name	ST	RA
House Sparrow	*Passer domesticus*	A	0.40
	ESTRILDIDAE - Estrildid Finches		
African Silverbill	*Lonchura cantans*	A	0.20
Nutmeg Mannikin	*Lonchura punctulata*	A	0.03
Java Sparrow	*Padda oryzivora*	A	0.43

Key to table 1

ST Status

A Alien – Introduced to the Hawaiian Islands by humans

IM Indigenous migratory – Native but not unique to Hawai'i, non-breeding in Hawai'i

RA Relative Abundance - Number of birds detected divided by the number of count stations (30)

Mammalian Survey

Six terrestrial mammalian species were detected during the course of these surveys. Several European house mice (*Mus musculus domesticus*) were seen within the landscaped terminal area. Tracks, sign and scat of feral goats (*Capra h. hircus*) were seen at numerous locations within the study site – goat usage appears to be focused around areas that are planted and/or there is irrigation, especially along Pao'o Street (Road N). Several small Indian mongooses (*Herpestes a. auropunctatus*) were seen within the site, including two dead animals, along the airport entrance road. Three cats (*Felis catus*) were seen in and around the developed terminal and infrastructure areas, sign, scat and tracks were encountered within more remote locations as well. Dogs (*Canis f. familiaris*) were heard barking from within the NELHA facilities located to the west of the airport boundaries, scat tracks and sign was also encountered at other locations within the study site. Tracks, and scat of donkeys (*Equus a. asinus*) was encountered at several locations along Pao'o Street (Road N).

No terrestrial mammalian species were detected during the course of this survey. Ergo. No mammalian species currently protected or proposed for protection under either the federal or State of Hawai'i endangered species programs were detected during the course of this survey (DLNR, 1998; USFWS; 2005a, 2005b, 2011).

Discussion

Avian Resources

The findings of the avian survey are consistent with the location of the site, and the xeric nature of the habitat present on it. These findings are also comparable to the results of at least one other survey conducted on the Airport property (David, 2000), and with recent surveys conducted on lands to the north of the Airport with similar habitat (David et al., 2008; David and Guinther 2011), and lands to the east (Guinther et al., 2005, 2009), and to the south of the property (David 2011).

As previously discussed we recorded a total of 15 separate avian species during the time spent within the study area. Two of the species recorded, Pacific Golden-Plover and Ruddy Turnstone are indigenous migratory shorebird species, both are widespread and commonly encountered in the Hawaiian Islands between August and early May each year. Both of these species do not nest in the Hawaiian Islands but rather spend the late fall and winter in Hawaiian and the Tropical Pacific. The other 13 species recorded are all alien to the Hawaiian Islands.

Although no seabirds were detected during this survey, it is probable that both the endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened endemic sub-species of the Newell's Shearwater (*Puffinus auricularis newelli*), over-fly the project area in small numbers between April and the middle of December each year. Both species have been recorded flying to and from their nesting colonies over the greater Kona area (Day et al., 2003; David 2011). Both of these pelagic seabird species nest high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris lineraris*) fern. There is no suitable nesting habitat for either of these seabird species on, or close to the Kona International Airport.

The primary cause of mortality in the two aforementioned seabird species is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983; Simons and Hodges 1998; Ainley et al., 2001). Collision with man-made structures is considered to be the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961; Telfer 1979; Sincock 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al. 1998; Ainley et al., 2001; Hue et al., 2001; Day et al 2003).

No waterbirds were recorded during the course of this survey though several have been recorded within the airport boundaries in the past, including endangered Hawaiian Stilt (*Himantopus mexicanus knudseni*), (Ducks Unlimited, 2001; David, 2011). In the past these birds were drawn to the general area by ponds within the Cyanotech complex, minimization measures and very creative biocontrol strategies have reduced the attractive nuisance posed by this aquaculture facility, and thus markedly reduced the number of birds being attracted to this facility.

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the site, and the xeric nature of the habitat present on it. They are also comparable to the results of at least one other survey conducted on the Airport property (David 2000), and with recent surveys conducted on lands to the north with similar habitat (David et al., 2008, David and Guinther 2011), and lands to the east (Guinther et al. 2005, 2009), and south of the property (David 2011).

Although only European house mice were detected, is likely that the several of the other three established alien *muridae* found on Hawai'i, roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use resources found within the site on a seasonal basis. These human commensal species are all but ubiquitous around human activity.

No Hawaiian hoary bats were detected during the course of this survey. Hawaiian hoary bats are widely distributed along the Kona coast and are present in most areas that still have tree and dense shrubs, (USFWS, 1998; Bonaccorso et al., 2005, 2007; 2011; David, 2011). There is very little suitable roosting habitat for this foliage roosting species within or close to the project site.

Potential Impacts to Protected Species

Seabirds

The principal potential impact that further development of the Kona International poses to protected seabirds is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main areas that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct nighttime construction activities, 2) following build-out, the potential operation of streetlights and security or facility lighting during the seabird nesting season.

Recommendations

1. If nighttime construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

2. Following build-out it is recommended that any streetlights, security or facility lighting be shielded (Reed et al. 1985, Telfer et al. 1987). This minimization measure would serve the dual purpose of minimizing the threat of disorientation and downing

of Hawaiian Petrels and Newell's Shearwaters, while at the same time complying with the Hawai'i County Code § 14 – 50 *et seq.* which requires the shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting to the astronomical observatories located on Mauna Kea.

3. It is recommended that, where appropriate and practicable, native plant species be used in landscaping efforts. Not only is this ecologically prudent, but also if the appropriate plants are used, it will also likely save maintenance and water costs over the long term.

Critical Habitat

There is no federally delineated Critical Habitat present on or adjacent to the study site. Thus the further development and operation of the Kona International Airport will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under State law.

Glossary

'A'ā – Clinker lava formed by slow moving lava flows
Alien – Introduced to Hawai'i by humans
Endangered – Listed and protected under the Endangered Species Act of 1973, as amended (ESA) as an endangered species
Indigenous – Native to the Hawaiian Islands, but also found elsewhere naturally
Mauka – Upslope, towards the mountains
Muridae – Rodents, including rats, mice and voles, one of the most diverse family of mammals
Nocturnal – Night-time, after dark.
'Ōpe'ape'a – Endemic endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*)
Pāhoehoe - Sheet lava formed by relatively fast moving lava flows
Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young
Sign – Biological term referring tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected
Threatened – Listed and protected under the ESA as a threatened species

AARF – Airport rescue fire fighting
DLNR – Department of Land and Natural Resources
DOA - State of Hawai'i Department of Agriculture
DOFAW – Division of Forestry and Wildlife
ESA – Endangered Species Act of 1973, as amended
HDOT - Hawai'i Department of Transportation, Airports Division
KTAR – Auxiliary Training Runway
NELHA – Natural Energy Laboratory of Hawai'i Authority
SWAC – Seawater air conditioning system
TLOF – Touchdown and Lift-off Facility
TMK – Tax Map Key
USFWS – United State Fish & Wildlife Service

Literature Cited

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, *in:* Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22: Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. (Pg. 108-123).

American Ornithologist's Union. 1998. *Check-list of North American Birds.* 7th edition. AOU. Washington D.C. 829pp.

_____. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds.* The Auk 117:847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds.* The Auk 119:897-906.

_____. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds.* The Auk 120:923-931.

_____. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds.* The Auk 121:985-995.

_____. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds.* The Auk 122:1031-1031.

_____. 2006 Forty-seventh supplement to the American Ornithologist's Union *Check-list of North American Birds.* The Auk 123:926-936.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2007 Forty-eighth supplement to the American Ornithologist Union *Check-list of North American Birds.* The Auk 124:1109-1115.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2008 Forty-ninth supplement to the American Ornithologist Union *Check-list of North American Birds.* The Auk 125:758-768.

Bonaccorso, F. J., C. M. Todd and, A. C. Miles. 2005. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Ope'ape'a, *Lasiurus cinsereus semotus*. 1 September 2004 to 31 August 2005.

_____. 2007. Interim Report on Research to Hawaiian Bat Research Consortium for The Hawaiian Hoary Bat, Ope'ape'a, *Lasiurus cinsereus semotus*. April 1, 2007.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2009. Fiftieth supplement to the American Ornithologist Union *Check-list of North American Birds.* Auk 126:1-10.

_____. 2010. Fifty-first supplement to the American Ornithologist Union *Check-list of North American Birds.* The Auk 127:726-744.

_____. 2011. Fifty-second supplement to the American Ornithologist Union *Check-list of North American Birds.* The Auk 128:600-613.

Cooper, B. A and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. Colonial Waterbirds, 21 (1): 11-19.

David, R. E. 2000. Faunal Survey of Avian and Mammalian Species, Kona International Airport Master Plan Update. Keahole, North Kona, Hawai'i. Prepared for: Edward K. Noda & Associates and the Hawaii Department of Transportation Airports Division (HDOT-AIR).

David, R. E. 2006. A Survey of Avian and Terrestrial Mammalian Species on TMK (3) 7-3-09:17, 25, 26, and 28, at Kaloko, and Kohanaiki, North Kona District, Island of Hawai'i. Prepared for: Wilson Okamoto Corporation.

David, R. E. 2011. Avian and Terrestrial Mammalian Surveys Conducted for the Kohanaiki Shores Frontage Road Corridor, North Kona District, Island of Hawai'i. Prepared for: Kohanaiki Shores, LLC.

David. R. E. 2011. Unpublished field notes – Hawai'i 1980 - 2011.

David, R. E., E. B. Guinther, and S. Burr 2008. Biological Surveys Conducted as Part of the Makalawena Master Plan, North Kona District, Island of Hawai'i. Prepared for Belt Collins Hawaii Ltd. & Kamehameha Schools.

David, R. E. and E. B. Guinther, 2011. Botanical, Avian and Terrestrial Mammalian Surveys Conducted for the Kīholo State Preservation Park, Master Planning Process, North Kona District, Island of Hawai'i. Prepared for: Planning Solutions, Inc., and the State of Hawai'i Department of Land and Natural Resources – State Parks Division.

Day, R. H., B. Cooper, and R. J. Blaha. 2003. Movement Patterns of Hawaiian Petrels and Newell's Shearwaters on the Island of Hawai'i. Pacific Science, 57, 2:147-159.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. The Auk 120: 669-679.

Department of Land and Natural Resources (DLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

Ducks Unlimited, Inc. 2001. A Conservation Plan for Hawaiian Stilt at Cyanotech Auaculture Facility, Keahole Poont, Hawaii. Prepared for Cyanotech Corporation.

Guinther, E. B., R. E. David and S. Montgomery 2005. Biological surveys of the University of Hawaii Center at West Hawaii (UHCWH) Main Street Collector Road, North Kona District, Island of Hawaii. Prepared for: Wil Chee Planning, Inc.

Guinther, E. B., R. E. David, and S. L. Montgomery 2009. Biological surveys for the University of Hawaii Center at West Hawaii (UHCWH), North Kona District, Island of Hawai'i. Prepared for: Wil Chee Planning, Inc.

Hadley, T. H. 1961. Shearwater calamity on Kauai. Elepaio 21:60.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat Use and Limiting Factors in a Population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i. , *in:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas (Pg. 234-242).

Podolsky, R., D.G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. "Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua'i". Colonial Waterbirds 21:20-34.

Pukui , M. K., S. H. Elbert, and E. T. Mookini 1976. *Place Names of Hawaii.* University of Hawaii Press. Honolulu, Hawai'i. 289 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. Auk 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell ' s Shearwater. Pages 76-78 in Proceedings of the Hawaii Forestry and Wildllife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. 'Elepaio 39:71

Telfer, T. C. , J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. Wildlife Society Bulletin 15:406-413.

Tomich, P.Q. 1986. *Mammals in Hawaii.* Bishop Museum Press. Honolulu, Hawaii. 37 pp.

U.S. Fish & Wildlife Service (USFWS) 1983. Hawaiian Dark-Rumped Petrel & Newell's Manx Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

_____. Recovery Plan for the Hawaiian Hoary Bat. U.S. Fish & Wildlife Service, Portland, Oregon.

_____. 2005a. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

_____. 2005b. 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.

_____. 2011. USFWS Threatened and Endangered Species System (TESS), online at http://ecos.fws.gov/tess_public/StartTESS.do. Last Checked December 12, 2011

Wagner, W.L., D.R Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i.* University of Hawaii Press, Honolulu, Hawaii 1854 pp.

Wagner, W.L. and D.R. Herbst. 1999. *Supplement to the Manual of the flowering plants of Hawai'i*, pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press

Wolfe, E. W., and J. Morris. 1996. Geological Map of the Island of Hawaii. U.S. Department of the Interior, U.S. Geological Survey.

APPENDIX C

Archaeological Literature Review and Field Inspection for Airfield, Terminal, and Facility Improvements for the Kona International Airport at Keāhole, ‘O‘oma 1 through Mahai‘ula Ahupua‘a, North Kona District, Hawai‘i Island

Cultural Surveys Hawai‘i, Inc.

June 2012

Archaeological Literature Review and Field Inspection for Airfield, Terminal, and Facility Improvements for the Kona International Airport at Keāhole, ʻOʻoma 1 through Mahaiʻula Ahupuaʻa, North Kona District, Hawaiʻi Island TMK: [3] 7-2-005: 007; 7-3-043: various State Project No. AH2011-05

Prepared for

Wilson Okamoto Corporation

Prepared by

Sarah Wilkinson, B.A,

Aulii Mitchell, B.A,

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawaiʻi, Inc.

Kailua, Hawaiʻi

(Job Code: KALAOA 14)

June 2012

Oʻahu Office
P.O. Box 1114
Kailua, Hawaiʻi 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

Maui Office
1860 Main St.
Wailuku, Hawaiʻi 96793
Ph: (808) 242-9882
Fax: (808) 244-1994

Management Summary

Reference	Archaeological Literature Review and Field Inspection for Airfield, Terminal, and Facility Improvements for the Kona International Airport at Keāhole, ʻOʻoma 1 through Mahaiʻula Ahupuaʻa, North Kona District, Hawaiʻi Island, TMK: [3] 7-2-005: 007; 7-3-043: various, State Project No. AH2011-05 (Wilkinson et al. 2012)
Date	June 2012
Project Number (s)	Cultural Surveys Hawaiʻi (CSH) Job Code: KALAOA 14
Investigation Permit Number	CSH prepared this report under state archaeological permit numbers 11-17 and 12-04, for the calendar years 2011 and 2012, respectively, issued by State of Hawaiʻi Department of Land and Natural Resources / State Historic Preservation Division (DLNR / SHPD).
Project Location	Kona International Airport at Keāhole (KOA) is located on the western coast of the Island of Hawaiʻi, approximately 10 miles north of the town of Kailua-Kona on Keāhole Point
Land Jurisdiction	State of Hawaiʻi
Reviewing Agencies	State Historic Preservation Division / Department of Land and Natural Resources (SHPD/DLNR)
Project Description	The State of Hawaiʻi, Department of Transportation, Airport Division (HDOT-A) has completed the 2010 Kona Keāhole Airport Master Plan Update, and is proposing numerous short-term and longer-term infrastructure improvements to the airport. A Draft Environmental Assessment (EA) is being prepared for the proposed short-term improvements, which are anticipated to be completed within the next five to ten years. The present study was scoped to focus on these short-term improvements, which include: 1. Expansion of the General Aviation facilities; 2. Construction of a new helicopter general aviation facility; 3. Construction of an interim secondary emergency runway by extending and widening the planned Kona Auxiliary Training Runway (KATR); 4. Initiation of construction of a new road (Road M); 5. Construction of a seawater air conditioning (SWAC) system; 6. Relocation of the Astronaut Ellison S. Onizuka Space Center; 7. Phase 1 of terminal modernization; 8. Construction of a high pressure hydrogen fuel storage and fueling station; 9. Construction of an Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility; 10. Construction of a medical transitional facility; and 11. Construction of a temporary State of Hawaiʻi Department of Agriculture (DOA) inspection facility

	12. Interior renovations of the existing ARFF Station for a new Commuter Terminal
Project Acreage	The airport property comprises approximately 3,470 acres
Area of Potential Effect (APE) and	For the purposes of this archaeological literature review and field inspection, the area of potential effect (APE) consists of the short-term improvement areas at the airport. These areas comprise roughly 125 acres within the overall airport property. While the study will seek to create a model predicting archaeological sensitivity throughout the overall airport property, it will focus on making specific recommendations for these short-term improvement areas, particularly those subject to Section 106 compliance.
Historic Preservation Regulatory Context	The proposed project is subject to Hawaii State environmental and historic preservation reviews in accordance with Hawaii Revised Statutes (HRS) Chapter 343 and HRS 6E-8/Hawaii Administrative Rules (HAR) Chapter 13-275, respectively. In addition, several of the proposed improvements will use federal funding and therefore will require compliance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the Department of Transportation Act (DTA). The short-term improvements that are subject to Section 106 compliance include: expansion of the General Aviation facilities, relocation of the Onizuka Space Center, Terminal Modernization Phase 1; and interior renovations to the existing ARFF Station for a new Commuter Air Terminal. This archaeological literature review and field inspection study was completed for use as a planning document. While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR Chapter 13-276), it serves as a document to facilitate the proposed project's planning and supports historic preservation review compliance by assessing if there are any archaeological concerns within the study area and to develop data on the general nature, density and distribution of archaeological resources.
Fieldwork Effort	Sarah Wilkinson, B.A., Michael Rivera, B.A., and Olivier Bautista, B.A. performed the fieldwork between March 19 and March 22, 2012, under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). The field work comprised a total of nine (9) person-days. Per the scope of work, the field work focused on a thorough inspection of the vicinity of the 12 improvement areas proposed by the current EA, with a general inspection of the overall airport property for the purpose of identifying potentially sensitive areas based on past study coverage, geology, and the presence or lack of disturbance.

Results Summary	A significant portion of the project area has been completely disturbed by airport-related development—any sites once present in these areas have been obliterated. A handful of features were identified on the 1801 lava flow areas; these include a midden scatter, a mound, and several *pāhoehoe* excavations, all of indeterminate age. A greater potential for the presence of sites on the older, intact flows was evidenced by the discovery of numerous archaeological features in the improvement areas situated in these sections of the property. These features include *pāhoehoe* excavations, alignments, enclosures, midden scatters, modified outcrops and overhangs, and a constructed pit, all of which can be related to transitory land use as practiced in the Intermediate Zone. The more substantial features presently found at Kawili Point support the traditional pattern of coastal settlement.
Recommendations	Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Apron expansion (Improvement Area 1); relocated Onizuka Space Center (Improvement Area 6); Terminal Modernization Phase 1 (Improvement Area 7); High Pressure Hydrogen Fuel Storage and Fuel Station (Improvement Area 8); the DOA Inspection Facility Site "C" (Improvement Area 11); and interior renovations of the existing ARFF Station for a new Commuter Terminal (Improvement Area 12). A lack of findings during 100% coverage of the proposed ARFF Regional Training Facility (Improvement Area 9), which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location. Given their situation over older lava flow areas containing archaeological features, the proposed Road M route (Improvement Area 4) and the DOA Inspection Facility Sites "A" and "B" (Improvement Area 11) are recommended for further study. While Improvement Area 4 has been subjected to past archaeological survey (Barrera 1987b), features were found immediately adjacent to the corridor that were not documented during that survey; depending on the finalized APE of the corridor, these features may be impacted by construction, and additional features might be present. No further work is recommended for the Medical Transitional Facility (Improvement Area 10), as thorough coverage of this site yielded no finds. The Helicopter General Aviation facility (Improvement Area 2) and Kona Auxiliary Training Runway (Improvement Area 3) are situated on a largely undisturbed 1801 flow areas. Features of indeterminate

	age were encountered during the inspection in these improvement areas. Inventory survey is recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties. The SWAC/AC Chilled Water Line (Improvement Area 5) represents a somewhat complex situation, given the inclusion of the Heat Exchanger Site and that the water line route is considered to be up in the air. The presently proposed Heat Exchanger Site will require archaeological inventory survey. It is recommended that the water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, inventory survey will be necessary. If the currently-depicted route is chosen, further survey will only be necessary if the water line footprint extends beyond previously-disturbed roadways or road shoulders. Based on the results of the archaeological inspection of the various proposed locations for the DOA Inspection Facility (Improvement Area 11), Site "C" is recommended for development based on its situation in an area of prior disturbance and lack of potential to impact historic properties. If the APEs of any of the short-term improvement areas change, further evaluation will be necessary. The predictive model included herein is designed to support long-term development strategies at the airport. This model identifies areas of greater and lesser archaeological sensitivity throughout the property. It is recommended that specific evaluations for archaeological work be made for future proposed developments not located entirely within previously disturbed areas or areas covered by recent archaeological study. Development does not appear to be currently anticipated for the Kawili Point area. It is highly recommended that this area be subjected to the archaeological work recommended by Carpenter et al. (1998), and that it be ultimately left undeveloped and preserved as an integral component of the pre-Contact and historic settlement at Mahai'ula Bay.

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

At the request of Wilson Okamoto Corporation, Cultural Surveys Hawai'i, Inc. (CSH) has prepared this Archaeological Literature Review and Field Inspection for Airfield, Terminal, and Facility Improvements for the Kona International Airport at Keāhole (KOA) (State Project No. AH2011-05). The project area consists of the entire airport property (approximately 3,470 acres), which straddles the *ahupua'a* (traditional land divisions) of 'O'oma 1 (also known as Kalaoa-'O'oma) through Mahai'ula, North Kona District, Hawai'i Island. KOA is located approximately 10 miles north of the town of Kailua-Kona at Keāhole Point. It is the primary airport on the western side of the island, serving international, overseas and interisland flights. The project area is depicted on a U.S. Geological Survey topographic maps (Figure 1 to Figure 3), tax map plats (Figure 4 and Figure 5), and on aerial photos (Figure 6 through Figure 8).

The State of Hawai'i, Department of Transportation, Airports Division (HDOT-A) has completed the 2010 Kona Keāhole Airport Master Plan Update, and is proposing numerous infrastructure improvements to the airport (Figure 9). Implementation of the Master Plan has been broken down into short-term improvements, for which the present Draft Environmental Assessment (Draft EA) is being prepared, and longer-term improvements. Wilson Okamoto Corporation will include the findings of the present study in the Draft EA. The proposed short-term improvements are anticipated to be completed within the next five to ten years, and include the following (Figure 9 and Figure 10):

1. Expand General Aviation facilities: The portion of the south ramp used for general aviation will be expanded for use by non-carrier fixed-wing aircraft to relieve congestion. Meanwhile, general rotary wing aircraft (helicopter) aviation operations in the south ramp area will be relocated to the north side of the airport (see item 2, below). Proposed improvements in the south ramp general aviation area include the following:
   a. Establishing a new area for general aviation facilities between Pāo'o Street (Road N) and U'u Street. Comprising approximately 22 acres, this area will be developed to include additional ramp space for staging aircraft, hangars, maintenance and storage facilities, aircraft parking areas, an aircraft wash rack and lighting. Road M will bisect this area, providing vehicular access and parking.
   b. Extending the existing aircraft parking apron, over a previously graded area of approximately 10 acres. The apron extension will include ramp lighting and approximately 20 aircraft tie-down anchors.
   c. Extending two existing taxiways, K and L, to the east, each to a finished size of approximately 150-feet wide and 850 feet long. The extended taxiways will provide access between the runway and the previously described new area for general aviation facilities.
2. Construct a new helicopter general aviation facility: A new helicopter general aviation facility will be developed to address safety concerns regarding separation of the helicopter

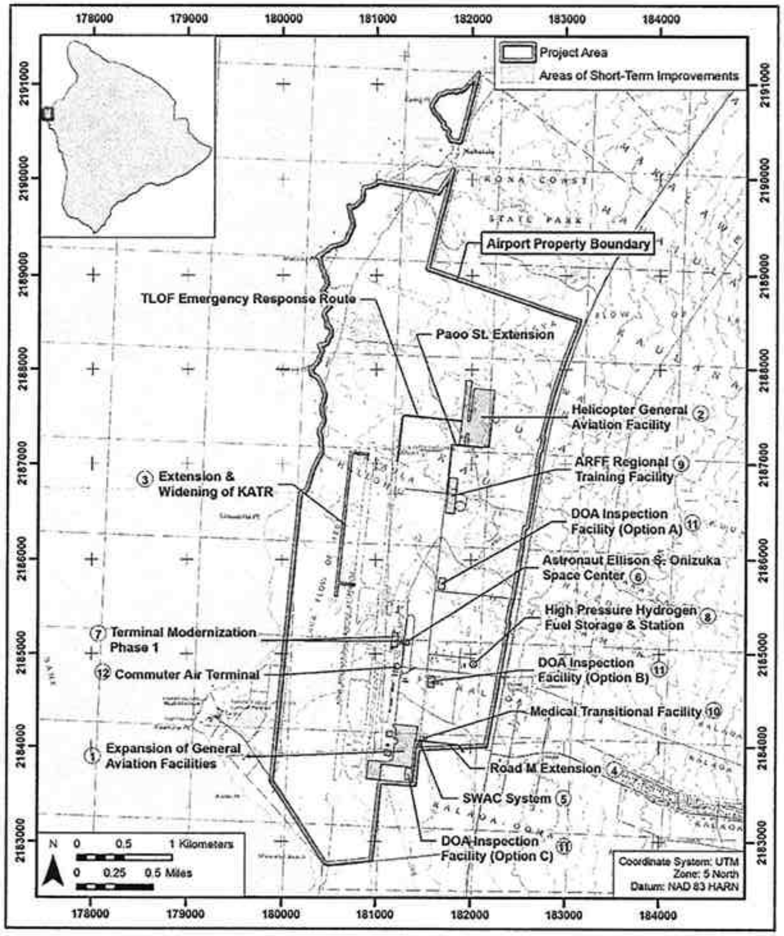


Figure 1. Portion of the 7.5-minute US Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) Quadrants, showing the overall project area (in blue) and the short-term improvement areas (in pink)

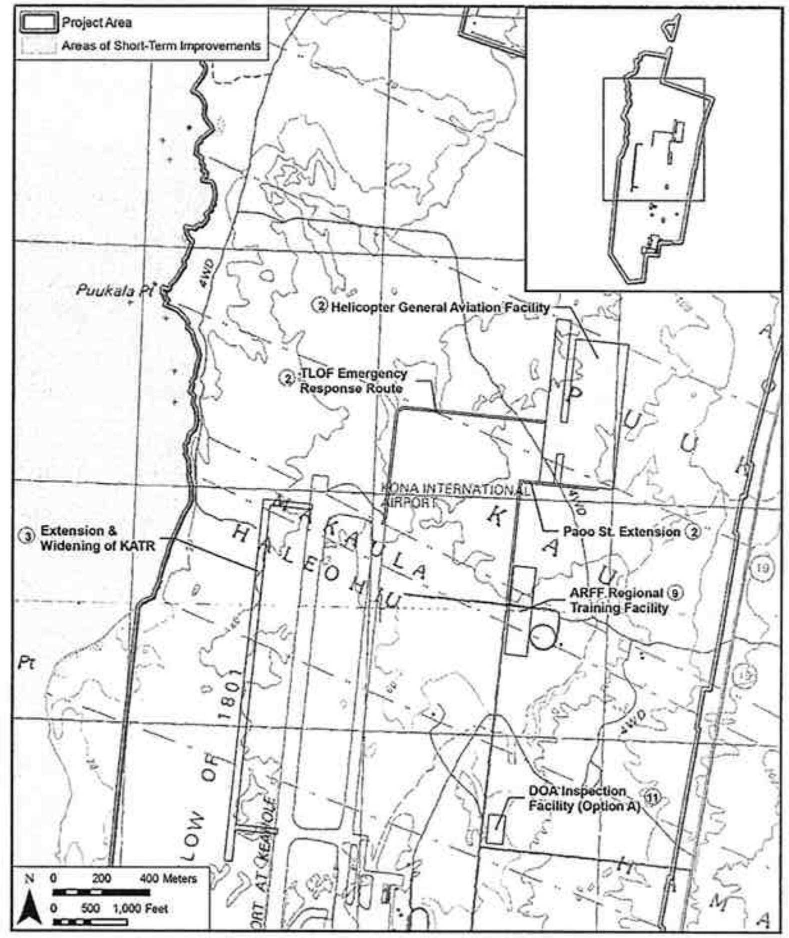


Figure 2. Portion of the 7.5-minute US Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) Quadrants, detailing the short-term improvement areas (in pink) within the northern portion of the overall project area (in blue)

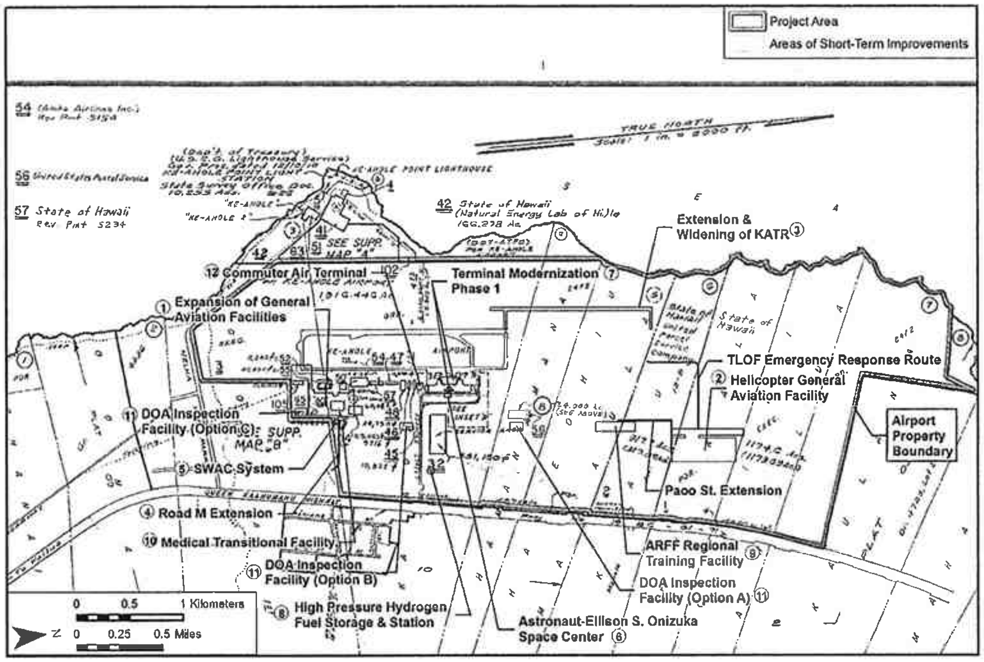


Figure 4. Tax Map Key [3] 7-3-43, showing the greater portion of the overall project area (in blue) and the short-term improvement areas (in pink)

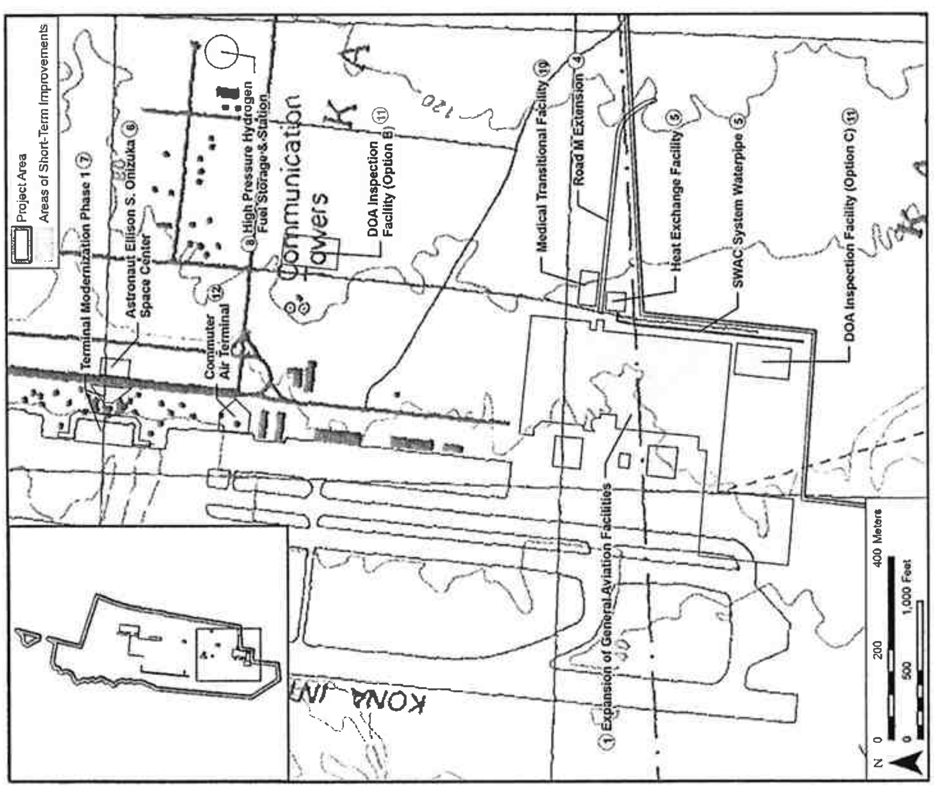


Figure 3. Portion of the 7.5-minute US Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) Quadrants, detailing the short-term improvement areas (in pink) within the southern portion of the overall project area (in blue)

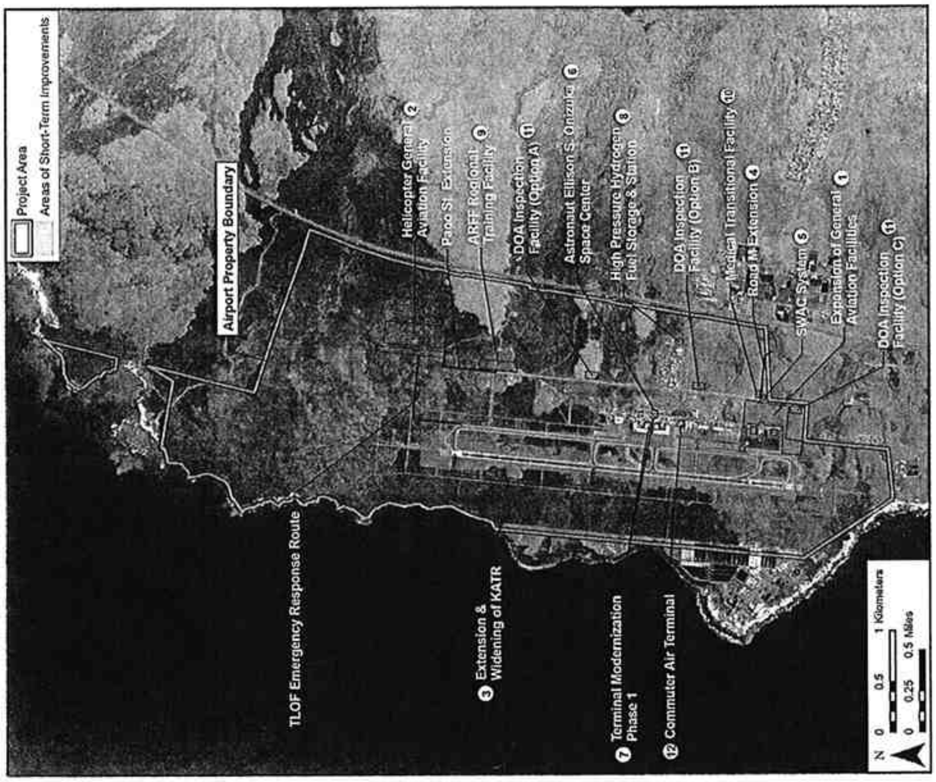


Figure 6. Aerial photo (Google Earth 2010) showing the showing the overall project area (in blue) and the short-term improvement areas (in pink)

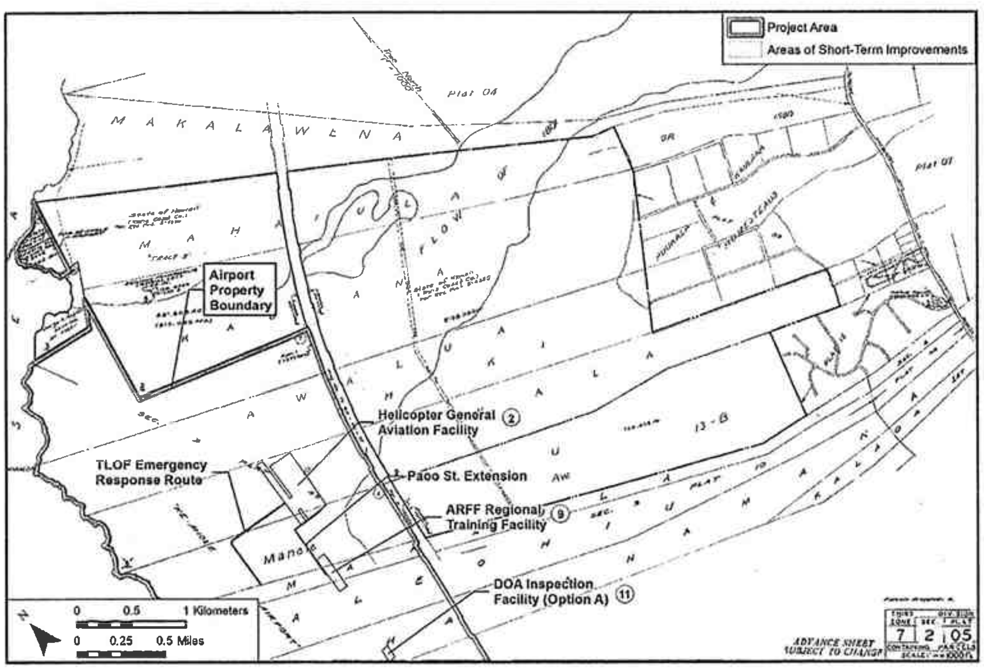


Figure 5. Tax Map Key [3] 7-2-05, showing the Kawili Point portion of the overall project area (in blue) in relation to the greater portion of the project area at TMK [3] 7-3-43 to the south

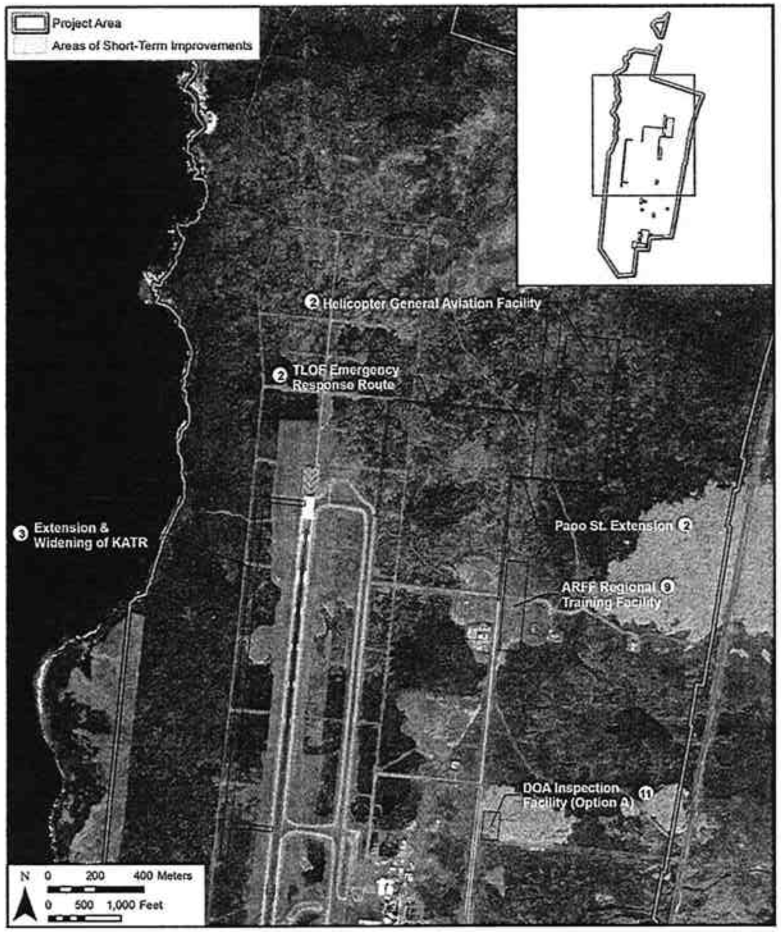


Figure 7. Aerial photo (Google Earth 2010) detailing the short-term improvement areas (in pink) within the northern portion of the overall project area (in blue)

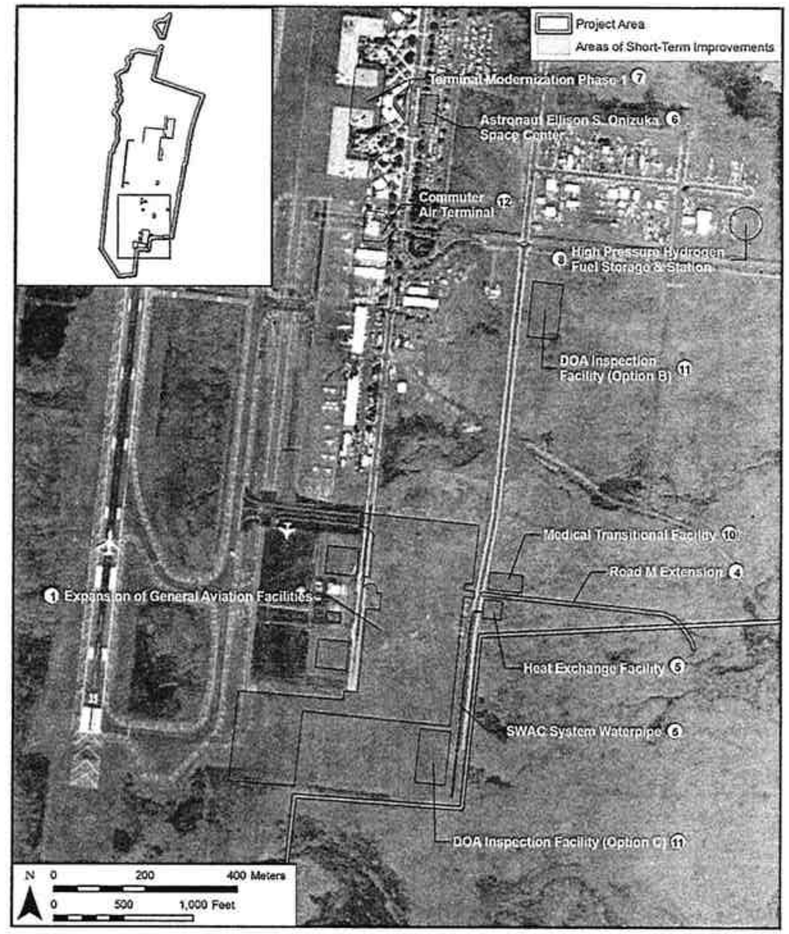


Figure 8. Aerial photo (Google Earth 2010) detailing the short-term improvement areas (in pink) within the southern portion of the overall project area (in blue)

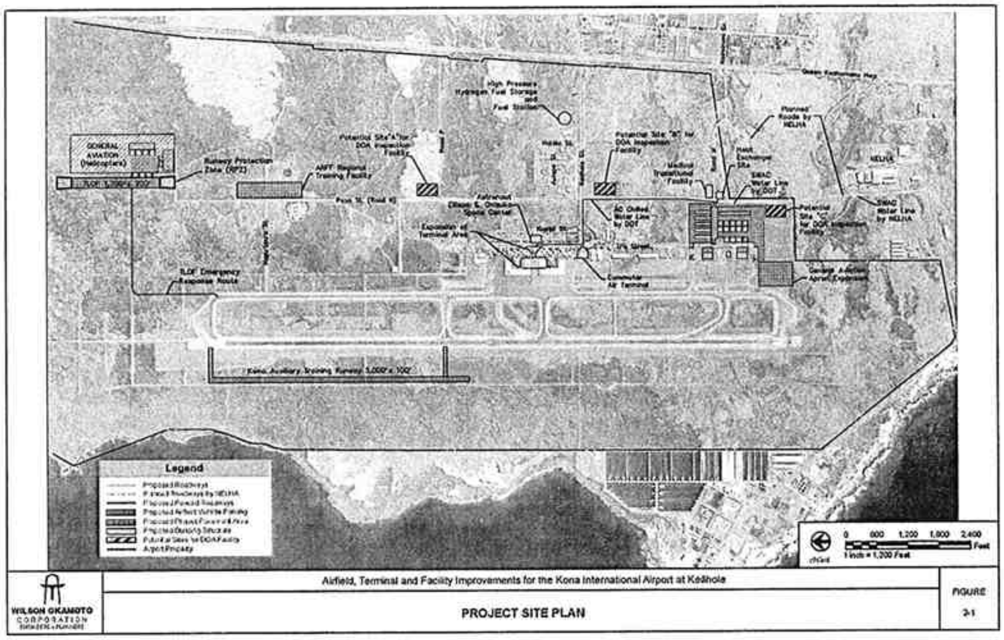


Figure 10. Project Site Plan (courtesy of the client), showing the specific proposed short-term improvement locations at the Kona International Airport at Keāhole (KOA); note: the route shown for the AC Chilled Water Line will likely be changed from that depicted

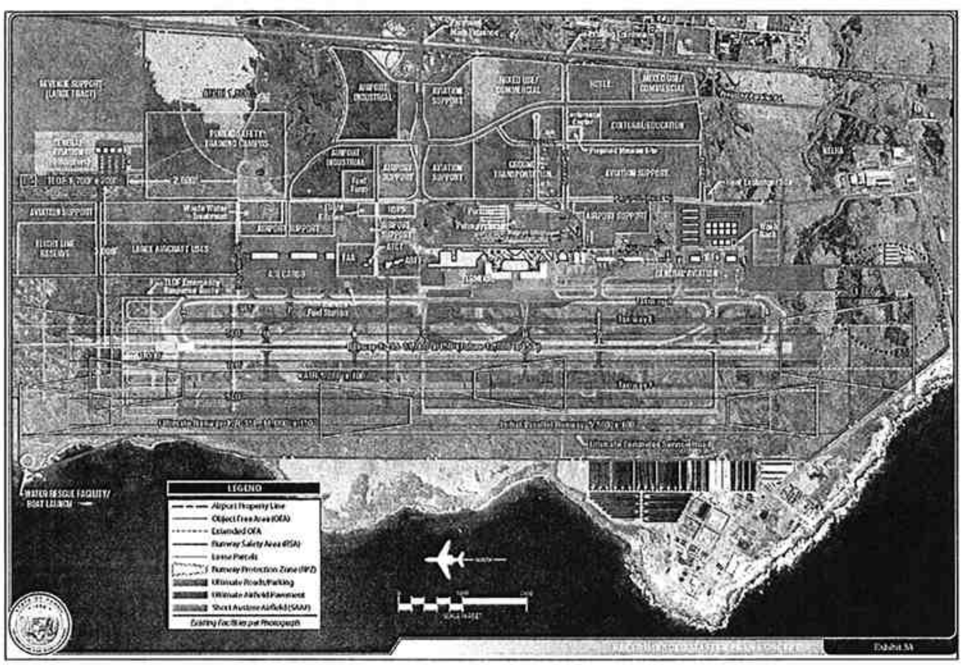


Figure 9. Concept Map from the 2010 Master Plan Update; note: some of the recommended improvements depicted are now obsolete

operations from the fixed-wing commercial and general aviation aircraft. The proposed facility will be located approximately 3,000 feet *mauka* (upslope) of the north end of the existing runway. Encompassing approximately 34 acres, the helicopter facility will include a new helicopter runway (approximately 200 feet wide and 1,700 feet long), a touchdown and lift-off facility (TLOF), hover pads, parking apron, taxi lanes, associated vehicle parking, an area for maintenance and storage facilities and tenant improvements. Pao'o Street will be extended 2,560-feet to access the new facility. In addition, an emergency response road approximately 1,940-feet long will be extended from the airfield to the facility to facilitate access by airport rescue fire fighting personnel.

3. Construct an interim secondary emergency runway by extending and widening the planned Kona Auxiliary Training Runway (KATR): The U.S. Air Force will soon begin construction of the KATR for flight training, primarily "touch and go" exercises. The DOT-A proposes to lengthen and widen the KATR from its initially planned size of by 4,250 feet long by 90 feet wide to 5,000 feet long by 100-feet wide. This expansion will allow the runway to be used as an interim secondary emergency runway until construction of a parallel runway can be initiated.
4. Initiate construction of a new road (Road M): Road M is planned to be a two-lane, two-way road providing public access from Queen Ka'ahumanu Highway to the airport's south ramp area and intersect with existing and planned north-south roads within and extending beyond the airport. The proposed initial construction of Road M will extend eastward, approximately 850-feet from its intersection with Pāo'o Street (Road N). This is opposite the portion of Road M that will be constructed in conjunction with the previously described new general aviation facilities area. Its eastern end will eventually connect with a roadway that the neighboring Natural Energy Laboratory of Hawai'i Authority (NELHA) plans to build on its property.

   NELHA plans to construct the unnamed continuation of Road M, extending from the aforementioned eastern end of DOT-A's proposed Road M to its intersection with Queen Ka'ahumanu Highway, opposite Ka'iminani Drive, where it will form a cross intersection.

   NELHA also plans to construct a two-lane, two-way road from its main facility to connect with the airport's Pāo'o Street (Road N). Pāo'o Street is the airport's primary north-south road, extending 1.86 miles from the airport's south ramp general aviation area northward to the wastewater treatment plant. As described in item 2, Pāo'o Street is proposed to be extended even further north to the proposed helicopter general aviation facility. It intersects and crosses, Keāhole Street, which is the airport's primary access road from Queen Ka'ahumanu Highway.
5. Construct a seawater air conditioning (SWAC) system: The SWAC system would pipe cold seawater recovered at NELHA to the airport, where a heat exchange facility will chill fresh water that will, in turn, be piped to and circulated within the terminal and other buildings for air-conditioning. The cold seawater will be conveyed by an 18-inch buried pipe. An exact route has not yet been determined for this pipeline, though it was initially proposed to run along portions of Road N and Keāhole Street.

6. Relocate the Astronaut Ellison S. Onizuka Space Center: The Onizuka Space Center, which is located between the two terminal areas, will be relocated across the terminal to the former ground transportation area. This will allow the terminal area to be expanded, as described in item 7, below.
7. Phase 1 of Terminal Modernization: The relocation of the Onizuka Space Center would allow the terminal areas to be connected by a single new building structure housing a centralized check-in area and in-line baggage handling system. The expanded terminal will improve passenger and baggage processing for the airlines.
8. Construct a high pressure hydrogen fuel storage and fueling station: In an effort to reduce dependence on petroleum-based fuels, the DOT-A proposes to offer a hydrogen fueling station in close proximity to the ground transportation operations.
9. Construct an Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility: The ARFF regional training facility will be located on the north side of the airport property, adjacent to the existing burn pit area. The training facility would be utilized two to three times a week, initially by airport ARFF personnel and County of Hawai'i fire fighting personnel and would eventually be opened up to all First Responders for training. The training center is comprised of a fuel spill trainer, a specialized air craft fire trainer (SAFT), a two-story control tower and classroom facility, a fuel farm, water storage tanks, a water recycling plant, and a three-story burn building.
10. Construct a medical transitional facility: The proposed medical transitional facility would be constructed on a four to six acre site to address the unmet need in Kona for doctors' services, especially those in specialized fields. The medical transitional facility would house an emergency room where patients could be received and stabilized prior to being transported by air to Honolulu or other off-island hospital for further treatment. It would also house an out-patient clinic where doctors from Honolulu, and even the mainland, could see patients from Kona during periodic visits. Having the clinic at the airport would significantly reduce ground travel time for doctors who would otherwise need to drive 40 miles to the North Hawai'i Community Hospital in Waimea or 20 miles to the Kona Community Hospital. This would allow more patients to be seen while the doctors are in Kona.
11. Construct a temporary State of Hawai'i Department of Agriculture (DOA) inspection facility: The proposed DOA inspection facility would be built on an approximately one to two acre site located at one of three possible locations:
    a. On the east side of Pāo'o Street adjacent to the proposed AARF station;
    b. On the east side of Pāo'o Street, between Keāhole Street and Road M; or
    c. The area directly south of the general aviation facility.

    In ten to twenty years, a permanent facility will be constructed in conjunction with a new cargo building.
12. Interior renovations of the existing ARFF Station for a new Commuter Terminal: DOT-A is currently pursuing the construction of a new ARFF Station at a different location. Once the new station has been constructed and occupied, the existing ARFF Station is

planned to be gutted and the interior renovated to be used as a new Commuter Terminal building.

While the present literature review and field inspection will seek to identify and recommend areas needing further archaeological study within the overall airport property, it will focus mainly on those short-term improvement areas, particularly in the field inspection component.

1.2 Document Purpose

The proposed project is subject to Hawaii State environmental and historic preservation reviews in accordance with Hawaii Revised Statutes (HRS) Chapter 343 and HRS 6E-8/Hawaii Administrative Rules (HAR) Chapter 13-275, respectively. In addition, several of the proposed improvements will use federal funding and therefore will require compliance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and the Department of Transportation Act (DTA). The short-term improvements that are subject to Section 106 compliance include: expansion of the General Aviation facilities, relocation of the Onizuka Space Center, Terminal Modernization Phase 1; and interior renovations to the existing ARFF Station for a new Commuter Air Terminal.

This archaeological literature review and field inspection study was completed for use as a planning document. While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR Chapter 13-276), it serves as a document to facilitate the proposed project's planning and supports historic preservation review compliance by assessing if there are any archaeological concerns within the study area and to develop data on the general nature, density and distribution of archaeological resources.

1.3 Scope of Work

The scope of work was to include:

1. Historical research to include study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.
2. Limited field inspection of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. This assessment will identify any sensitive areas that may require further investigation or mitigation before the project proceeds. In this particular project, the field inspection will focus on the 12 short-term improvement areas included in the present EA, although minimal inspection will occur outside of these areas throughout the overall project area as well. Furthermore, inspection of the four short-term improvement areas subject to Section 106 compliance will consist of 100% coverage.
3. Preparation of a report to include the results of the historical research and the limited fieldwork with an assessment of archaeological potential based on that research, with recommendations for further archaeological work, if appropriate. It will also provide mitigation recommendations if there are archaeologically sensitive areas that need to be taken into consideration.

1.4 Environmental Setting

1.4.1 Natural Environment

The project area is situated between sea level and approximately 175 feet amsl on the leeward slope of Hualālai Volcano, in the dry region of North Kona known as Kekaha. Rainfall in the present project site averages 10 inches per year (Cordy 1981). There are no natural springs or perennial streams within the project area. The coastline consists of a series of small bays and points. The dominant point is Keāhole, which represents the western cape of Hawai'i Island.

Overall, the project area slopes very gently *makai*, or to the west. The land surface throughout the airport property is comprised entirely of exposed *pāhoehoe* (smooth) and *'a'ā* (rough) lava (Sato et al. 1973). *Pāhoehoe* lava (rLW) covers the vast majority of the project area (Figure 11). The surface is generally uneven and characterized by numerous tumuli and pressure ridges with depressions or undulations in the *pāhoehoe* having thin soil pockets. Collapsed portions of lava tubes also contribute to the uneven surface of the *pāhoehoe* flows. A substantial area of *'a'ā* lava flow (rLV) occurs along the central-eastern portion of the project area, as well as in pockets in the southern portion of the airport property (Figure 11). The surface of the *'a'ā* lava ranges from fairly level expanses to rough, fractured ridges.

The *pāhoehoe* lava flow comprising much of the project area was the result of the 1801 eruption of Hualālai (Qh5, Figure 12). This lava flow covered a large fishpond once situated at this location, extending the shoreline out as much as a mile (see Section 3.5.2). An area of 5,000-11,000 year-old lava flow is found along the eastern side of the airport property (Qh1o, see Figure 12); this is the oldest flow area within the airport property. The southern portion of the project area largely consists of 1,500-3,000 year-old lava flow (Qh2; see Figure 12), although areas of 3,000-5,000 year-old lava flow are also present here (Qh1y; see Figure 12). Side-by-side comparison of Figure 11 and Figure 12 indicate that flows Qh1o, Qh1y, and Qh2 contain both *pāhoehoe* and *'a'ā* lava types. The pockets of Qh1y in the central-eastern portion of the property appear to consist entirely of *pāhoehoe* lava.

Vegetation is generally sparse throughout the undeveloped portions of the project area. The 1801 lava flow is characterized by the presence of very little to no vegetation. On the older flow areas, non-native fountain grass (*Pennisetum sectacacum* or *sectacacum*) is the most common plant. Shrubs and trees present in scattered numbers include: the native *'ilima* (*Sida fallax*), *noni* (*Morinda citrifolia*), and *maiapilo* (*Capparis sandwichiana*); the non-native Christmas berry (*Schinus terebinthifolius*), lantana (*Lantana camera*) and various ferns in fissures in the lava. Plants observed at the Kawili Point portion of the project area include: coconut or *niu* (*Cocos nucifera*), *kiawe* (*Prosopis pallida*), and the native *hau* (*Hibiscus tiliaceus*) and *naupaka* (*Scaevola sericea*). Developed areas have been landscaped with a variety of ornamental trees, shrubs and lawn grass.

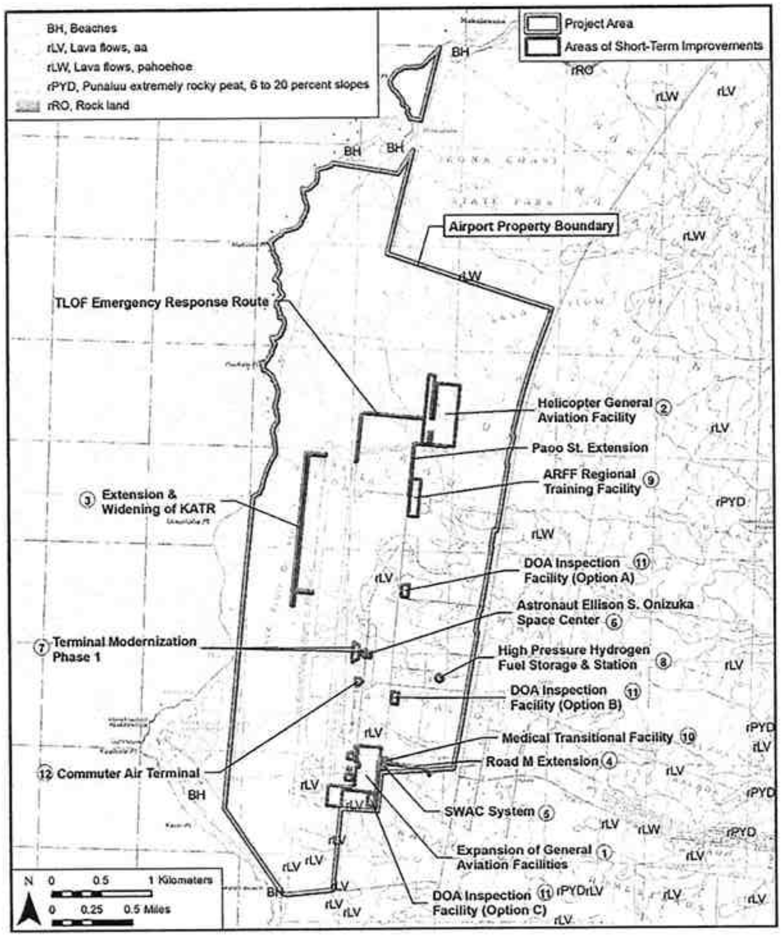


Figure 11. Portion of the 7.5-minute U.S. Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) quads, overlain with soil survey data (Sato et al. 1973), showing the soil and land types within the project area

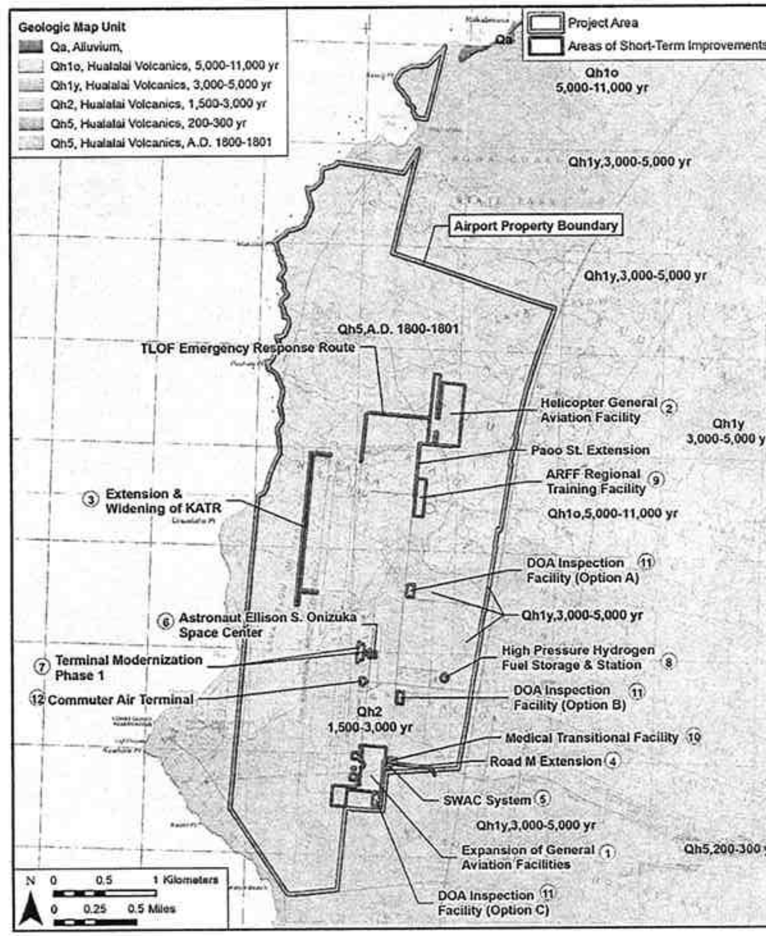


Figure 12. Portion of the 7.5-minute U.S. Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) quads, overlain with geologic survey data (Sherrod et al. 2008), showing the lava flows within the project area

1.4.2 Built Environment

The project area includes the present KOA facility comprised of terminals, baggage areas, runways and taxiways, roadways, parking areas, sidewalks, office buildings, the Onizuka Space Center, a fire station, car rental facilities, and other associated buildings and storage/staging areas. The airport property is cross-crossed by a network of both paved and unpaved roads, particularly to the east between the main airport facility and the Queen Ka'ahumanu Highway. An agricultural subdivision is present east of the airport property across the highway, and the Natural Energy Laboratory of Hawai'i Authority (NELHA) comprises facilities immediately south and west adjacent to the shoreline. The remainder of the airport property and surrounding lands are undeveloped. Kekaha Kai State Park bounds the airport property to the north.

Section 2 Methods

2.1 Document Review

Historic and archival research was obtained from the University of Hawai'i at Mānoa's Hamilton Library, the State Historic Preservation Division Library, the Hawai'i State Archives, the State Land Survey Division, and the Archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary historical sources. Information on Land Commission Awards was accessed through Waihona 'Āina Corporation's Māhele Data Base (www.waihona.com).

This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources studied were used to formulate a predictive model regarding the expected types and locations of historic properties in the project area.

2.2 Field Methods

The fieldwork component of the archaeological literature review and field inspection was completed from March 19 to March 22, 2012 by CSH archaeologists Sarah Wilkinson, B.A., Michael Rivera, B.A., and Olivier Bautista, B.A., under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). The field work, which comprised a total of nine (9) person-days, was carried out under archaeological permit number 12-04 issued by the Hawai'i State Historic Preservation Division/Department of Land and Natural Resources (SHPD/DLNR), per Hawai'i Administrative Rules (HAR) Chapter 13-282.

Given its large size, it was not feasible to inspect the entire airport property; therefore such an inspection was not included in the scope of work. Instead, the fieldwork focused on a thorough inspection of the vicinity of the 12 short-term improvement areas proposed by the current EA, with a brief, general inspection of the overall airport property for the purpose of identifying potentially sensitive areas based on past study coverage, geology, and the presence or lack of disturbance.

Pedestrian inspection of the short-term improvement areas focused on locating previously-recorded sites and additional archaeologically sensitive areas. Given the approximated nature of the improvement area locations on the handheld GPS unit, the archaeologists sought to inspect the lands immediately adjacent to the improvement areas as well. Areas not completely disturbed were inspected using pedestrian transects spaced approximately 10 to 30 m apart, which provided 75-100% coverage depending on the size, terrain, and geology of the improvement area.

Furthermore, given the need for Section 106 compliance at four of the short-term improvement areas, inspection sought to definitively determine the need for archaeological inventory survey (or lack thereof). As these short-term improvement areas are situated completely within developed portions of the airport property, this was accomplished with written and photographic documentation of the extent of prior disturbance.

The general inspection of the overall airport property largely consisted of observations made during a vehicular survey along existing airport roadways. This included a vehicular survey of the coastline within the northern portion of the project area, and a cursory pedestrian survey of the Mahai'ula Bay-Kawili Point area to identify any potential for coastal archaeological remains.

A Garmin GPS Map 60CSx was used to record the route traveled during the inspection and the location of any archaeological features or other points of interest. Notes and photographs were taken at all of the short-term improvement areas and any other points of interest. Areas of potential concern were identified and included in the field notes.

Some of the inspected areas fall completely within or overlap what is referred to as the AOA (Airport Operations Area). These areas require heightened security and safety measures given their proximity to the active runway and taxiway. Within these areas, CSH personnel were escorted by trained airport security staff.

Section 3 Traditional and Historical Background

This section summarizes aspects of the traditional and historical importance of the project area, which includes descriptions of place names and *wahi pana* (legendary places), *'olelo no'eau* (poetical sayings), and significant historical events and persons.

3.1 *Wahi Pana* (Place Names)

Wahi pana ("legendary place" - Pukui and Elbert 1986:376) or "place names" are an integral part of Hawaiian culture. "In Hawaiian culture, if a particular spot is given a name, it is because an event occurred there which has meaning for the people of that time (McGuire and Hammatt 2000:23)." The *wahi pana* are then passed on through language and oral tradition, thus preserving the unique significance of the place. Hawaiians have named a wide variety of objects and places, including points of interest that may have gone unnoticed by persons of other cultural backgrounds. Hawaiians have named taro patches, rocks and trees that represented deities and ancestors, sites of houses and *heiau* (places of worship), canoe landings, fishing stations in the sea, resting places in the forests, and the tiniest spots where miraculous or interesting events are believed to have taken place (Pukui et al. 1974:x).

The primary compilation source for place names in this section is the online database of Lloyd Soehren's (2010) *Hawaiian Place Names*. Soehren has compiled all names from the mid-nineteenth century land documents, such as Land Commission Awards (LCA) and Boundary Commission Testimony (BCT) reports. The Boundary Commission testimony lists boundary points for many (but not all) of the *ahupua'a*. The names of *'ili 'āina* (land units within an *ahupua'a*) and *'ili kū* (land units rewarded separately from a specific *ahupua'a*) are compiled from the testimony in Māhele Land Commission Awards, from both awards successfully claimed and from those rejected.

The Soehren database includes place name meanings from the definitive book on Hawaiian place names, *Place Names of Hawai'i* (Pukui et al. 1974). Where Pukui et al. (1974) do not provide a translation, Soehren often suggests a meaning for simple names from the *Hawaiian Dictionary* (Pukui and Elbert 1986). Thomas Thrum (1922) also compiled a list of place names in the 1922 edition of Lorrin Andrews's *A Dictionary of the Hawaiian Language*, although these meanings are considered to be less reliable than those in *Place Names of Hawai'i*. Oftentimes these place names can be found on historic maps.

The current project area encompasses a vast swath of land comprising portions of ten *ahupua'a* (that is, if Kalaoa 1-5, the *ahupua'a* on which the majority of the present airport facility is constructed, is counted as a single unit). These *ahupua'a* include, from south to north: 'O'oma 1 (also seen as Kalaoa-'O'oma), Kalaoa 1-5, Hāmanamana, Hale'ōhi'u, Maka'ula, Ka'ū, Pu'ukala, Awalua, Kaulana, and Mahai'ula. Table 1 presents the meanings of these names as given by Soehren (2010); additional place name meanings are given as appropriate throughout Section 3.

Table 1. Meanings of Names of *Ahupua‘a* Comprising the Project Area (compiled by Lloyd Soehren 2010, with additions)

Ahupua‘a Name	Name Meaning
‘O‘oma (1 and 2)	"Concave" (Pukui et al. 1974:171)
Kalaoa	According to Pukui et al. (1974:75), literally translates as "the choker (as a stick for catching eels); this *ahupua‘a* was named after "Kalaoa Pu‘umoi, sister of Kapalaoa, the mother of riddling expert, Kala-pana."
Hāmanamana	*Hāmana*, which may represent the root of this place name, translates as "fork; branching, forked" (Pukui and Elbert 1986:55)
Hale‘ōhi‘u	Based on definitions given in Pukui and Elbert (1986:278), the name means "house made with a thatching shuttle" (Maly in Henry et al. 1993:22)
Maka‘ula	According to Pukui et al. (1974:142), translates as "red eye (so named because of a fire there)."
Ka‘ū	Soehren identifies the lexicology of this place name using the diacriticals used throughout this report. While Pukui et al. (1974:91) don't mention this *ahupua‘a*, they discuss the origin of the name as given to the Hawai‘i Island district "…as an ancient name, with cognates in Samoa (Ta‘ū) and Mortlock Islands (Takuu)…"
Pu‘ukala	Literally translates as "fish hill"; the place "where fishponds were destroyed by the lava flow of 1801" (Pukui et al. 1974:197-198).
Awalua	According to Pukui et al. (1974:15), translates as "double harbor."
Kaulana	May refer to literal translation of "Resting place, place to out things, placement; restful, quiet" (Pukui and Elbert 1986:136).
Mahai‘ula	While no literal translation for this place name could be found, Pukui et al. (1974:137) note the following in the context of "Mahai‘ula": "A stone fish goddess about a fathom from the shore was named Pōhaku-o-Lama; she was brought gifts by fishermen except during May, June, and July. During these months the sea thereabout turned yellowish and the people thought the deity was menstruating."

3.2 *‘Ōlelo* (Poetical Sayings) and *Mo‘olelo* (Stories)

3.2.1 Introduction to Kekaha

The *ahupua‘a* of the project area lie within the Kekaha region of the North Kona District; according to Kalima (1992:A-l), the *ahupua‘a* comprising Kekaha were generally treated as a unit. Based on a recent translation of the "Legend of Ka-Miki" by Kepa Maly (cited in Henry et al. 1993) the region or *‘okana* of Kekaha extends from Keahuolū northward to the Kona/Kohala boundary. The Kekaha region is also called *Kekaha wai‘ole*, or "waterless place," a name which reflects its dry and barren appearance. Despite its desolate appearance, legends and other traditional accounts indicate that Kekaha was once a populous and productive region.

The character of Kekaha, as it had been established in the Hawaiian consciousness, is represented in a traditional saying recorded by Mary Kawena Pukui and in a brief description by John Papa ‘Ī‘ī: "*Kekaha wai ‘ole na Kona.*" Pukui translates this as "waterless Kekaha of the Kona district" and explains that "Kekaha in Kona, Hawai‘i, is known for its scarcity of water but is dearly loved by its inhabitants" (Pukui 1983:184).

Samuel Kamakau, the native historian, relates that in the 15th century, High Chief ‘Umi-a-Līloa fished for *aku* (bonito, skipjack; *Katsuwonus pelamis*) along the Kekaha coast, and around 1810, Kamehameha I also fished the shores of Kekaha (Kamakau 1992:20, 203).

‘Ī‘ī describes the winds of Kekaha:

> …a cold wind from Kekaha, the Hoolua. Because of the calm of that land, people often slept outside of [sic] the tapa drying sites at night. It is said to be a land that grows cold with a dew-laden breeze, but perhaps not so cold as in Hilo when the Alahonua blows [‘Ī‘ī 1959:122].

These passages suggest that Kekaha was firmly identified with its austere physical environment. A legend told in Maguire (1994) reveals the importance of water resources in this general area (see also Wolforth et al. 2005:8-9). The story takes place at the Cave of Mākālei, which is located outside of the current project area near ‘Akahipu‘u (a nearby mountain). The story focuses on a man named Ko‘amokumokuohe‘eia, who moved to this area and was told by the current residents that water was very scarce. Water, he was told, could be obtained in "celebrated" caves, but these caves were *kapu* (forbidden), and if caught, trespassers would be killed by the owner of the cave. However, Ko‘amokumokuohe‘eia discovered a very small cave entrance that no else knew about. The cave had water dripping from its roof (Maguire 1994:20). Ko‘amokumokuohe‘eia and his father used carved *‘ōhi‘a* and *wiliwili* (*Erythrina sandwicensis*) trees to capture the dripping water, and his family was thus able to survive during dry spells. This legend clearly demonstrates the importance of water as a difficult-to-procure resource, as well as highlighting the importance of water collection caves.

John Ka‘elemakule Sr., a Kekaha native, wrote newspaper articles between 1928 and 1930 that provide details about life and customs in the last half of the 19th century. Kepā and Onaona Maly (2003:41-42) translated these serial accounts that appeared in *Ka Hoku o Hawaii*. The two following excerpts provide additional details related to water collection:

> There were not many water holes, and the water that accumulated from rain dried up quickly. Also there would be weeks in which no rain fell… The water which the people who lived in the uplands of Kekaha drank, was found in caves. There are many caves from which the people of the uplands got water… [*Ka Hoku o Hawaii*, September 17, 1929:3 in Maly and Maly 2003].
>
> …The *kūpuna* [elders] had very strict *kapu* (restrictions) on these water caves. A woman who had her menstrual cycle could not enter the caves. The ancient people kept this as a sacred *kapu* from past generations. If a woman did not know that her time was coming and she entered the water cave, the water would die, that is, it would dry up. The water would stop dripping. This was a sign that the *kapu* of Kāne-of-the-water-of-life (Kāneikawaiola) had been desecrated. Through this, we learn that the ancient people of Kekaha believed that Kāne was the one who made the water drip from within the earth, even the water that entered the sea from the caves. This is what the ancient people of Kekaha *wai 'ole* believed, and there were people who were *kia'i* (guardians) who watched over and cleaned the caves, the house of Kāne… [*Ka Hoku o Hawaii*, September 24, 1929:3 in Maly and Maly 2003:41-42].

The following passage is from Kihe and appeared in *Ka Hoku o Hawai'i* between January 31 and April 10, 1928. It relates the variety of agricultural crops that grew in Kekaha:

> Departing from O'ahu, Makalie and his family landed at Hale'uki, Ka'upulehu and were greeted by Ke'awalena a chief and overseer of the Kekaha region. Ka'upulehu and all Kekaha were extensively cultivated at this time. Dependent on seasons, the uplands were used for residences and farming, and the coastal lands for residence and fishing. *Pao wai* (dug out water catchments) on the *pāhoehoe* and in upland fields were a means of water catchment. Crops grown here included: taro, sweet potatoes, sugar canes, bananas, and *'awa*… [from Maly in Henry et al. 1993:25].

Maly (in Henry et al. 1993:29) explains that traditional accounts of the Kekaha region describe a lush environment that differs from its current state due to several factors. The Hualālai lava flow in 1801 covered the former agricultural and forested lands, residential areas, and fishponds. The loss of forests began the decrease in rainfall that was exacerbated by the introduction of livestock and ranching. Goats and cattle stripped the vegetation from the lands causing water resources to dry up. Thus, over the last 150 years, the environment has been significantly altered.

Pukui (1983:271) underscores the importance of fishing in this region in the following poetical saying:

> *Ola aku la ka aina kaha, ua pua ka lehua I kai.*
>
> Life has come to the *kaha* lands for the *lehua* blooms are seen at sea.

Pukui (1983:271) further explains this saying: "Kaha lands refers to Kekaha. When the season for deep-sea fishing arrived, expert fishermen and their canoes headed for the ocean."

It is likely because of its abundance of fish that Kekaha was "valued by ruling chiefs, inhabited by attendant chiefs, and upon occasion abused by warring chiefs" (Kamakau 1979:31). Kamakau (1992:66) reports that during the war between Alapa'inui of Hawai'i and Kekaulike of Maui, Kekaulike "abused the country people of Kekaha" by destroying all the coconut groves and slaughtering "the country people." The destruction of these valuable trees was devastating.

Describing the apportioning of land by the *ali'i* (royalty) before the ascendancy of Kamehameha, records this information about the lands of Kekaha:

> Waimea [he is referring in this case to Waimea, O'ahu] was given to the Pa'ao kahuna [priest, sorcerer] class in perpetuity and was held by them up to the time of Kamehameha III when titles had to be obtained. But there was one land title held by the kahuna class for many years and that was Puuepa in Kohala. In the same way the land of Kekaha was held by the kahuna class of Ka-uahi and Nahulu [Kamakau 1992:231].

Kamakau further records that during the 1770s, "Kekaha and the lands of that section" were held by descendants of the Nahulu line, the Ka-me'e-ia-moku and Ka-manawa, the twin half brothers of Ke'e-au-moku, the Hawai'i island chief (Kamakau 1992:310). The Great Seal of the State of Hawai'i depicts Kame'eiamoku and Kamanawa (Springer 1989:23).

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

3.2.2 The Story of Ka-Miki

Kepā Maly (in Henry et al. 1993) translated the "Kaao Hooniua Puuwai no Ka-Miki" (The Heart stirring Story of Ka-Miki) that appeared in the newspaper *Ka Hoku o Hawai'i* between 1914 and 1917. The legend provides details about life and the environment of Kekaha as well as for the entire island of Hawai'i. Ka-Miki, the quick or adept one, and his brother Maka'iole ("rat or squinting eyes"), traveled around the island to participate in competitions circa the thirteenth century when Pili-a-Ka'aiea was the chief of Kona. The boy's parents were Pōhaku-o-Kāne (male) and Kapa'ihilani (female), the *ali'i* of Kaloko and Kohanaiki. The legend relates that the supernatural brothers "were empowered by their ancestress Ka-uluhe-nui-hihi-kolo-i-uka (the great entangled growth of *uluhe* fern which spreads across the uplands), a reincarnate form of the earth-mother goddess, creative force of nature Haumea (also called Papa) who dwelt at Kalama'ula on Hualālai, in the uplands of Kohana-iki, Kona" (Maly in Henry et al. 1993:21-22). The twins were raised by Ka-uluhe, who taught them how to use their supernatural powers. Portions of the legend that are relevant to the current study follow.

In 'O'oma and Kalaoa, the priests of the different *ahupua'a* are named:

> Puhili was the high priest of 'O'oma and Kohanaiki, the place where he lived is on the plain of Kohanaiki, at the shore, and bears his name to this day. It is on the boundary between Kohanaiki and 'O'oma.

> Kalua'ōlapa was the high priest of Hale'ōhi'u and Kamāhoe, that is the waterless land of Kalaoa (*Kalaoa wai 'ole*) [and presumably the intervening Hamanamana]. The place where he lived was in the uplands of Maulukua on the plain covered with *'ilima* growth. This place bears his name to this day [Maly in Henry et al. 1993:28].

The *ahupua'a* of Awalua is mentioned poetically:

> While Ka-Miki was competing at 'Iwa'awa'a, the contest arena of Kohanaiki, Maka-'iole was at Ka'aipapa'a, Kaloko (the royal compound of Pōhaku-o-Kāne). Maka-'iole compared the rising voices of those watching the contest to the sounds of the murmuring ocean of Awalua, a sound that was carried upon the winds:
>
> Shouting is heard like the distant murmuring of the ocean
>
> It is the sea of Kaloa that rumbles at Awalua
>
> A murmuring that rises gently to the uplands of Kalama'ula [Maly in Henry et al. 1993:20]...

Both the Keāhole area and the *ahupua'a* of Hale'ōhi'u are specifically discussed in the Ka-Miki tale in the context of fishing practices:

> ...After lighting in the ocean with the *'ōlohe* master Kanāhāhā, who had threatened Pili's kingdom, Ka-Miki left the body of Kanāhāhā bound in the ocean as a *ko'a* (fishing station) off of Hale'ōhi'u. Ka-Miki then swam and landed at Awalua, which was also a *mākāha* (sluice gate) of the great fishpond Pa'aiea [Maly in Henry et al. 1993:20]...
>
> ...While at Kalāhiki (Kona-hema), with Kūalaka'i and his fishermen in the *hālau wa'a* (canoe sheds) of Kuaokalā, Ka-Miki described the fishing grounds of [Kekaha] his home region. The narratives include the following site descriptions:
>
> **Ka'ele-huluhulu (Splintered outer hull)** This place name described the splintered or rough nature of canoes from the area of Hale'ōhi'u. At low tide canoes had to be dragged over an outcropping of rock in the waters of the canoe landing at Hale'ōhi'u [Maly in Henry et al. 1993:22]...
>
> ...Ho'onā is a point near the tip of Keāhole, and it is the source of the famous supernatural currents Ke-au-kā (The current that strikes), Ke-au-kāna'i (The current of smooth waters), and Ke-au-miki (The current that pulls out to the deep sea). [These currents are identified as brothers of Pele *mā* in the lore of Pele's migration to Hawai'i.]
>
> Ka-Miki was fishing off of the deep sea *ko'a* of *Pāo'o* (between Ho'onā and Hale'ōhi'u), when the *aku* began to strike at the canoe. Ka-Miki told his companion Uhalalēma to take the first caught and place it in a gourd container. After this the *aku* rose like biting dogs, tearing at the water, and Ka-Miki moved like a swift wind. In no time the canoe was filled with more than 400 *aku*.

> An amazing thing is that although Pili's fishermen, and all the fishermen of the region, were fishing at Kāka'i, Kanāhāhā (Hale'ōhi'u), and all the way from the fort [at Ahu'ena] to Kahawai (Ka'ūpūlehu), none of them caught any fish at all...
>
> After catching more than 400 *aku*, Ka-Miki landed the canoe at Nā-Hono-'elua, now called Honokohau. Ka-Miki divided the fish among the family of the sacred chiefess Paehala and people of those lands [Maly in Henry et al. 1993:24]...

3.2.3 The Legend of Wāwāloli

A legend about Wāwāloli, on the 'O'oma shore across from the southern boundary of the airport property, was documented by Maguire (1994:21) in her book *Kona Legends*:

> This little pool of water is situated near the seashore between 'O'oma and Kaloko. The story of this pool has been handed down from generations past to the present day, and is related thus:
>
> Wawaloli [Wāwāloli] was the name of a certain *loli* (a sea slug). He was a *kupua* (wizard). He had two bodies, a limpsy fish body and the body of a man.
>
> There lived in the uplands covered with ilima (a) [sic], a man by the name of Kaluaolapa [Kalua'ōpala] and his wife, and their beautiful and charming daughter, Malumaluiki.

Malumaluiki traveled to the shore to collect *limu* (seaweed) and *'opihi* (sea snails). When she bent down to get a drink from the pool, a handsome man arose. He was the charmer Wāwāloli, and the girl fell in love with him. Each day she returned to the pool, crying out a chant, and her lover would join her. The girl could not eat or sleep, however, and one day her father followed her. Seeing the form of her lover, he vowed to trap him. He memorized the chant, and disguised his voice to make the *loli* (double-bodied being) appear and then caught him in a net. He gave the captured *loli* to a priest, Pāpa'apa'o, he baked the *loli* in an *imu* (underground oven), and saved the life of Malumaluiki (Maguire 1994:11-17).

3.2.4 Pa'aiea Fishpond and Kamehameha I

By the late 1600s a four class hierarchy had been developed in Hawaiian society: "ruler, high chiefs, local chiefs and commoners" (Cordy et al. 1991:575). Often, the construction of a fishpond, or *loko i'a*, is attributed to a particular chief, and while some fishponds may have been constructed as early as the 14th century, most were probably built between the 16th and 18th centuries (Kirch 1985:214). This later range likely includes the fishpond Pa'aiea, which was once situated at the coast within the present project area. Maguire (1994) includes an excellent introduction to this pond and the surrounding environment:

> The fishpond of Paaiea [Pa'aiea]. This was a very large fishpond extending from Kaelehuluhulu [Ka'elehuluhulu], adjoining the little fishing hamlet of Mahaiula [Mahai'ula], and as far as Wawaloli on the boundary of Ooma ['O'oma].
>
> This pond was not far from Ka-Lae-O-Keahole, (fisherman's point) which is the extreme western point, or cape on the island of Hawaii, and on which there was a lighthouse [Ke'āhole refers to the *āhole*, a fish favored by Hawaiians].

> To mariners of the days of sailing crafts, this point was a test of skillful navigation; the wind and tide and current, all combining to thwart the mariner's effort to round the cape, and make the entrance into Kailua Bay.
>
> This fish-pond of Paaiea [Pa'aiea] was three miles long, and a mile and a half wide. The fishermen going to Kailua and further south, often took a short cut by taking their canoes into the pond and going across, thus saving time and the hard labor of paddling against the Eka, a strong sea breeze from the south, and also against the strong current from Keahole [Keāhole] [Maguire 1994:4].

Pa'aiea "was said to be over 600 acres" (Wyban 1992:89). The pond was so large, it inspired a Hawaiian proverb that was recorded in the book, *'Ōlelo No'eau: Hawaiian Proverbs and Poetical Sayings* by Pukui (1983:275):

O na hoku o ka lani, o Pa'aiea ko lalo.

The stars are above, Pa'aiea below.

Wyban (1992:89) writes that "[t]he saying is a reference to the numerous islets that dotted the great fishpond's interior, mimicking the vast sky with its many stars." It was refurbished and maintained by Kamehameha I, and is said to have been one his favorite fishponds. According to 'Ī'ī (1959:132), a man named Kepaalani was awarded "the fish ponds Paaiea [Pa'aiea] in Makaula [Mahai'ula] and Kaulana in Kekaha" by Kamehameha I due to his paddling skills. Pa'aiea was destroyed by the 1801 eruption of Hualālai, in the fourth year of Kamehameha's reign (see Section 3.5.2). Legend surrounds this eruption; one account is summarized below:

> One such story tells of the *konohiki* [headman of an *ahupua'a*; likely here referring to Kepaalani] of Pa'aiea fishpond catching an abundance of *aku* in the ocean. Upon returning to shore he was approached by an old woman who requested a share of the fish. The *konohiki* refused. She then asked for some bait or some tiny *'opae* [shrimp]. Again he refused, for he did not know that the old woman was Pele. She turned and walked the path to the mountain. That night a lava flow lit the mountains of Hualalai [Hualālai]. Its flow destroyed the great fishpond, evaporating its water and filling it with black lava [Wyban 1992:127].

Pukui et al. (1974:61) also refer to this pond as Ka'elehuluhulu, "belonging to Kamehameha I and destroyed by Pele who wanted the *aku* fish there." Kamakau mentions this legend as well, but identifies alternative motives for Pele's fury. One of these motives was attributed to Pele's displeasure at Kamehameha's devotion to his wife Kaheiheimalie over his other wife Ka'ahumanu (Kamakau 1992:186). In addition:

> The people believed that this earth-consuming flame came...because of her [Pele's] jealousy of Kamehameha's assuming wealth and honor for himself and giving her only those things which were worthless; or because of his refusing her the tabu [sic] breadfruit of Kameha'ikana which grew in the uplands of Hu'ehu'e where the flow started [Kamakau 1992:184-185].

Kamakau describes Kamehameha's course of action after learning of the eruption:

> Kamehameha was in distress over the destruction of his land and the threatened wiping-out of his fish ponds. None of the kahunas, orators, or diviners were able

> to check the fire with all their skill. Everything they did was in vain. Kamehameha finally sent for Pele's seer (*kaula*), named Ka-maka-o-ke-akua, and asked what he must do to appease her anger. "You must offer the proper sacrifices," said the seer. "Take and offer them." replied the chief. "Not so! Troubles and afflictions which befall the nation require that the ruling chief himself offer the propitiatory sacrifice, not a seer or a kahuna." "But I am afraid lest Pele kill me." "You will not be killed," the seer promised. Kamehameha made ready the sacrifice and set sail for Kekaha in Mahai'ula [Kamakau 1992:185].

Upon Kamehameha's return to Hawaii in 1812, when he commenced permanent residence at Kailua, his fleet passed the lands of the current project area (Cordy 1985:34). 'Ī'ī (1959:109) mentions that fishing canoes from 'O'oma approached one of the ships, and he notes the lands of the "Kalaoas, Hoona [Ho'onā], on to Oomas ['O'omas]" ('Ī'ī 1959:110).

3.3 Traditional Settlement Zones of Kekaha

Kelly (1971:74) clarifies Kekaha as the band of barren lava fields extending north from Kailua-Kona to Anaeho'omalu. As has been observed throughout the *ahupua'a* comprising Kekaha, this band of barren lava fields does not encompass the entire *ahupua'a,* nor does it inhibit land usage from occurring along the coast and inland where rainfall is sufficient for intensive agriculture. Instead, Kekaha refers more accurately to portions or "zones" of the regions where lava flows encompass the lands which, according to elevation, sustain little rainfall. Correspondingly, the lands of Kekaha are suggested, based on ethnographies, ethno-histories and archaeological sources, to contain three general terrestrial zones that directly influenced land usage of prehistoric and historic populations. These three zones include: (1) Coastal; (2) Intermediate or Transitional and; (3) Upland. Walsh and Hammatt (1995:32) present a synthesis of five different models of Kekaha's three-zone settlement pattern, originally presented by Rosendahl (1973:60-61, 65-66), Davis (1977:19-21), Cordy (1985:7-8), Hammatt (1987:69-71), and Barrera (1987b). Henry et al. (1993:55) discuss these models as follows:

> The preceding models, though varying in detail, have several common elements. First, there is a general agreement on separation of the region into three basic environmental zones: the coastal zone, the barren or intermediate zone, and the upland zone. Second, all five models associate the coastal zone with marine exploitation and the upland zone with dryland cultivation. Depending on their proximity to the coast or uplands, sites within the barren zone are considered extensions of the two major patterns into marginal areas, or as sites related to travel between the two poles (e.g. trails, shelters, etc.). Third, and finally, all of the models posit some level of interaction between the coast and the uplands, although there is little agreement concerning the nature and intensity of this interaction.

Table 2, adapted from that found in Walsh and Hammatt (1995:33), summarizes the major characteristics of the three Kekaha settlement zones. The airport property lies almost entirely within the Intermediate Zone, though its northern section extends to the coast as well. Archaeological evidence supports traditional accounts of a zone of permanent habitation and activity at the coast of 'O'oma through Kalaoa (and likely further north around Mahai'ula,

Table 2. Summary of Kekaha Zone Model Characteristics

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

though this area has not been documented to the same extent, and the 1801 eruption may have destroyed some of the archaeological remains here). These settlements may have always been relatively small in terms of population (Cordy 1985:34, 37). According to Cordy (1985:39):

> Counts of permanent house sites (identified during archaeological survey in the coastal zone) and conversion to population estimates (Cordy 1978[1981]:244-245) suggest that the population of Ooma ['O'oma] 1 and 2 and Kalaoa 4 and 5 together never had more than 102 people (with the maximum at c. 1750-1780). If permanent dwellings were present inland prehistorically, the overall population figures would still not be expected to vastly increase.

Radiocarbon analysis from samples collected at habitation sites in the coastal and intermediate zones of 'O'oma and Kalaoa tend to date to the 1400-1600s and the historic era (Cordy 1985:29-30, Barrera 1990:25). However, Barrera (1990:25) documented two much earlier dates at one site (SIHP 10679) first identified during his 1987(b) study of portion of the airport property: one ranging from A.D. 640 to A.D. 1390., and the second between A.D. 781 and A.D. 1385. These dates represent the earliest documented in the area (Barrera 1990:25); Cordy et al. (1991) note dates from around A.D. 900 at coastal settlements at both Kaloko and Kohanaiki, and "...sites in the barren Rockland [intermediate] zones [of Kohanaiki] may have been inhabited as early as AD 1180" (O'Hare and Goodfellow 1992:ii).

3.4 Development of the Kona Field System

As expressed in Table 2, elevation is a critical factor in trying to understand the traditional background of the Kekaha region of North Kona. *Kānaka Maoli* (Native Hawaiians) in leeward Hawai'i developed ingenious methods of maximizing the availability of moisture to produce plant foods even in apparently barren landscapes. The settlement pattern described above reveals a variety of land uses across all zones, including the Intermediate Zone, during the prehistoric and early historic period. For example, Hawaiian gardeners in the Intermediate Zone created mulching mounds and stone piles that captured the heavy night dew for which the area is famous.

Intensive non-irrigated agriculture is characteristic of the Kona slopes and other regions of Hawai'i and Maui where irrigation, because of the lack of perennial waterways, is not possible. The "Kona Field System," generally defined by a grid-like patterning of stone constructed field boundaries, represents an interrelated network of intensive non-irrigated agriculture covering an estimated area of 139 km^2 (456,037 ft^2) between Kealakekua Bay and Kailua Bay (Kirch 1985:225). Archaeological studies beyond the arbitrary northern boundary of the "Kona Field System" have documented evidence of intensive non-irrigated agriculture in the Kekaha region within the Upland Zone between approximately 400 to 1200 ft. amsl (e.g., Davis 1977; Cordy 1985; Hammatt et al. 1987; Telea and Rosendahl 1987; Walker and Haun 1988; Walker and Rosendahl 1990a and b; O'Hare and Rosendahl 1991; Thompson and Goodfellow 1992; Barrera 1992, 1995; Robins et al. 1993; Shideler and Hammatt 2005).

This type of agriculture is characterized by concentrated occurrences of similar feature types (i.e. field walls, modified *'a'ā* lava, *pāhoehoe* excavations, and mound complexes). Variations in the methods of non-irrigated agriculture occur as a response to topographical and geological variation, and rainfall in the region. While radiocarbon dates taken from upland field shelters within the Kona Field System date as early as A.D. 1280 (Walker and Haun 1988, O'Hare and Rosendahl 1991), generally radiocarbon data from this region indicates that intensive agriculture began developing between ca. A.D. 1400-1600 and intensified with permanent upland settlements between ca. A.D. 1600-1779, as the distance between the upland farms and original coastal settlements expanded (Schilt 1984). By the end of this period it is expected that most of the upland permanent habitations were occupied.

3.5 Early Historic Period

3.5.1 Explorers and Visitors

Archibald Menzies, the first foreigner to record his visit to Kekaha, accompanied Captain Vancouver in 1792. He described the land as "barren and rugged with volcanic dregs and fragments of black lava…in consequence of which the inhabitants were obliged to have recourse to fishing for their sustenance" (Menzies 1920:99). On January 17, 1792, Menzies hiked to the top of Hualālai, and observed the following:

> We commenced our march with a slow pace, exposed to the scorching heat of the meridian sun, over a dreary barren track of a gradual ascent, consisting of little else than rugged porous lava and volcanic dregs, for about three miles, when we entered the bread fruit plantations whose spreading trees with beautiful foliage were scattered about that distance from the shore along the side of the mountain as far as we could see on both sides. Here the country began to assume a pleasant and fertile appearance through which we continued our ascent for about two miles further, surrounded by plantations of the esculent roots and vegetables of the country, industriously cultivated…From this place we had a delightful view of the scattered villages and shore underneath us, and of the luxuriant plantations around us…
>
> January 18th….We observed here and there on the path little maraes [shrines] pointed out by taboo sticks in the ground round a bush or under a tree. In passing these places the natives always muttered a prayer or hymn, and made some offering as they said, to their akua, by leaving them a little piece of fruit, vegetable or something or other at these consecrated spots. Even in this distant solitary hut, we found a corner of it consecrated by one of these taboo sticks which the natives earnestly requested us not to remove when we took possession of it, and we very strictly obeyed their injunction, conceiving that religious forms whatever they are, ought to be equally inviolable everywhere [Menzies 1920:151-160].

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

William Ellis traveled extensively throughout the island in 1823, and remarked on the lava flow covering much of the present project area (see Section 3.5.2 below). Kalaoa is depicted on Ellis' 1823 map of Hawaii Island. In 1840, the explorer C. Wilkes observed "a considerable trade

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

3.5.2 Eruption of 1801

As discussed in Section 3.2.4, in 1801 Hualālai volcano erupted from its Hu'ehu'e crater, which is situated at approximately 500 feet in elevation. Samuel Kamakau noted that the 1801 eruption "…had been destroying houses, toppling over coconut trees, filling fish ponds, and causing destruction everywhere" (Kamakau 1992:86). Ellis included a description of the event in his journal, as related by a resident of the area. He wrote:

> Stone walls, trees and houses, all gave way before it [the lava flow]; even large masses or rocks of hard ancient lava, when surrounded by the fiery stream, soon split into small fragments, and falling into the burning mass, appeared to melt again, as borne by it down the mountain's side.
>
> Numerous offerings were presented, and many hogs thrown alive into the stream, to appease the anger of the gods, by whom they suppose it was directed, and to stay its devastating course.
>
> All seemed unavailing, until one day the king Tamehameha [Kamehameha] went, attended by a large retinue of chiefs and priests, and, as the most valuable offering he could make, cut off part of his own hair, which was always considered sacred, and threw it into the torrent.
>
> A day or two after, the lava ceased to flow. The gods, it was thought, were satisfied; the king acquired no small degree of influence over the minds of the people, who, from this circumstance, attributed their escape from threatened destruction to his supposed interest with the deities of the volcanoes [Ellis 2004:44-45].

According to an article entitled "Fishponds Versus Lava Flows" found on the website of the U.S. Geological Survey Hawaii Volcano Observatory (1997), "[r]ecent mapping of stranded beach and ocean entry deposits within the Hu'ehu'e flow shows that this flow extended the coastline out at least one mile and added nearly four square kilometers (nearly 1000 acres) to the island." A replacement pond was subsequently constructed on the north side of Kīholo Bay, though this pond was destroyed by the 1859 flow from Mauna Loa (USGS Hawaii Volcano Observatory 1997). KOA is constructed largely upon the Hu'ehue'e flow in the vicinity of the former Pa'aiea fishpond.

Settlers displaced by the eruption may have moved immediately south, to Keāhole Point (Kalaoa 4), though this is conjecture (Cordy 1985:39).

3.5.3 Changes in Population

Missionary censuses of the 1830s chart the diminishing population of Kekaha and North Kona. In 1834, the total population of Kekaha is recorded as 1,244, comprising 21% of the total North Kona population of 5,957 (Schmitt 1973:31). The North Kona figure represents a population loss of 692 since the previous census of 1831 (during which no figure specific to Kekaha was noted), which recorded 6,649 persons in the district (Schmitt 1973:9). One factor inducing the diminishing population of Kona, inter-island migration, was specifically noted by missionaries in 1832: "We have been sensible for some time that the number of inhabitants in this island is on the decrease. There is an almost constant moving of the people to the leeward islands, especially since the removal of the governor (Kuakini) to Oahu. Some leave by order of the chiefs, and others go on their own responsibility" (cited in Schmitt 1973:16).

The pattern of population decrease continued throughout the following decades. According to Schmitt (1973:37), between 1848 and 1849 newly-introduced diseases were responsible for the deaths of more than 10,000 people throughout the Hawaiian Islands. Furthermore, Kelly (1971:12) writes that "...the *mahele* and *kuleana* laws displaced people—took land away from them and forced them to go elsewhere, such as into the trade centers of Kailua and Kawaihae. The concentration of large landholdings by ranchers and the subsequent fencing in of lands that were formerly accessible to residents served as an additional impetus to leave." This outmigration from outlying settlements, such as those found at the coast near the project area, represented a drastic change in the settlement pattern of these areas. The paucity of settlement in the outlying region around Keāhole Point (and the current project area) compared to that further south around Kailua and Kealakekua is expressed on an 1853 map showing population estimates for Hawai'i Island (Figure 13).

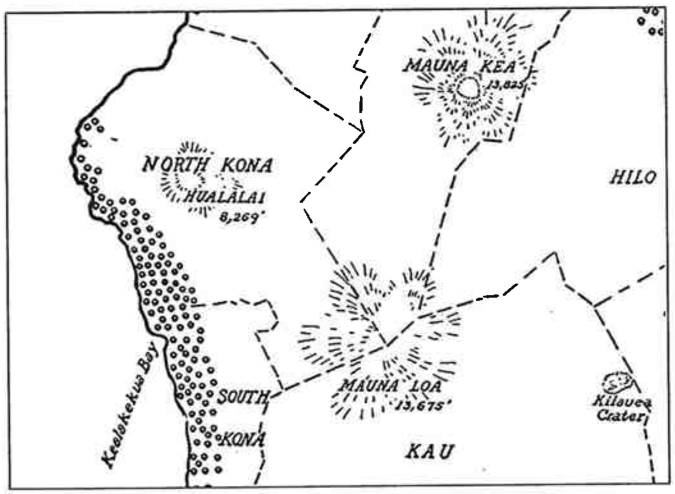


Figure 13. Population estimates for Hawai'i Island in 1853 by Coulter (1931); each symbol represents 50 people; indicating a few hundred people settled in the vicinity of Keāhole Point

3.6 The Māhele of 1848

In 1845, the Board of Commissioners to Quiet Land Titles, also called the Land Commission, was established "for the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any landed property" (Chinen 1958:8). This led to the Māhele of 1848, the division of lands between the King of Hawai'i, the *ali'i*, and the *maka'āinana* (common people), which introduced the concept of private property into the Hawaiian society. Previous to the Māhele, all land belonged to the *akua* (gods), held in trust for them by the paramount chief, and managed by subordinate chiefs.

Under the Māhele, Kamehameha III divided the land into four divisions: certain lands to be reserved for himself and the royal house were known as Crown Lands; lands set aside to generate revenue for the government were known as Government Lands; lands claimed by *ali'i* and their *konohiki* (supervisors) were called Konohiki Lands; and habitation and agricultural plots claimed by the common people were called *kuleana* (Chinen 1958:8-15). Land Commission Awards (LCAs) for *kuleana* parcels were awarded to commoners and others who could prove residency on and use of the parcels they claimed. In theory, this "setting aside" of hundreds of thousands of acres as potential *kuleana* parcels ultimately led to about 10,000 claimants obtaining approximately 30,000 acres, while 252 chiefs, for example, divided up about a million acres. Many or most Hawaiians were simply disenfranchised by these acts.

In Kekaha, land claim testimonies indicate that there were relatively few native tenants that made *kuleana* claims and the majority of lands became the property of the government. There is very little indication of land use throughout the intermediate and lower elevations, including an absence of claims made for house lots on the coast.

Government lands were subsequently sold off to generate income for the Kingdom, since the King had given up his traditional right to collect taxes and goods under the Māhele. These parcels are referred to as Land Grants (not to be confused with Royal Patent Land Grants, which represent the legal documentation of an LCA). About 90 percent of the government lands capable of cultivation were sold during the 1850s; the largest parcels were typically sold to foreign residents, though many smaller parcels did go to Hawaiian individuals or *hui* (associations, alliances) (www.waihona.com). As Cordy (1985:40) notes above, the Land Grants in this region were usually located in the upland Homestead areas (see 3.7.2).

Table 3 summarizes the land classification and total LCAs and Land Grants present for each of the project *ahupua'a*. As Table 3 shows, within the project area, only one *ahupua'a* was held as Konohiki land (Ka'ū). Furthermore, only six *kuleana* claims were awarded across all ten *ahupua'a*; considerably more Land Grants are present than LCAs, and are concentrated in 'O'oma and Kalaoa *ahupua'a*. More specific information is given in separate discussions of each *ahupua'a*, below.

Table 3. Summary of Māhele and Land Grant Results for the Project *Ahupua'a*

Ahupua'a	Land Classification	No. of LCAs Awarded	No. of Land Grants
'O'oma 1-2	Government	3	17
Kalaoa 1-5	Government	2	22
Hāmanamana	Government	0	4
Hale'ōhi'u	Crown	0	5
Maka'ula	Government	0	2
Ka'ū	Konohiki	0	0
Pu'ukala	Government	1	7
Awalua	Government	0	0
Kaulana	Konohiki (*mauka* half) and Government (*makai* half)	0	7
Mahai'ula	Government	0	2

3.6.1 'O'oma 1-2

The entire *ahupua'a* of 'O'oma was classified as Government Land, and only three Land Commission Awards were granted, all in the same *'ili* (subdivision of an *ahupua'a*). Kauikeaouli, the future King Kamehameha II, was born and lived in his early childhood at 'O'oma. He originally claimed the land of 'O'oma as his own land, but returned it to the government for commutation. Kamakau (1992:264) notes:

> Ka-iki-o-'ewa became the boy's guardian and took him to rear in an out-of-the-way place at 'O'oma, Kekaha...Here at 'O'oma he was brought up until his fifth year, chiefly occupied with his toy boats rigged like warships and with little brass cannon loaded with real powder mounted on [their] decks.

In the Māhele, 'O'oma 1 was awarded as a *konohiki* award to Moses Kekūāiwa, while 'O'oma 2 was awarded to an *ali'i* named Kekaha. Moses Kekūāiwa was the brother of the future Kamehameha IV and Kamehameha V; he died of the measles at the age of 19. Both Kekūāiwa and Kekaha returned these awards to the government to pay the commutation fee for lands they decided to keep. Commoners claimed five *kuleana* awards in 'O'oma, but only three were granted (Table 4), all in the same *'ili* within 'O'oma 1 and *mauka* of the project area.

Table 4. Land Commission Awards in 'O'oma

LCA	Awardee	*'Ili*	R.P.	Acreage
8245-B	Kiekie	'O'omakaa	--	3.2
8059	Naiwi	'O'omakaa	3950	4.4
11004	Waa	'O'omakaa	5433	4.8

3.6.2 Kalaoa 1-5

Kalaoa was divided into five sections: Kalaoa 1 was awarded to Emilia Keaweamahi; Kalaoa 2 was awarded to Kinimaka; Kalaoa 3 was awarded to Hapakuka Hewahewa; Kalaloa 4 was awarded to William Pitt Leleiōhoku; and Kalaoa 5 was designated Government Land. Emily Keaweamahi was the wife of Kaikio'ewa, an early supporter of Kamehameha I. He became governor of Kaua'i in 1825, and was succeeded at that post by his wife after his death in 1839. Kinimaka was a high *ali'i* who became the *makua hānai* (adopted father) of the future King Kalākaua (Barrère 1994:367). Hewahewa was the last high priest of the Hawaiian *kapu* [tabu] system and had been the *kahuna* of Kamehameha I and Ka'ahumanu, before he became an early Christian convert. Leleiōhoku was the brother of two Hawaiian monarchs, King Kalākaua and Queen Lili'uokalani. The awardees of Kalaoa 1 to 4 all returned their lands to the government as commutation fees. Thus, Kalaoa in its entirety was designated as Government Land in the Māhele, and only two *kuleana* parcels were awarded (Table 5), both in Kalaoa 5. A "series of Grants were issued in the *ahupua'a* from 1852-1864 -- evidently commoners acquiring lands. All these awards were in the upland forest zone from the 800 - 2,200 foot elevations ... They would seem to be agricultural parcels" (Cordy 1985:35).

Table 5. Land Commission Awards for Kalaoa

LCA	Awardee	*'Ili*	R.P.	Acreage
7899	Kupae	Kalaoa 4	--	4.9
7937	Kukaaui	Kahuku	--	5.8

3.6.3 Hāmanamana

Ruth (Luka) Ke'elikōlani, wife of William Pitt Leleiōhoku and, later, Isaac Young Davis, gave up Hāmanamana (LCA 7716) in lieu of commutation (Barrére 1994:316-17). Hāmanamana Ahupua'a therefore became Government Land; no *kuleana* parcels are present.

3.6.4 Hale'ōhi'u

Hale'ohi'u was awarded to Hapakuka Hewahewa (recipient of Kalaoa 3), but he also returned this land (LCA 3237) to the government as commutation fees (Barrére 1994:39). Thus, Hale'ohi'u was retained as Crown Land. No *kuleana* lands were awarded in Hale'ohi'u, though one claim was made.

3.6.5 Maka'ula

O'ahu Chief Iona Pehu was awarded Maka'ula (LCA 5931), which was subsequently returned for commutation fees (Barrére 1994:525). The *ahupua'a* was retained as Government Land. Waihona 'Āina lists single *kuleana* claim in Maka'ula (08459! to Kaao), though it is listed (incorrectly) as falling within South Kona, and the exclamation notation indicates that the number itself is erroneous.

3.6.6 Ka'ū

Pa'alua, granddaughter of Hewahewa, received 1,560 acres in Kau exchange for relinquished lands (LCA 00013BMA, R.P. 8625; Barrére 1994:500, Williams et al. 1993:13). This award is depicted on a 1914 Hawai'i Territory Survey map (Figure 14). This is the only *ahupua'a* within the project area that was not retained as Crown or Government Land. No *kuleana* parcels were awarded. According to Shun et al. (1993:13), " [i]n the uplands, above the 1801 lava flow, unclaimed government lands adjoining Kau were sold for amounts ranging from 50 cents to $1.00 an acre."

3.6.7 Pu'ukala

Pu'ukala (also written Pu'ukola) was omitted at the Māhele (Soehren 2010), and became Government Land. LCA 9164 (Table 6) was awarded to Kuapu'u, and consisted of one house lot, bounded by a stone fence, and 10 *kalo* (taro) *kīhāpai* (gardens, fields); this lot is located adjacent to the Māmalahoa Highway. Land Grant 2410 was also made to Kuapu'u, and totaled 208.66 acres.

Table 6. Land Commission Awards for Pu'ukala

LCA	Awardee	*'Ili*	R.P.	Acreage
9164	Kuapu'u	Ohiki	8552	4.4

3.6.8 Awalua

Grandnephew to Kamehameha I and future King William Charles Lunalilo relinquished his control of Awalua (LCA 8559B) for commutation fees; under the Māhele the *ahupua'a* became Government Land (Barrére 1994:430). No *kuleana* parcels were awarded.

3.6.9 Kaulana

According to Barrére (1994:448), Joshua Malo, sometimes called a "brother" of David Malo, exchanged as commutation one-half of Kaulana *ahupua'a* for control of the other half. No reference to an LCA can be found in relation to this award. The surrendered (*makai*) portion became Government Land. No *kuleana* parcels were awarded. One land grant (Grant 4723 to Ka'elemakule, later to Magoon) was made at the coast, just outside of the current project area (see Figure 5 and Figure 14). This grant also included a one-acre parcel *mauka* that was used as a family cemetery. According to Carpenter et al. (1998:4), this cemetery is enclosed by a "stone-walled enclosure" and currently belongs to the Catholic Church, though it represents the burial plot for the Ka'elemakule family. This cemetery appears on Figure 1 and Figure 5 (near the northern boundary with Mahai'ula about 0.5 miles inland).

3.6.10 Mahai'ula

William Pitt Leleiōhoku gave up Mahai'ula (LCA 9971) in lieu of commutation, and as such the *ahupua'a* became Government Land (Barrére 1994:407). No *kuleana* parcels were awarded. Despite the lack of *kuleana* awards within Kaulana and Mahai'ula, the claims at the coast within

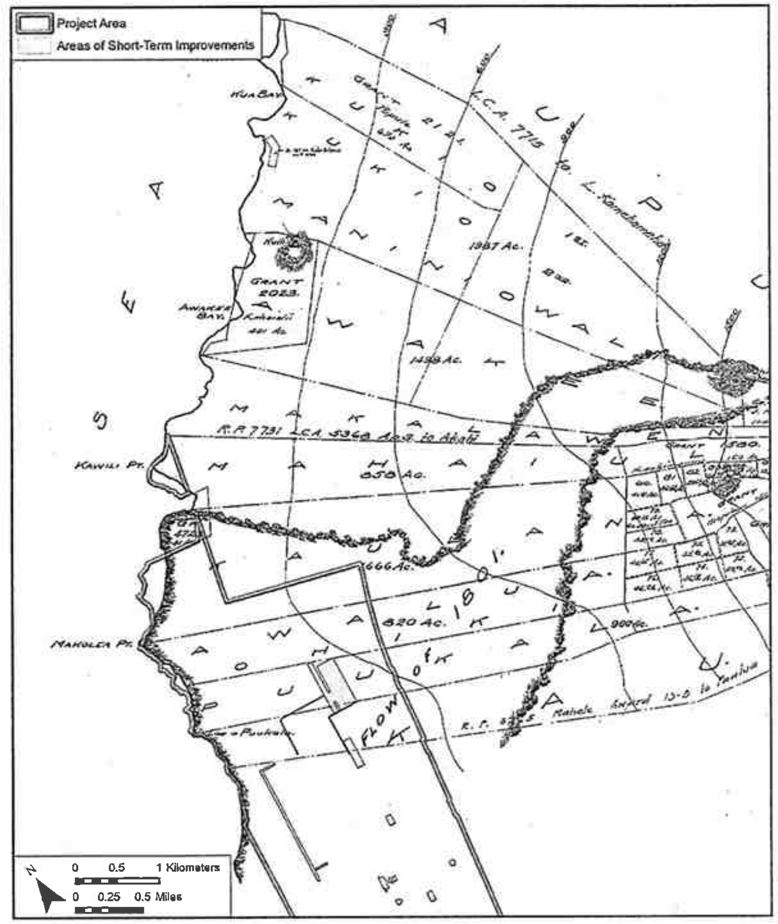


Figure 14. Portion of the 1914 map showing the Kukio-Maniniowali to Puukala Government Tracts (Hawai'i Territory Survey Plat 304) by Walter E. Wall, showing items discussed in the text in relation to the current project area

these *ahupua'a* indicate that "several families inhabited the shoreline area...in the middle of the nineteenth century" (Carpenter et al. 1998:12).

3.6.11 Summary

Cordy (1985:40) summarizes the general paucity and distribution of settlement in the *ahupua'a* of Kalaoa and 'O'oma, as reflected by Māhele data:

> Indeed, the Mahele land claims and early 1850s grants indicate only 13 households, as a maximum lived in the area; some may have had their homes elsewhere.
>
> ...Restrictions were made on the number of claims in certain areas of Hawaii, leading to only portions of former land used being awarded. In these ahupua'a, awards and later grants were few and restricted to the upland forest zone—the primary agricultural area. Interestingly, no house plot claims on the coast were awarded.

Based on the results of the present Māhele research, Kalaoa and 'O'oma are known to have held the highest numbers of documented LCAs and Land Grants in the project area (see Table 3), likely due to the fact that these *ahupua'a* were largely unaffected by the 1801 lava flow. The more northern project *ahupua'a* experienced settlement to a lesser degree, though a significant settlement was present at the Mahai'ula Bay area.

3.7 Mid- to late-1800s and Early 1900s

3.7.1 The Māmalahoa Trail and Other Trails in the Vicinity

Traditional trail systems in Kekaha linked coastal villages laterally and connected coastal villages with upland settlements. In reference to these *mauka-makai* trails, Clark and Rechtman (2006a:61) write: "[s]ometimes these were mere footpaths, marked by cairns across the bare *pāhoehoe* or *'a'ā* lava." Often water-worn steppingstones were used over *'a'ā* flows.

The first improved cross-*ahupua'a* trails through Kekaha (inland of the coastal trail) were the *alaloa* and the *alahele*. The *alaloa* was modified in the 1840s and called the *Alanui Aupuni* (Government Road), the King's Highway, or the Māmalahoa Trail. Cordy et al. (1991:403) believes that the curb-lined Māmalahoa Trail was built between 1836 and 1855. Portions of this trail are aligned with the current Queen Ka'ahumanu Highway. The *alahele*, or Kealaehu ("path of Ehu"), extended from Kailua to the uplands of Kekaha; the current Belt Highway, or Māmalahoa Highway, is aligned with portions of this old trail.

Many of these trails were improved in the mid-nineteenth century for horse or carriage traffic. Clark and Collins (2011:7) note that this included removal of steppingstones from some older trails; the steppingstones would often be deposited along the trail shoulder. The government paid for the work or used prisoners working off penalties to construct the roads, which became straighter, back from the coast, and sometimes paved and lined with kerbstones. As the population shifted to the agricultural zone along the inland trail, the Māmalahoa Trail on the lower barren shore was abandoned. By the time of J. S. Emerson's survey of homestead lands in Kekaha in 1888, the trail (incorrectly shown ending just inside of 'O'oma 2) was noted as

"Lower Govt. Road – little used" (Registered Map [RM] 1446, see Figure 15). Similarly, RM 1280 from 1891 (Figure 16, also by Emerson) does not include the route of the Māmalahoa Trail, though it does depict a coastal trail. This trail does not appear to continue north of the 1801 lava flow, but the map does depict the location of "Kaelemakule's House" at Mahai'ula beach (the map incorrectly labels "Kuwili [sic] Point" as the point immediately south of, not north of, the beach; see Figure 16). The 1891 map also depicts the relative ages of the lava flows in the vicinity (see Figure 16).

In Kalaoa, the *mauka-makai* trail was the Alanui Kauhini, or *ka'uhini* (meaning "grasshopper"), which predated the division of the Kalaoa lands into Government Grants in 1852 (Walker and Rosendahl 1990:A-2). After World War II, a jeep road was bulldozed from Māmalahoa Highway to Keāhole Point along the alignment of the Alanui Kauhini. This jeep road was abandoned when access to the coastal lands became easier with the construction of Queen Ka'ahumanu Highway in the 1970s (Walker and Rosendahl 1990:A-3).

3.7.2 Homesteading

Leases and sales within the *ahupua'a* of Kekaha began ca. 1860. Leases and sale documents do not indicate land use, but information gleaned from Interior Department memoranda from 1863 to 1889 indicate that grazing (goats and cattle) was probably the main focus of land utilization in the vicinity of the project area.

To encourage more native tenants to buy or lease lands, the Hawaiian Kingdom established the Homestead Act in 1884. Government lands from Kohanaiki north to Kūki'o were set aside for these homesteads, and 20-acre lots were leased, mainly adjacent to Māmalahoa Highway in the uplands. King Kalākaua gave up his lands in Kekaha in 1889 to increase the amount of land available for homesteads.

Under the Land Act of 1895, the Kingdom initiated a homestead lease system permitting the acquirement of public land by "qualified persons" without payments other than a fee of two dollars upon application and a fee of five dollars upon issuance of a homestead lease; successful applicants received a homestead lease for "nine hundred and ninety-nine years" (Mitchell et al. 1903:4) if certain conditions were fulfilled; these conditions included that:

> He [the occupier] shall, before the end of two years...build a dwelling house on the said premises... [and] before the end of two years...begin to reside on the premises. He shall continuously maintain his home on the said premises from and after the end of two years from date of certificate of occupation. He shall, before the end of six years from date of certificate of occupation...have in cultivation at one time not less than five per cent of the land, and plant and keep in good growing condition not less than ten timber, shade, or fruit trees per acre thereof... or if the same if classed as pastoral land, he shall, before the end of six years... fence in the same [Mitchell et al. 1903:11].

In Hale'ōhi'u, records document transfers of some of the homestead parcels based upon claimed failure of the original lessee to fulfill the lease conditions or because of the death of the lessee.

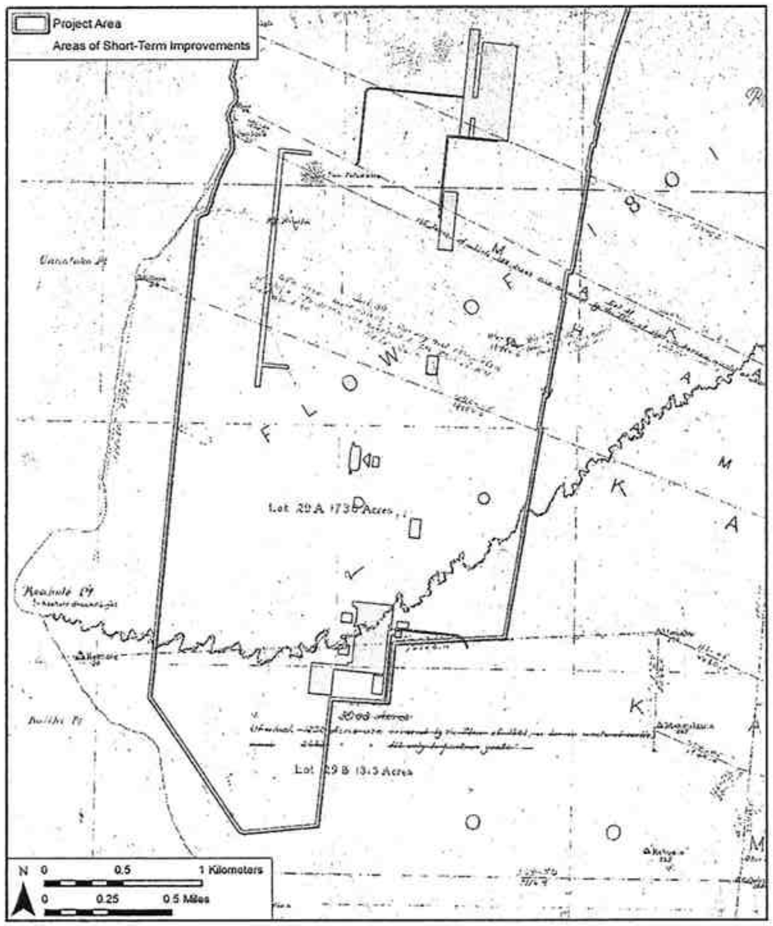


Figure 15. Portion of 1888 map (Registered Map [RM] No. 1446) by J.S. Emerson of the Akahipuu Section of Kona, Hawai'i, showing items discussed in the text in relation to the current project area

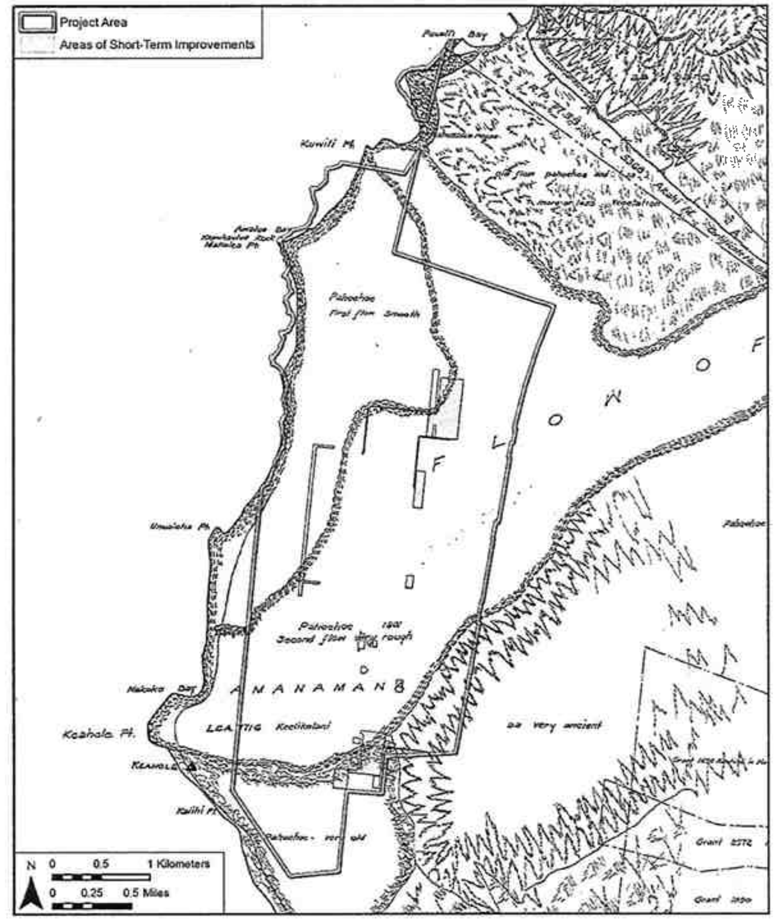


Figure 16. Portion of 1891 map (Registered Map [RM] No. 1280) by J.S. Emerson of the Kailua Section of Kona, Hawai'i, showing items discussed in the text in relation to the current project area

Very little information specific to the project *ahupua'a* can be found pertaining to land use in the homesteads. However, based on research of homestead lands at nearby Pu'uanahulu, it is suggested that lessees and their families worked the land and their products (i.e. cattle, pigs, fruits, vegetables) were utilized either to supplement store-bought goods or were sold for profit.

In the case of Pu'uanahulu homesteads, a majority of the homesteaders worked for Pu'uwa'awa'a Ranch. It is suggested that many of the homesteaders in the project *ahupua'a* likely worked for one of the large ranch enterprises of North Kona, such as Hu'ehu'e Ranch (see 3.7.3).

Cordy (1985:35) notes that "...road access to the inland Mamalahoa Highway was given with these [homestead] parcels", and cites evidence of a "shifted housing focus to these inland agricultural areas." It is likely that outmigration to commercial centers continued during this time and into the early 1900s (Cordy 1985:41).

3.7.3 Inception of Large-Scale Ranching

Across Kekaha, upland areas were developed into cattle ranches by the turn of the century. Pu'u Wa'awa'a Ranch was formed over vast portions of that *ahupua'a* in 1893, and five years later absorbed Francis Spencer's ranch at Pu'u Anahulu. Sheep, cattle, and turkeys were raised on the ranch until its 1958 sale to Dillingham Ranch, Inc. (Maly 1999:129). Maly and Maly (2003:78) discuss the extent and activities of another ranch that dominated the Kekaha region:

> In 1899, John A. Maguire, founder of Huehue Ranch applied for a Patent Grant on... lots in 'O'oma 2nd, but he only secured Grant No. 4536.... Maguire's Huehue Ranch did secure General Lease No.'s 1001 and 590 for grazing purposes on the remaining government lands in the Kohanaiki and 'O'oma vicinity. Thus, by the turn of the century, Huehue Ranch utilized both the upper forest lands and lower kula lands to the shore for ranching purposes. Oral history interviews with elder former ranch hands record that this use extended across the Kapena and Huliko'a grant lands of Kohanaiki, from the fee and leasehold lands of Kaloko and 'O'oma. Nineteenth century goat drives, gave way to formalized cattle drives and round ups on these lands.

Williams et al. (1993:15) mention that Ka'u Ahupua'a was added to the Hu'ehu'e Ranch in 1917. It can be inferred that the ranch crossed the upland portions of additional project *ahupua'a*.

3.8 Early 1900s to 1959

Cordy (1985:35) writes that the Keāhole Point Lighthouse was constructed in 1905, and that the unattended beacon was rebuilt in 1915. However, an 1888 map (see Figure 15) indicates that some other "Beacon Light" was present here prior to 1905.

In the first half of the 20th century, the primary method of travel was "by foot or on horse or donkey, and those who traveled the land, were almost always native residents..." (Maly and Maly 2003:99). The continued difficulty of travel and access throughout this region precluded any significant development and/or population increase during this time period.

On a 1928 U.S. Geological Survey map (Figure 17), the only cross-*ahupua'a* trail shown is the Māmalahoa Trail (Site 50-10-27-00002; see Section 4.3). The Māmalahoa Trail extended to the 1801 lava flow within the project area; presently, all that remains of it within the airport property is a disconnected segment in between the existing runway and taxiway. The trail picks up and continues south across the property line to the south in NELHA land. Some other trails are also shown on this map: one in 'O'oma, extending from Wawāloli Beach east to the Kalaoa-'O'oma Homesteads in the uplands near the Belt Road, one in Kaulana extending to the settlement at Mahai'ula, and one connecting Mahai'ula to Makalawena to the north (see Figure 17). The 'O'oma trail is depicted on the 1959 U.S. Geological Survey map (Figure 18), but is labeled there as a "jeep trail", while the trail between the Mahai'ula settlement and Makalawena is described as a "foot trail."

After the overthrow of the Hawaiian Kingdom in 1898, the Crown and Government Lands were ceded to the U.S. government. Under Statehood (1959), these lands became known as Ceded Lands. Ceded Lands were transferred to the state by a federal act, with the intent that they be held in trust for Native Hawaiians. KOA is comprised entirely of ceded lands save Ka'ū *ahupua'a* north of the terminal.

3.9 Modern Land Use

3.9.1 Kona International Airport at Keāhole

By the 1970's, the old airport in Kailua was no longer sufficient to handle the volume of tourism to West Hawai'i. A state website devoted to the history of Hawaiian aviation gives the following introduction to the airport at Keāhole:

> The Hawaii Legislature appropriated $80,000 for plans for a new airport at Keahole through Act 195, SLH 1965. In 1968, the Legislature appropriated $4.686 million for land acquisition and construction of a new airport with runway, apron, terminal buildings and other related improvements at Keahole through Act 40, SLH 1968.
>
> Ceremonial charges of dynamite signaled the start of work for the new Keahole Airport in West Hawaii on May 27, 1969. The new airport would replace Kailua-Kona Airport and be located 7.5 miles north of the old airport. The airport was expected to be in operation by July 1970 for interisland flights and was master planned for eventual expansion to handle trans-Pacific flights.
>
> The initial facilities at Keahole included a 6,500 foot runway and parallel taxiway, high intensity lights, a control tower and 10 aircraft parking positions, terminal buildings and motor vehicle parking areas [State of Hawai'i DOT 2012].

According to a history provided on the airport's 2010 Master Plan Update website:

> The construction of America's first open-air-style airport posed enormous hurdles to the team...charged with building the new facility. Thousands of acres of lava fields, much of it interlocked with lava tubes up to 40 feet in diameter, presented a serious challenge. Construction crews used an astronomical three million pounds of dynamite to create the unprecedented airfield. It took a monumental effort

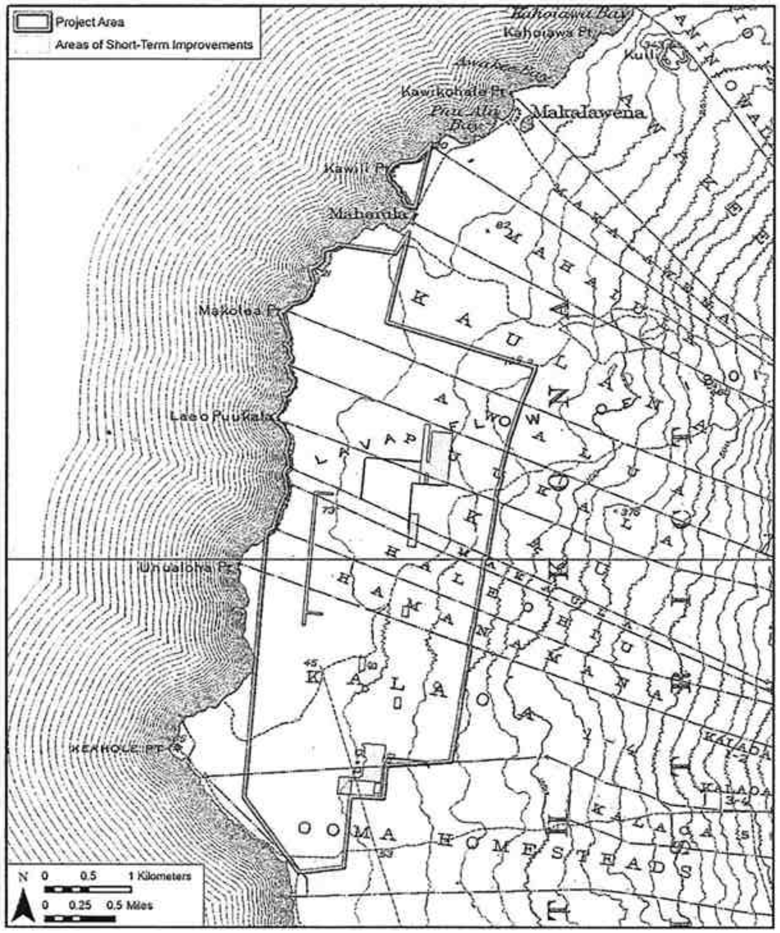


Figure 17. Portion of the 1928 USGS map, Keāhole Quadrangle, showing features discussed in the text in relation to the current project area

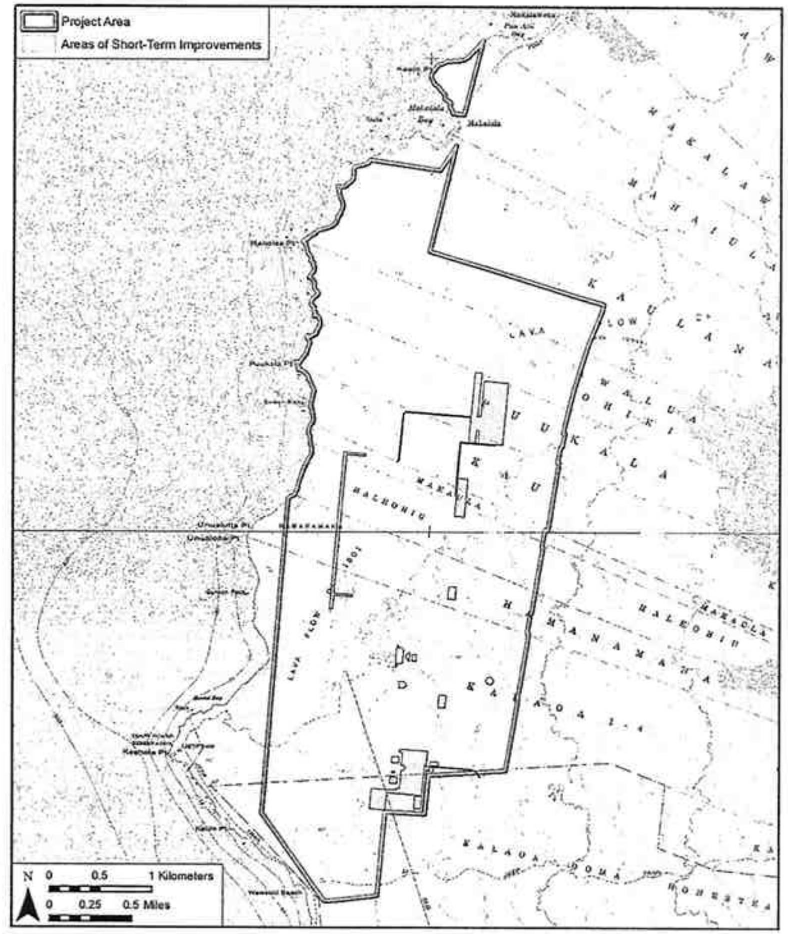


Figure 18. 1959 U.S. Geological Survey map, Keāhole Point and Makalawena Quadrangles, showing features discussed in the text in relation to the current project area

consisting of 12-hour shifts, 6 days- a-week to open the airport within the 13-month time frame.

The 15 tropical bungalows that comprised the new airport are still in use today. The open-air, high-beamed, thatched-roof structures reflect architecture that is expressive of old Hawaii and the people and culture of Kailua-Kona. The design of the new airport was unlike any of the concrete, glass and air-conditioned airports in the United States and had a unique style made possible by the Big Island's moderate trade winds and warm year-round temperatures. In its first year of operation, 515,378 passengers passed through the new airport [www.kona-airport.com/history_planning.html].

The theme for cultural emphasis for KOA is one based on King Kamehameha I (State of Hawai'i 2012). As shown in Table 7, since its construction in the 1970s many improvements have been made to the airport.

3.9.2 Queen Ka'ahumanu Highway

With the development of the airport at Keāhole and large-scale resorts to the north, the need for a coastal road connecting the harbor at Kawaihae to the recreational and commercial center of Kailua became increasingly vital. The Queen Ka'ahumanu Highway, an extension of Highway 19, was completed in 1973 (Clark and Rechtman 2006a:66). The new highway appears on a 1977-78 U.S. Geological Survey orthophoto (Figure 19), which also indicates the extent of disturbance caused by the construction of the airport.

3.9.3 Natural Energy Laboratory of Hawai'i Authority (NELHA)

The following introduction to the Natural Energy Laboratory of Hawai'i Authority (NELHA), which is adjacent to the airport and dominates much of Keāhole Point, is provided on the organizations' website:

> NELHA began as "NELH" in 1974 when the Hawaii State Legislature created the Natural Energy Laboratory of Hawaii on 322 acres of land at Keahole Point. NELH was mandated to provide a support facility for research on the ocean thermal energy conversion (OTEC) process and its related technologies…
>
> …In 1980…the NELH facilities and first pipeline to draw deep seawater from 2000 feet and surface seawater from 45 feet depths were constructed at Keahole Point…
>
> …In 1985, the Legislature created the Hawaii Ocean Science and Technology (HOST) Park on an adjacent 548 acres at Keahole in anticipation of expansion needs of NELH's growing businesses.
>
> In 1990, HOST Park and NELH were melded into one [Hawai'i State] agency, the NELH Authority (NELHA) …
>
> Today, NELHA is "landlord" to nearly 30 thriving enterprises which generate about $30-40 million per year in total economic impact, including tax revenues, over 200 jobs, construction activity and high value product exports. Two pipeline

Table 7. Improvements and Notable Events at KOA

Year	Description
1969	Work begins for the new Keāhole Airport
1970	FAA Control Tower becomes operative; airport is dedicated
1983	United Airlines begins direct flights between mainland; work begins for additional roads and utilities, as well as a new maintenance facility
1986	Construction of new ramp apron and taxiways at the North Ramp
1987	The Master Plan for Keāhole Airport was completed, focusing on the development for expanded overseas activity
1990	Onizuka Space Center is dedicated; construction of lei stands, a gift shop and a Visitor Information display area
1991	Construction begins for renovations including converting the old Aloha Airlines Cargo building into office and storage space for airport tenants and installing a new mechanical baggage claim device; new cargo building and renovated ground transportation facility open
1993	Hawaii State Legislature changes the name of Keāhole Airport to Keāhole-Kona International Airport; Runway 17-35 extended to 11,000 feet to allow a wide-body aircraft to take off fully loaded, making it the longest runway at a Neighbor Island airport in Hawai'i
1994	First long-range flight arrives from Europe; mainland wide-body service begins. Work begins on Phase I Terminal Improvements, to expand the gate/hold areas and construct a baggage claim unit at Terminal 1. Work also begins to widen the peripheral road from three to five lanes, expand the parking lot by 150 stalls, and provide new landscaping at the north and south ends of the parking lots
1996	Interim Federal Inspection Service Facility opens; first international flight from Japan arrives
1997	Work begins on Phase II of the Terminal improvements, including apron lighting, security improvements and enlargement of the passenger waiting area; Hawai'i State Legislature changes the name of Keāhole-Kona International Airport to Kona International Airport at Keāhole
1998	Direct daily service between mainland begins. 2015 Master Plan completed by the DOT. Numerous improvements made throughout airport, including construction of new apron area, parking facilities, non-potable water system, two-level overseas domestic and international arrival terminal, heliport with 12 helipads, general aviation fuel storage system and fuel farm site preparation, air monitoring system, Ramp K, Road N, utility upgrades, etc.
1999	Shelter for arriving international passengers at the Interim FIS Facility is constructed
2000	Improvements made to the ticket counters, lobby, offices and baggage system
2001	Money appropriated for design and construction of parking lot expansion, construction of general aviation fuel site preparation, paving Ramp K, and construction of an interim Federal Inspection Service improvement. New way finding signs installed
2002	Sewage treatment plant replaced; site prepared for a new postal facility

Year	Description
2003	Fuel access road to the lease lots is constructed; existing general aviation facilities relocated providing fixed based operator lots and the supporting infrastructure (this project addressed the high demand for general aviation facilities at the airport); Ramp K constructed; general aviation fuel storage system installed
2004	Triturator was constructed; electrical system was upgraded
2006	Work begins on the Perimeter Road and fence and general aviation apron lighting project
2007	Airfield lights and sign replacement project completed
2008	Money appropriated for terminal expansion, parking lot expansion, construction for storm water permit compliance, program management support, Environmental Impact Statement, and construction improvements to the existing terminal
2009	New South Terminal baggage carousel completed, wash-rack installed

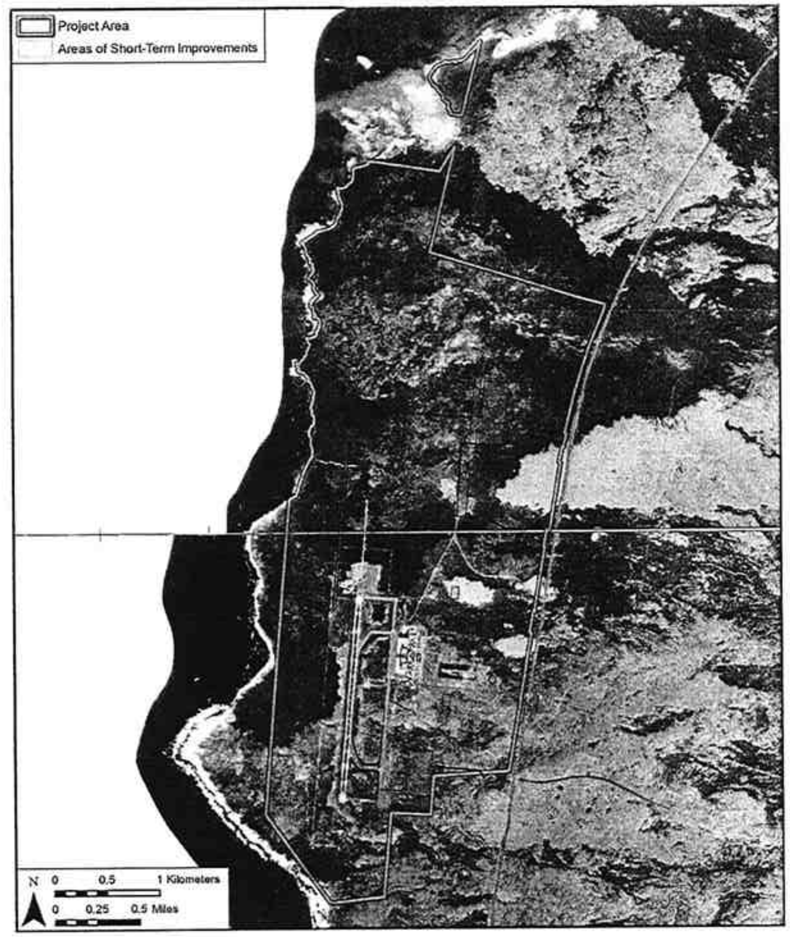


Figure 19. 1977-78 U.S. Geological Survey orthophoto, Keāhole Point and Makalawena Quadrangles, showing features discussed in the text in relation to the current project area

systems pump deep and surface seawater to shore 24/7 and a third, the world's largest and deepest (to a depth of 3,000 feet), is being developed now.

[http://www.nelha.org/about/history.html].

3.9.4 Preservation Efforts of the 1990s

In the early 1990s, two significant areas in the vicinity of the airport were set aside for preservation and/or recreation. These include the Ho'ona Preserve at Keāhole Point, and Kekaha Kai State Park (formerly Kona Coast State Park), which borders the airport property to the north. According to Dye and Prassad (2000:10), the 16.5 acre-Ho'ona Preserve "...contains a range of well-preserved traditional Hawaiian habitation structures typical of coastal hamlets in Kona dating to the 1800s and early 1900s", and includes burial structures. Similar structures have been documented in and adjacent to Kekaha Kai State Park, around Mahai'ula Bay at Kawili Point, which overlaps the disconnected, northern-most portion of the airport property (see Carpenter et al. 1998, Sections 4.2.13 and 4.3).

3.10 Background Summary

Radiocarbon dates from the Kekaha region may indicate that all three land use zones were utilized to some degree or another as early as A.D. 1280 (Walker and Haun 1988); chronological data from projects in the vicinity of the airport have generally yielded dates in the A.D. 1400s (Cordy 1985). This period of time correlates with an apparent population increase and geographical expansion in the Hawaiian Islands identified as the "Expansion Period" (Kirch 1985:303) or the middle of the "Pioneer Settlement" (Schilt 1984:276). Permanent settlement continued to be centered on the coast and agriculture developed upland as the endemic forest lands were gradually reduced by slash-and-burn methods.

During early historic times (ca A.D. 1800-1840) following western contact, the population in and around the project area undoubtedly declined rapidly due to disease and a major shift in the traditional Hawaiian settlement pattern. The residents who survived disease likely shifted their residences to economic centers such as Kailua-Town, or in closer proximity to major roadways and localities of churches and schools established by the missionaries.

By the end of the 1800s, land use in North Kona had undergone significant alterations from the dryland cultivation and fishing practiced during prehistoric and proto-historic times. Maly (1994) summarizes the gradual replacement of Hawaiian lifestyle in this area as the result of two major factors: the 1801 eruption of Hualālai, and changing land use patterns over the last 150 years. The lava flows from Hualālai reclaimed much of the land used for settlement, agriculture and fishponds, reducing the land to a shadow of its former condition. Introduction of foreign plants and animals brought about additional changes, as once barren lava fields became overgrown with *kiawe* and other weedy shrubs, and goat and cattle ranching became a mainstay of local industry. The last half of the nineteenth century saw the development of large-scale commercial ranching and agriculture as a result of the shift to private land ownership brought about by the Māhele and other changes in the law regarding land rights. Settlements were typically concentrated in and around homesteads located in the project *ahupua'a*, in the vicinity of the upland Māmalahoa Highway.

Little change occurred in Kekaha during the first half of the twentieth century. The continued difficulty of travel and access throughout this region precluded any significant development and/or population increase during this time period. In the 1970s, the airport at Keāhole and the Queen Ka'ahumanu Highway were completed, resulting in increased access throughout the region. Modern development includes the construction of nearby housing and agricultural subdivisions and adjacent NELHA facilities. In the 1990s, preservation efforts resulted in the creation of Kekaha Kai State Park north of the airport property and the Ho'ona Preserve at Keāhole Point.

Section 4 Previous Archaeological Research

4.1 Introduction

Numerous archaeological studies have been conducted at and in the vicinity of the airport. However, the majority of the overall airport property has never been subjected to intensive archaeological survey using currently-accepted methods and standards. The *Master Plan* proposes both short- and long-term, large-scale development that would comprise hundreds upon hundreds of acres that have not undergone current survey. The short-term improvements included in the present EA represent discrete portions of the airport property, some of which have been subjected to current study. This section seeks to present a comprehensive account of previous archaeological study throughout the entire project area, with the intention of providing a backdrop for the field inspection (which will focus primarily on the short-term improvements areas).

The airport property lies almost entirely within the Intermediate (or Barren) Zone, aside from a strip along the coast north of Unualoha point, which has almost been completely covered by the 1801 flow (see Figure 12). Most of the past studies in the vicinity have either fallen outside of the airport property (along the coast or *mauka* of the Queen Ka'ahumanu Highway), or have comprised discrete areas within the overall airport property at locations proposed for development. As the airport facility and related development predominately lie within 'O'oma 1, Kalaoa, and Hāmanamana *ahupua'a*, little to no work has been completed in the northern seven *ahupua'a* of the airport property. A general lack of development in these northernmost *ahupua'a* outside of the airport property lends to a paucity of archaeological research overall in these areas.

A valuable resource for early archaeology in 'O'oma and Kalaoa is found in Ross Cordy's 1985 *Working Paper 1: Hawaii Island Archaeology*. This report includes a summary of the environmental zones discussed in Section 3 above; the history and nature of past archaeological work in these *ahupua'a*; a complete inventory of the sites found during past studies, their locations (with map), chronological data, and a summary of site patterns; background research and interpretation; and, perhaps most importantly, a section entitled "Concerns for the Future." This final section is a compelling discussion of the problems presented by early studies in the area, and the importance of thorough documentation of the archaeological record going forward. Cordy's (1985) work has proven very helpful in terms of making sense of the early studies in the airport environs. Though these studies have proven to be problematic over time, they provide evidence that the Intermediate Zone contains significant archaeological remains, if not to the degree found along the coast or in the Upland Zone. Naturally, as better archaeological field and reporting standards have been adopted over the past few decades, more recent work in this region is not plagued by the problems characterized by the earlier studies.

Table 8 presents the previous archaeological studies that have been conducted within the current project area (indicated in bold text), as well as many more studies that have been conducted in the immediate vicinity. Figure 20 shows the locations of almost all of the past studies at the airport, and a limited sample of the adjacent studies. The past studies conducted at the airport are discussed individually in further detail below.

Table 8. Previous Archaeological Studies in and around the Current Project Area (studies at least partially within the present project area are in bold)

Reference	Project Location	Report Type	Findings
Reinecke 1930	**Cursory survey**	**Coastal Survey**	**Briefly notes numerous sites, Sites 66-78 are within 'O'oma, mainly habitation sites**
Ching et al. 1968-69	**Kailua-Kawaiahae Road corridor road extension and parcel near Keāhole Airport**	**Archaeological Reconnaissance Survey and Excavations**	**A total of 343 sites were recorded, 216 features in the coastal portion, and 117 in the inland portion from 800 ft to 3 miles from the coast, plus over 200 more sites not investigated**
Ching & Rosendahl 1968	**Kailua-Kawaiahae Road corridor, Honokohau to Keāhole Point (Section II)**	**Archaeological Reconnaissance Survey**	**Several archaeological features identified, including cave sites and three trails (Sites 500, 603, and 630). Archaeological salvage recommended for all sites.**
Ching 1971	**Kailua-Kawaiahae Road corridor, Keāhole to Kawaihae (Section III)**	**Archaeological Reconnaissance Survey**	**A total of 665 features were recorded within the corridor, and 259 artifacts were recovered from the surface. Archaeological salvage was recommended for all of the features located within the final road alignment**
Rosendahl 1973	**Keāhole to Anaeho'omalu Section for the Kailua-Kawaiahae Road corridor**	**Archaeological Salvage**	**284 features investigated, mainly those found during the 1968 and 1971 reconnaissance surveys but also including some newly identified features**
Rosendahl & Kirch 1975	NELH, Keahole Point	Archaeological Reconnaissance Survey	Fourteen sites recorded, all previously identified
Davis 1977	Keahole Ag. Park, Kalaoa 1-5& 'O'oma 1; from Queen Kaahumanu Hwy to the 400 ft elevation	Archaeological Reconnaissance Survey	22 agricultural and habitation sites recorded; minimal recording
Rogers-Jourdane 1978	Keahole Point, NELH, 22.5 ac parcel	Archaeological Reconnaissance Survey	Eleven sites recorded
Barrera 1979	**Keahole Airport Emergency Service Roads TMK 3-7-3-043:003**	**Archaeological Reconnaissance Survey**	**Two walled shelters, 50-10-27-06961 and 50-10-27-06962**

Reference	Project Location	Report Type	Findings
Bonk 1979a and b	**Keahole Airport TMK 3-7-3-010**	**Archaeological Survey and Addendum Survey**	**Survey of borrow pit areas, as well as some documentation of 50-10-27-500 (petroglyph field)**
Barrera 1980	**Three Locations at Keahole Airport TMK 7-3-43:03 por.**	**Archaeological Survey**	**Two c-shape shelters (SIHP 50-10-27-06987) which were dismantled; no midden or artifacts were recovered and the features were recommended for no further work**
Hammatt & Folk 1980	Keahole Ag. Park & 370 acre parcel north of the park	Subsurface Excavations, Archaeological Reconnaissance Survey	Twelve site complexes first identified by Davis (1977) were tested; eighteen new sites recorded in the 370 ac. parcel
Rosendahl 1980	NELH, Keahole Point, TMK: 3-7-3-010:036	Archaeological Inventory Survey & Data Recovery	Follow-up on work of Rogers & Jourdane 1978
Soehren 1982	TMK 3-7-3-005:013, Kalaoa 4	Archaeological Reconnaissance Survey	Recorded a house platform and a square enclosure, sites 50-10-27-10214 and 50-10-27-07266
Clark 1984	Natural Energy Laboratory Hawai'i (NELH) Property, Keahole Point, TMK 3-7-3-010:036	Archaeological Reconnaissance Survey	50-10-27-00185 50-10-27-00246 50-10-27-01920 50-10-27-05601 50-10-27-10191 50-10-27-10192 50-10-27-10194 to 50-10-27-10201
Barrera 1985a	Keahole Point, 450 ac. Parcel, TMK: 3-7-3	Archaeological Reconnaissance Survey	42 sites identified
Barrera 1985b	'O'oma II Resort, 314 ac. Coastal parcel, TMK 3-7-3-009:004	Archaeological Reconnaissance Survey	40 sites identified
Cordy 1985	**'O'oma, Kalaoa, TMK: 3-7-3**	**Site Inventory**	**Inventory of Previous Identified Sites**
Cordy 1986a	'O'oma 2 Resort, TMK: 3-7-3-009:004	Archaeological Field Inspection	Re-evaluation of Barrera's survey (Barrera 1985b)
Cordy 1986b	NELH Property: Kalaoa 5 Ahupua'a, Keahole Point TMK 3-7-3-010	Archaeological Field Check	50-10-27-01920 50-10-27-10205 to 50-10-27-10214

Reference	Project Location	Report Type	Findings
Barrera 1987a	**Keahole Airport, of South Ramp and Ground Transportation Expansion, Kalaoa, TMK 3-7-3-043:043**	**Archaeological Survey**	**50-10-27-00002** **50-10-27-10306**
Barrera 1987b	**Five Areas Proposed for Airport Expansion Ke--āhole Airport,**	**Archaeological Survey**	**Six sites recorded**
Cordy 1987	Kalaoa 3 Uplands, TMK: 3-7-3-028:005	Archaeological Field Inspection	Recorded one platform/terrace
Donham 1987	'O'oma 2 Resort, TMK: 3-7-3-009:004	Data Recovery	27 new sites with 130 features were recorded and 54 features were recorded at previously identified sites
Telea & Rosendahl 1987	Kona Palisades Subdivision Parcel, TMK 3-7-3-005:086 (6.6 acres) Kalaoa 4th	Archaeological Reconnaissance Survey	14 features at six sites identified
Walker and Haun 1988	Kona Palisades Subdivision Parcel, TMK 3-7-3-005:087 (5.6 acres) Kalaoa 4th	Limited Archaeological Data Recovery	Identified 17 features, including two agricultural complexes that are part of the Kona Field System
Barrera 1989	NELH & Host Park, TMK: 3-7-3-043:003, 042	Data Recovery	Excavations of Site identified by Barrera 1985a
Walker and Rosendahl 1989	Pu'uhonua Subdivision TMK 3-7-3-010:027 Kalaoa 5th	Archaeological Inventory Survey	34 sites with 84 features recorded, comprised of sites 50-10-27-05745 to 50-10-27-05778
Barrera 1990	**Keahole Airport Expansion**	**Archaeological Data Recovery**	**Excavations at two caves found during Barrera 1987b**
Schilz et al. 1990 (revised 1993)	1000 acres in Ka'ū mauka of Queen Ka'ahumanu Highway	Archaeological Inventory Survey	Recorded 132 sites
Walker & Rosendahl 1990a	Kona Palisades, TMK: 3-7-3-005:012	Archaeological Inventory Survey	12 sites identified, including a refuge cave

Reference	Project Location	Report Type	Findings
Walker & Rosendahl 1990b	Kona Palisades, TMK: 3-7-3-005:086	Archaeological Inventory Survey	18 additional features recorded, in addition to the 14 features found during the reconnaissance survey (Telea & Rosendahl 1987)
Drolet & Schilz 1991	'O'oma 2, TMK: 3-7-3-007:038; 3-7-3-009:005, 008	Archaeological Inventory Survey	29 with 41 features identified; the majority were agricultural mounds
Yent 1991	Upland 'O'oma at an elevations of 2600 to 3200 ft	Reconnaissance Survey	10 sites found at the 2280 ft elevation, walls and mounds of agricultural fields, probably for sweet potato cultivation
Dowden & Graves 1992	HELCO Keahole Parcel, Kalaoa 1-4, 15-acre parcel	Inventory Survey	Four sites with *pāhoehoe* excavations were recorded
Thompson, and Goodfellow 1992	Kona Palisades Development Parcel, TMK 3-7-3-005:086 Land of Kaloa 4th	Interim Report: Background, Summary of Findings, and Recommendations; Archaeological Data Recovery - Phase II, Archaeological Mitigation Program	Additional recording at four sites; 50-10-28-14135 50-10-28-14136 50-10-28-14137 50-10-28-14565 24 test units excavated
Thompson & Rosendahl 1992a, b	Keahole Transmission Lines, TMK: 3-6-; 3-7-; 3-8-	Archaeological Assessment	Relocated previously identified sites
Barrera 1993	**Kalaoa, at TMK: 7-3-05:88 (5.0 acres)**	**Archaeological Data Recovery, Mamalahoa Trail**	**Further recording of the Māmalahoa Trail**
Henry et al. 1993	Makaula to 'O'oma Ahupua'a; TMK: 3-7-3-009:001;010:001	Archaeological Assessment	Assessment of a 1260 acre parcel; 25 sites recorded
Barrera 1995	Kalaoa Mauka, TMK: 7-3-05:98	Archaeological Inventory Survey	50-10-28-19823 to 50-10-28-19831
Walsh & Hammatt 1995	**Queen Ka'ahumanu Highway, TMK: 3-7, 3-4**	**Archaeological Inventory Survey**	**Seventeen cultural resources were located**
Masterson & Hammatt 1997	Kalaoa Reservoir, TMK: 3-7-3-010:033	Archaeological Reconnaissance Survey	Upland sites

Reference	Project Location	Report Type	Findings
Carpenter et al. 1998	**Kekaha Kai State Park, Mahai'ula Section, Kaulana and Mahai'ula TMK 7-2-005:002, 3, 4**	**Archaeological Reconnaissance Survey**	**71 sites and site complexes identified, primarily at the coast, including many features at Kawili Point and Mahai'ula Bay/beach**
Cleghorn 1998	Proposed University Center at West Hawai'i TMK 3-7-3-010:033	Archaeological Investigations	50-10-28-06418 50-10-28-15263 to 50-10-28-15265 50-10-28-15268 50-10-28-15281 to 50-10-28-15288 50-10-28-15300 50-10-28-21361
Wolforth 1999	HELCO Keahole-Kailua 69kV Transmission Line: Lands of Kalaoa 1-4,	Monitoring Report with A Detailed Description of Māmalahoa Trail (50-10-27-2)	Monitoring of Māmalahoa Trail
Dye and Prasad 2000	**Kona International Airport at Keāhole**	**Archaeological Update (including limited fieldwork) and PASH Rights Interviews**	**Fieldwork relocated six previously recorded sites and documented three new sites**
Corbin 2000	NELH, 'O'oma II, TMK: 3-7-3-009:004	Archaeological Data Recovery	Sites 1916 and 18028
Haun & Henry 2000	'O'oma 1st, 50-acre parcel, TMK 3-7-3-10:03	Archaeological Inventory Survey	186 features at 17 sites recorded, including a habitation cave and a basalt rock quarry
McGerty, and Spear 2000	Kalaoa Mauka, TMK: 7-3-05:98 (5.9 acres)	Final Addendum to: Archaeological Inventory Survey	50-10-28-19823 to 50-10-28-19832, 50-10-28-19839 & 50-10-28-21812
Roberts & Roberts 2001	Natural Energy Laboratory of Hawaii Authority TMK 3-7-3-043:003 Kalaoa 5	Archaeological Data Recovery	Sites: 50-10-27-10211, 50-10-27-10212, 50-10-27-10213
Haun & Henry 2002	'O'oma, Sites 22740, 22741 & 22749, TMK: 3-7-3-005:004	Data Recovery	Data Excavation at three caves, sites 22740, 22741 & 22749
Clark et al. 2003 (revised 2004)	Kaū Development Area TMK 3-7-2-05:1 por., Land of Ka'ū	Archaeological Inventory Survey	Addendum/resurvey of lower 750 acres of Schilz et al. 1990 study area; 83 new sites recorded

Reference	Project Location	Report Type	Findings
Haun, Henry and Berrigan 2003	Pu'uhonua Subdivision Parcel, Land of Kalaoa 5, TMK 3-7-3-010:027	Archaeological Data Recovery	Sites 5748, 5749, 5750, 5753, 5755, 5756, 5761, 5762, 5764, 5771, 5773, and 5774; excavations at four sites; charred sweet potato found in one feature
Haun and Henry 2003a	TMK: 3-7-3-23:88, Land of Kalaoa 3rd	Archaeological Inventory Survey	50-10-28-23789
Haun & Henry 2003b	'O'oma, 41 acre parcel, TMK: 3-7-3-007:040	Archaeological Inventory Survey	21 sites with 2,046 features recorded, including six habitation caves
Haun and Henry 2003c	TMK: 3-7-3-10:29, Land of Kalaoa 4th	Archaeological Inventory Survey	50-10-28-11271 50-10-28-21886 50-10-28-23640 to 50-10-28-23643
Rosendahl 2004	HELCO Station, Kalaoa 1-4, TMK: 3-7-3-49:36, 37	Archaeological Assessment	Four sites recorded, all *pāhoehoe* excavations
Clark & Rechtman 2005	'O'oma 1st and 2nd parcel, TMK:3-7-3-007:039 and 3-7-3-046:105	Archaeological Inventory Survey	3 sites previously identified (Drolet & Schilz 1991) & 12 new sites identified, including habitation occupied as late as 1939
Haun et al. 2006	TMK 3-7-3-007:040, 041	Archaeological Data Recovery	Sites 23825, 23831, 23832, 23835, 23836,and23839; 18 features tested
Clark and McCoy 2009	**Very High Frequency, Omni-Directional Range (VOR) Facility at the Kona International Airport (KOA) TMK 7-3-43:03**	**Archaeological Assessment**	**No sites documented in APE**
Escott and Keris 2009	**5.423-acre parcel for Proposed Relocated Onizuka Museum Site at Kona Airport TMK 73-43:003 por.**	**Archaeological Inventory Survey**	**A single site, SIHP 26868 was documented, consisting of three *pāhoehoe* excavations**

Reference	Project Location	Report Type	Findings
Escott and Spear 2009	**11.36 acres covering three separate improvement areas at the Kona International Airport, Kalaoa 3 TMK 7-3-43:003 por.**	**Archaeological Assessment**	**No sites documented in APE**
Nakamura et al. 2009	**Proposed New Airport Traffic Control Tower and Parking Lot, Kona International Airport, Hamanamana TMK 7-3-043: 001**	**Archaeological Inventory Survey and Limited Test Excavation**	**Two historic properties, as well as two recent structures determined not to be over 50 years in age, were recorded: SIHP 26737 (trail) and 26738 (agricultural complex)**
Clark and Mintmier 2010	**Pre-Contact Trail Segment, at the Kona International Airport TMK 7-3-043: 001**	**Preservation Plan**	**SIHP 50-10-27-26737, trail discovered by Nakamura et al. 2009**
Altizer and Monahan 2011	**North Segment of the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa – Kohanaiki TMK 7-3-009 & 7-3-043**	**Archaeological Data Recovery and Preservation Plan (report is PRELIMINARY)**	**Addresses several sites documented under the Monahan et al. 2011 inventory survey**
Clark and Collins 2011	**Duct Bank for the New Airport Traffic Control Tower, Hamanamana TMK 7-3-043:001 (por.); 7-3-043: 045**	**Archaeological Assessment**	**No sites documented in APE**
Clark et al. 2011	**Two Borrow-Pit Areas at the VOR Facility at the Kona International Airport 7-3-43: Por.03**	**Archaeological Inventory Survey**	**Two sites documented in updated VOR APE: SIHP 28568 (walled overhang shelter with three features) and 28569 (quarry complex with 17 features)**

Reference	Project Location	Report Type	Findings
Monahan et al. 2011	Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa - Kealakehe TMK 7-4-008, 7-3-009 & 7-3-043	Archaeological Inventory Survey (Report is PRELIMINARY)	55+ sites were identified within the project area, over 35 of which were newly documented

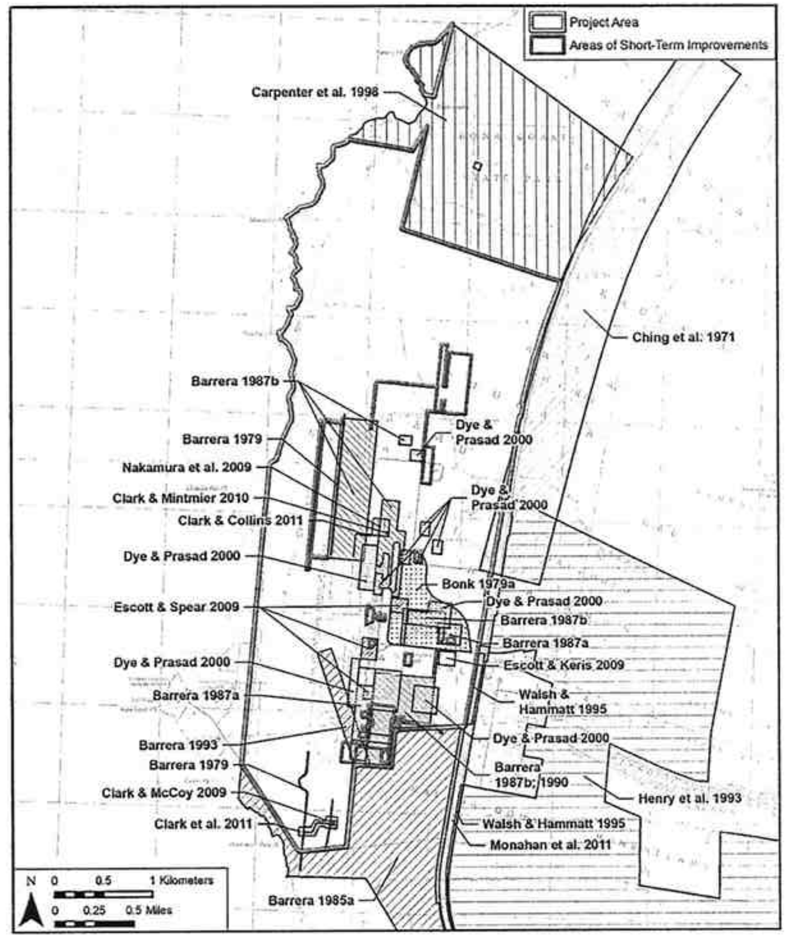


Figure 20. Portion of the 7.5-minute US Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) Quadrants, showing the location of previous archaeological studies in and around the project area (in blue) and the improvement areas (in pink)

4.2 Previous Archaeological Studies in the Project Area

Only one comprehensive study has been undertaken at the airport, though it did not cover some of the northern-most portions of the property. This study was conducted in 1968-69 by DLNR and was undertaken in relation to initial construction for the airport. All of the remaining studies have either been related to the adjacent Queen Ka'ahumanu Highway or Kekaha Kai State Park, or have focused on discrete areas proposed for improvement within the airport property (see Figure 20 and Table 8, bolded entries). While these studies can tell us about the distribution and nature of historic properties at these specific areas, and can improve our understanding of the settlement zones in this portion of Kekaha, they represent a somewhat disjointed picture of land use throughout the project area as a whole.

4.2.1 Reineke 1930

Bishop Museum conducted an early coastal study survey of the western portion of the Hawai'i Island (Reineke 1930; not shown on Figure 20). According to Cordy (1985:9), the report for this reconnaissance survey included brief site descriptions and a "location map." Just outside (*makai*) of the southern half of the project area at 'O'oma and Kalaoa, 22 sites were located along the coast (Cordy 1985:9). Nakamura et al. (2009:9) note that "[o]nly one site was recorded by Reinecke for Hāmanamana Ahupua'a [also *makai* of the present project area]. This site, Site 61, was described as a recent shelter." These sites were almost certainly further documented in the later coastal studies. Reineke declares that his survey north past the Keāhole Lighthouse was "quite cursory" (Reineke 1930:1). He describes this area north of Keāhole to Kūki'o as "consisting of alternate hamlets on sandy beaches and waste stretches of lava flow and beach (usually coral)" (Reineke 1930:1). This northern stretch of the 1930 study overlaps the northern section of the airport property along the coastline at Kawili Point. According to Borthwick et al. (1992:7):

> John Reinecke recorded five sites (sites 90-94) between the north edge of Kaulana ...along the edge of the 1801 flow, and Mahaiula Bay... These sites include platforms, concrete salt pans, walled pools, cave shelters, *papamu* and pens. ... He also states, regarding the Mahaiula area, "Owing to my hurried tour of the coast here, I did not see the *heiau* which Mr. J. Kaelemakule, a *kama'aina* of the place, says is located at the spot Kaelehuluhulu, on the beach. It is a fishing *heiau*, called HALE O HIU (also name of the *ahupua'a* south of Makaula). He says that there are petroglyphs on the *pāhoehoe* about 1 ½ miles from Mahaiula, I did not find them either"...

A map showing these *ahupua'a* (and the sites documented therein) does not appear to have been included in the report. However, these sites were accounted for during a relatively recent survey completed for Kekaha Kai State Park (Carpenter et al. 1998; see Section 4.2.13).

4.2.2 Ching and Rosendahl 1968

The following account of the initial survey work at the airport (not shown on Figure 20) is taken from Cordy's (1985) *Working Paper*:

> In early 1968 survey associated with the building of the Queen Ka'ahumanu Highway and the Keahole Airport began. This work was done by the Department of Land & Natural Resources (DLNR) and the University of Hawaii Department of Anthropology. Initial survey was done early in the year by Francis Ching and Paul Rosendahl (1968). This work covered an initial road corridor to the airport and the airport area [from Honokohau]. It was done by helicopter with ground checks by 4-wheel drive, vehicles and by landing the helicopter. This was a reconnaissance level survey. 1 site was found in Ooma 2, 1 in Kalaoa 5 and 4 in Kalaoa 1-4. All sites were caves. The report briefly describes the sites and includes photographs [Cordy 1985:9].

In addition, two sites were recorded within Haleohiu (T1 and T2) and three in Ka'ū (T1 – T3); all but Ka'ū site T3 fall within the project area. The brief report only includes site descriptions for the T1 sites of each of these two *ahupua'a* (see Section 4.3 and Appendix A). Of the six sites documented in Kalaoa and 'O'oma, four were located in the bounds of the airport property, and three (T-2, T-3 and T-4) were later recorded as SIHP 10677 and 10679 (see Section 4.3 and Appendix A).

4.2.3 Ching et al. 1968-69

Cordy (1985) gives this account of the only comprehensive survey to be completed on the airport property, and discusses the limits of its use today:

> Additional road/airport work was carried out over a 10 day period in 1968-69 (December 26-January 4) (Ching, Cluff and Riley 1968-69). The area surveyed was expanded. It extended roughly from today's Ka'ahumanu Highway (and just inland) to the coast. Initial survey again was by helicopter, with follow-up ground survey on the coast south of the 1801 flow, at scattered sites near the road, and along trails. Evidently, excavations also occurred in some sites along the road corridor. One serious problem relates to this work. Evidently, only a preliminary report was prepared (Ching, Cluff and Riley 1968-69). The copy of this report in the Historic sites Section is missing the chapter on the road corridor work...
>
> Additionally, this preliminary report lists no information for specific sites other than trail information [authored by Jennie Peterson in the same report].... A site map has been attached to our file's report [see Section 4.3], and it seems to have the final site numbers. Unfortunately, the numbers on this map also do not correlate with any files found in the office. Thus, at present, this sizable survey has limited data that can be used. The trail descriptions can be correlated with the map, however [Cordy 1985: 12].

Cordy (1985:12) notes that only the trail information can be considered useful, and that he was "trying to track down the missing information." Present research indicates that the missing information was never located. Because the locations of the non-trail sites cannot be determined, they were not included on Cordy's 1985 site distribution map (see Section 4.3). However, all told, 385 "features and sites were identified and recorded during the ten-day field trip...to this can be added an additional 230 features and sites [which were] ...estimated from aerial photographs and observation from the ground" and excluded from the survey due to a miscalculation of the project bounds (Ching et al. 1968-69:i). These sites can be seen in relation to the current project area on Figure 21 in Section 4.3 below; because the limits of the 1968-69 survey are somewhat vague, this study area has not been included on Figure 20.

Cordy (1985) was able to place six sections of trail found during the 1968-69 study onto his map. These include SIHP 00185, 00246, 00302, 00373, a trail later assigned two separate State site numbers (00245 and 10202), and a trail later assigned four separate State site numbers (SIHP 00487, 00495, 00501, and 00502) (see Section 4.3 and Appendix A).

4.2.4 Ching 1971

In 1970, a reconnaissance survey was conducted for the Kailua-Kawaihae Road Corridor (present Queen Ka'ahumanu Highway) within a 2,000-foot wide corridor stretching 23 miles from the *ahupua'a* of Lālāmilo to the *ahupua'a* of Hāmanamana (Ching 1971; see Figure 20). This study narrowly overlapped the eastern portion of the airport property between Hāmanamana and Kaulana *ahupua'a*. Hundreds of sites of various types were recorded throughout the survey corridor, including a handful adjacent to, but just outside of, the project area. These included three *ahu* or mounds (SIHP 1188, 1189 and 1358), two c-shaped structures (SIHP 1174 and SIHP 1175), and one foot trail (SIHP 1357) (see Figure 22 in Section 4.3). Ching (1971:7) recommended archaeological salvage, or data recovery, for all of the sites encountered during his survey, as all of the sites would potentially be destroyed by construction of the road corridor.

4.2.5 Rosendahl 1973

In 1972, the Bishop Museum conducted archaeological salvage of "features located within and adjacent to the Ke-āhole to 'Anaeho'omalu Section of the Kailua-Kawaihae Road alignment" (Rosendahl 1973:iii; not shown on Figure 20). The salvage focused on archaeological features that had been located and recorded primarily under the Ching and Rosendahl (1968) and Ching (1971) studies. A site complex (SIHP 00701 "Complex D") was recorded in Ka'u (see Section 4.3 and Appendix A), around a lava tube feature identified as "Kau T3" by Ching and Rosendahl (1968). The complex comprised 62 features straddling the proposed highway corridor, including a "dwelling cave", cairns, shelters, platforms, rock-filled depressions, enclosures, petroglyphs, stone mounds, and a pavement (Rosendahl 1973:23-29). According to Borthwick et al. (1992:7-8):

> Complex D was comprised of 62 features located from 150 to 170 ft. A.M.S.L. (Rosendahl 1973:3-6). The principal feature of the site complex was a dwelling cave, although the complex also included L-shapes and C-shapes, stone mounds, platforms, pavement, walls, enclosures, surface midden areas, cairns, rock-filled depressions, and petroglyphs (Rosendahl 1973:23-30). Five square meters of the interior of the dwelling cave were excavated. Portable artifacts retrieved include abraders, debitage, ornaments, fishing gear, domestic implements, and two slingstones (1973:50-51).

The *makai* cluster of Complex D overlaps the current project area, and, based on the site description, lies roughly in the vicinity of Ching and Rosendahl's (1968) sites Kau T1 and T2. Another Site area, Complex A (Features 574-599), was preliminarily recorded in Hāmanamana

Ahupua'a during one of the earlier studies, and included a shelter, *ahu*, a mound, midden deposit, caves and shelters; this complex could not be relocated due to either initial mislocation or subsequent destruction. Similarly, near the Hānamanama and Hale'ōhi'u boundary,

> ...three foot trails with associated circular, low-walled enclosures were reported [Sites 600, 603, and 630; likely Site Hale'ohi'u T-1]...However, Rosendahl's team could not relocate these structural features or foot trails and determined that they were either destroyed by Keahole airport construction activities, or they were not located accurately on the survey map and not actually situated within the highway alignment [Nakamura et al. 2009:9-10].

These latter sites are also included in Section 4.3 and Appendix A.

4.2.6 Barrera 1979

In 1979, William Barrera conducted an intensive survey of two airport emergency service roads extending directly off either end of the runway (see Figure 20). According to Cordy (1985:13), two sites, SIHP 06961 and SIHP 06962, were found along the southern extension, corresponding to previously-discovered sites documented by Cordy (1985); only SIHP 06961 is situated within the airport property (see Section 4.3 and Appendix A). Henry et al. (1993:9) describes these sites as "a crude habitation shelter and a complex consisting of twelve features. These features were a platform, a habitation shelter, two C-shape shelters, and eight mounds." Feature C at SIHP 06962, an L-shaped habitation shelter, was subjected to test excavation. The report includes descriptions, site and feature maps, photographs, and the results of the excavation. A midden deposit including ash and a small piece of worked mammal longbone (likely representing the initial stage of a bone fishhook) was documented during excavation.

4.2.7 Bonk 1979a and b

That same year, William Bonk surveyed two proposed borrow areas at the airport. The first was located between the parking lot and Queen Ka'ahumanu Highway (Bonk 1979a; see Figure 20). Henry et al. (1993:9) discuss the details of the first study:

> At the time of the survey, at least half of the project area had been leveled by bulldozing, with approximately one-seventh of the leveled area occupied by a car rental agency. Due to the extensive disturbance in the area, Bonk reported that there were no archaeological artifacts, structures, or remains in the leveled area. The rest of the project area, unaffected by bulldozing, was not examined in detail as no specific development was planned for it.

The second proposed borrow area was located approximately one mile north of the airport parking lot in an area already used for borrow activities (Bonk 1979b; not shown on Figure 20). Given the disturbed nature of this area, no historic properties were noted. At this time, however, Bonk was made aware of the presence of a small petroglyph field (SIHP 00500) that had been previously recorded, likely by Ching et al. (1968-9). According to Henry et al. (1993:9), "Bonk made a sketch map of the petroglyphs, plotted their location on his project area map, and noted that the airport had already established a protective buffer around them." This site, which is plotted on Cordy's (1985) site distribution map (see Figure 23 in Section 4.3), is located east of the terminal in the parking lot.

4.2.8 Barrera 1980

The following year, Barrera conducted a survey near the airport terminal. No project area map is supplied in the brief letter report, so its extent is not included on Figure 20. According to Barrera (1987:2), two C-shaped structures were documented in the area south of the terminal building (SIHP 06987; see Section 4.3 and Appendix A). These features "were dismantled completely to check for deposits: none were found" (Cordy 1985:14). They were not recommended for further work. These features also appear on Cordy's (1985) site distribution map as D16-22 (see Figure 23 in Section 4.3).

4.2.9 Barrera 1987a and b

Barrera conducted an archaeological reconnaissance survey on two parcels at the Keahole Airport (1987a; see Figure 20). Survey Area I consisted of 11 acres slated for a ground transportation facility just east of the existing car rental lot. Survey Area II comprised 40 acres proposed for the expansion of the south ramp adjacent to the terminal. No archaeological sites were identified within Survey Area I. In Survey Area II, the Māmalahoa Trail (SIHP 00002) and a site complex containing 11 features (SIHP 10306) were encountered. According to Henry et al. (1993:11), "[t]hese features included four mounds and seven habitation shelters. Short site descriptions, accompanied by sketch maps, photographs and a site location map [see Section 4.3 and Appendix A], were included in the report."

A memo from the SHPD dated January 13, 1993 (Log No. 7200, Doc No. 9301KS06; Appendix B) indicates that a letter report prepared by Barrera in 1992 satisfied further documentation efforts required for the portion of Māmalahoa Trail within Survey Area II, and that destruction of this portion of the trail was permissible. In regard to SIHP 10306, Barrera (1987a:12) felt that data recovery should be undertaken in order to fully "retrieve the scientific information contained in it." However, Barrera (1987a:12) did not foresee that preservation would be warranted for this site.

That same year, Barrera conducted an archaeological reconnaissance survey of five parcels in conjunction with a planned expansion of the airport (Barrera 1987b; see Figure 20), crossing portions of ʻOʻoma, Kalaoa, Hāmanamana, Haleʻōhiʻu, and Makaʻula *ahupuaʻa*. Survey Areas II and III overlapped with Bonk's (1979) study area. Henry et al. (1993:11) detail the results of the fieldwork at each area:

> Survey Area I consisted of approximately 150 acres of undisturbed *pāhoehoe* lava, Survey Area II consisted of approximately 17 acres previously excavated as a borrow pit, Survey Area III consisted of 55 acres previously excavated as a borrow pit, Survey Area IV consisted of 130 acres on top of the 1801 AD lava flow, and Survey Area V consisted of 3 acres on the 1801 AD lava flow. Six sites, including two cave shelters [SIHP 10677 and SIHP 10678], two areas of *pāhoehoe* excavations [SIHP 10675 and SIHP 10680], a cairn [SIHP 10676] and a complex comprising a lava tube shelter and a small petroglyph field [SIHP 10679], were identified in Survey Area I. These sites were assigned habitation and/or indeterminate functions. No sites were encountered in Survey Areas II, III, IV or V. Site documentation included short site descriptions, photographs and a site location map [see Section 4.3 and Appendix A].

The petroglyphs at SIHP 10679 were located "immediately inside the seaward overhang of the easternmost entrance" (Barrera 1987a:10), and consisted of oval shapes and Arabic lettering. Archaeological data recovery was recommended for the three cave sites, and the remaining sites were classified as "no longer significant" (Barrera 1987a:11).

Over a decade later, Dye and Prasad (2000:14) would determine that SIHP 10677 and 10679 correlate with three of Ching and Rosendahl's (1968) sites Kalaoa T2, T3, and T4 (see Section 4.2.14).

4.2.10 Barrera 1990

In 1990, Barerra returned to conduct data recovery at the three cave sites (SIHP 10677, 10678 and 10679) found in Survey Area I of his reconnaissance survey of five parcels (Barerra 1987b; see Figure 20). According to Roberts and Roberts (2001:8-9), "[b]ased on the limited cultural deposits present, the sites were interpreted as temporary habitation sites. Radiocarbon analysis of charcoal collected at site 10,677 yielded dates of AD 1430 and AD 1650..." However, two samples collected from SIHP 10679 yielded date ranges of A.D. 640 to A.D. 1390 and A.D. 781 and A.D. 1385, which "...make this site perhaps the earliest in the area" (Barrera 1990:25). Barrera (1990:25) reiterates his prior interpretation that these sites functioned as temporary shelters, and in the case of SIHP 10679, as a water collection area. The report includes plan view and excavation profile drawings, as well as photographs and description of the test unit findings (see Appendix A).

4.2.11 Barrera 1993

An isolated segment of the Māmalahoa Trail between what is presently the southern half of the airport runway and taxiway was documented by Barrera in 1993 (see Figure 20). Two additional sites were documented during that study directly adjacent to the trail: SIHP 15259, a "roughly square concentration of waterworn basalt and coral pebbles measuring about 0.8 meter on a side"; and SIHP 15260, a complex consisting of a collapsed lava blister containing midden, artifacts, and other cultural modifications, a collapsed mound with a nearby midden deposit, a stone concentration possibly representing a foundation or work area, and an irregular mound (Barerra 1993:6; see Section 4.3 and Appendix A). The latter site is of indeterminate age and function. These sites may correlate with some found on the site map produced by Ching et al. (1968-69), but it is impossible to know for sure since those older site descriptions are missing. According to Clark and McCoy (2009:16), "Barrera's report does not provide a map showing the locations of these two sites but he recommended that no further work be conducted. Dye and Prasad (2000:9) note that "the SHPD determined that field documentation of this trail was successfully completed and accepted the report."

Given that the short-term improvements will not impact this segment of trail and the two adjacent sites, and given the difficulty of access to this area due to safety concerns, it will not be inspected during the current study. The main section of the Māmalahoa Trail extending toward the airport from the south ends somewhere just south of the southern property boundary.

4.2.12 Walsh and Hammatt 1995

In 1995, Cultural Surveys Hawai'i (CSH) conducted an archaeological inventory survey of a corridor along the Queen Ka'ahumanu Highway from Kalaoa to Keahuolū Ahupua'a (Walsh and Hammatt 1995; see Figure 20). Three sites were located along the boundary of the airport property and the highway right-of-way: a lava tube (SIHP 19943), a petroglyph area (19944), and mounds (19945) (see Section 4.3 and Appendix A).

4.2.13 Carpenter et al. 1998

The State of Hawai'i Division of State Parks conducted a reconnaissance survey for what is known as the Mahai'ula Section of Kekaha Kai State Park in 1998 (see Figure 20). This section of the park includes a portion of Kaulana Ahupua'a as well, and bounds the bulk of the airport property to the north. The survey included Kawili Point, despite the fact that this area is controlled by the DOT Airport Division and is not technically part of the park. The rationale behind this coverage was that sites located at the point are subject to impacts resulting from activities occurring within the park (Carpenter et al. 1998:4). This study essentially represents the only archaeological coverage within the Mahai'ula Section of Kekaha Kai State Park (aside from the 1930 Reineke survey).

During the survey of the 38-acre Kawili Point, numerous archaeological features were encountered and recorded; some of these are related to the presence of the Ka'elemakule family and the later Magoon Estate at Mahai'ula beach, just out of the current project area (Carpenter et al. 1998:4). The Ka'elemakule family resided at the beach from the late 1800s to 1933, when the Magoon family took control of the land (holding it until 1993 when it was absorbed by the State; refer to Section 3.6.9). Carpenter et al. (1998:7) note that this area was likely an attractive settlement area (in prehistoric times as well) due to the presence of the slightly brackish anchialine ponds at Kawili Point, which are fed by underground freshwater springs.

Carpenter et al. (1998:17) summarize the findings of Reineke's (1930) survey data for Mahai'ula Bay and Kawili Point:

> Reineke's observations are important, as they represent the last recorded observations prior to the large tsunamis of this century, which apparently caused a great deal of disturbance to the nearshore area. He notes concrete salt pans and house sites at the northern end of Kaulana near the beach "at the edge of the flow", evidence that salt manufacturing was taking place. This industry may explain the Ka'elemakule purchase of the land encompassing the [1801] lava flow in Kaulana as well as his house site at Mahai'ula.

According to Carpenter et al. (1998:28), "[m]uch of the field time was spent mapping the Kawili Point Complex ([temporary] site T70), the most extensive and well-preserved complex in the project area. In this complex, approximately 65 features were mapped, ranging from small rock-lined pits to large complex habitation platforms," (see Section 4.3 and Appendix A). These features fall entirely within this disconnected section of the airport property. A handful of other sites were documented at the point, including T1 (trail), 3 (trail), 10 (*ahu*/platform), 11 (stepped platform), 12 (c-shaped shelter), 13 (brackish pool), 14 (four-feature complex), 15 (enclosure), 56 (trail), and 68 (anchialine pool) (see Section 4.3 and Appendix A). Many of the sites documented during the 1998 survey were correlated with Reineke's (1930) sites. It is currently

unknown if these sites were later assigned State site numbers, although it is likely. Some other features documented during the 1998 survey correlate with Ching (1971) sites, and a handful are located within very close proximity, but just outside of, the current project area.

4.2.14 Dye and Prasad 2000

In 2000, the International Archaeological Research Institute, Inc. (IARII) conducted a study of 548 acres at the airport for inclusion in a Master Plan Update (Dye and Prasad 2000; see Figure 20). The study included updating archaeological information (i.e., validating prior findings and identifying new sites) and conducting interviews concerning Public Access Shoreline Hawaii (PASH) rights. The Phase I and II study areas largely fell over areas surveyed by Barrera in 1987(a, b) and 1993 (see Section 4.3, Figure 20).

Dye and Prasad (2000:13) confirmed construction-related destruction of SIHP 10306, 10675, 10676, and a portion of the Māmalahoa Trail (SIHP 00002), all previously documented by Barrera (1987a and b, 1993). The former sites were determined to be "no longer significant" upon their initial documentation (Barerra 1990:1), although it is unknown at this time whether Barrera's recommendation for salvage at SIHP 10306 was ever undertaken. The destruction of the segment of the Māmalahoa Trail had been mitigated (see Section 4.2.11).

The four sites that Barrera (1987b) documented in the vicinity of proposed Phase II heliport (SIHP 10677 through 10679) were revisited. All of these sites have been evaluated as no longer significant, though this area does not appear to have been since disturbed. Dye and Prasad (2000:14) did note a useful link between these sites and the Ching and Rosendahl (1968) survey: "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" (see Section 4.2.2).

Dye and Prasad (2000:17) reported a lack of historic properties within two previously-unsurveyed but heavily-disturbed areas at the northern end of the airport: the Fuel Farm Site Preparation area and Wastewater Treatment Plant. An unsurveyed area to the south of the proposed Fuel Farm Site Preparation area comprises of a large *kīpuka* (an area of land completely surrounded by one or more younger lava flows) of 3,000 to 5,000 year-old lava (visible on Figure 7). Ten sites were encountered in this *kīpuka*; of these, three (Sites 1, 7 and 8) were situated in the bounds of the proposed Phase II Emergency Generator and Flight Kitchen Site Preparation areas. Basic site descriptions were completed for all ten of these sites (see Appendix A). Photos of Sites 1, 7 and 8 are included in the report, as well as the following evaluation:

> 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 *pāhoehoe* 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 [Dye and Prasad 2000:20].

The current field inspection will seek to determine whether the ten sites recorded by Dye and Prasad (2000) are still present within the project area. The *kīpuka* in which these sites were encountered does not appear to have been developed, but one of the present proposed DOA inspection facility sites (Site A) encompasses the area (see Figure 20).

4.2.15 Escott and Keris 2009

In 2009, Scientific Consultant Services, Inc. (SCS) undertook an archaeological inventory survey of a 5.423-acre parcel along Keāhole Street that was being considered as a new location for the Onizuka Space Center (Escott and Keris 2009; see Figure 20). One site consisting of three *pāhoehoe* excavations was documented along the eastern side of the project area. This pre-Contact site, SIHP 26868, was interpreted as having an exploratory function only, and no further work was recommended (Escott and Keris 2009:23) (see Section 4.3 and Appendix A). Apparently this proposed location for the museum was abandoned, as under the current project it is proposed for construction near the center of the main airport parking area (see Figure 10).

4.2.16 Escott and Spear 2009

That same year, SCS also accomplished an archaeological assessment of 11.36 acres at the airport for proposed improvements including the installation of photovoltaic panels and parking lot and commuter terminal improvements (Escott and Spear 2009; see Figure 20). These improvement areas were all situated over "previously disturbed ground surfaces" including gravel lots, paved lots, and bulldozed *pāhoehoe*. The areas of proposed improvements are not located in close proximity to any previously documented cultural resources..." (Escott and Spear 2009:16). No historic properties were encountered.

4.2.17 Nakamura et al. 2009; Clark and Mintmier 2010

In 2009, Pacific Consulting Services Inc. (PCSI) completed an archaeological inventory survey and test excavations at a 7.2-acre parcel proposed for development of a new Airport Traffic Control Tower (ATCT) and associated parking lot east of the existing taxiway and north of the terminal near the present proposed ARFF facility (Nakamura et al. 2009; see Figure 20). Two historic properties were documented (SIHP 26737 and SIHP 26738), as well as two modern structures. According to the report, "[t]he two historic properties were located in *'a'ā kīpuka* surrounded by the 1801 *pāhoehoe* flow..." (Nakamura et al. 2009:i). SIHP 26737 is a pre-Contact segment of a steppingstone trail for which preservation was recommended, and SIHP 26738 was interpreted as a possible agricultural feature based on the results of test excavation (see Section 4.3 and Appendix A). No further work was recommended for the latter site.

The following year, PCS completed a preservation plan for SIHP 26737 (Clark and Mintmier 2010). The preservation area extends around the entire *kīpuka* in which the trail segment is located, and establishes that the areas around the ATCT facility and parking lot shall remain natural (Clark and Mintmier 2010:20).

4.2.18 Clark and McCoy 2009; Clark et al. 2011

During the same year that PCSI conducted the inventory survey for the ATCT, they also undertook an archaeological assessment for a proposed new Very High Frequency, Omni-Directional Range (VOR) Facility (Clark and McCoy 2009; see Figure 20). According to the report," the existing VOR, built in 1966, is located south of the airport in Keahuolū Ahupua'a.

Because this existing facility has been graded and paved, no archaeological sites are anticipated to be encountered during its demolition" (Clark and McCoy 2009:i). The APE for the new VOR facility consisted of the facility area, located south of the runway, several sections of access road, and an electrical line corridor between the VOR parcel and the OTEC Road. No historic properties were found during the field work, and no further archaeological work was recommended.

The following year, two borrow-pit areas were added to the VOR project area APE. Following the discovery of a cave shelter along the boundary of one of the borrow pits, PCSI conducted and inventory survey of the borrow-pit area (Clark et al. 2011; see Figure 20). Two historic properties were documented during this study: SIHP 28568, interpreted as a habitation site; and SIHP 28569, a 17-feature quarry complex (see Section 4.3 and Appendix A). Test excavations were undertaken at both sites, and no further work was recommended (Clark et al. 2011:70).

4.2.19 Clark and Collins 2011

Last year, PCSI undertook an archaeological assessment for a proposed new duct bank connecting the new ATCT facility to the existing communications network at the airport (Clark and Collins 2011; see Figure 20). The project area consisted of narrow sections of corridor extending from the ATCT to a point along the taxiway, in the vicinity of the present proposed ARFF facility. No historic properties were found during the reconnaissance survey of the three corridors.

4.2.20 Monahan et al. 2011; Altizer and Monahan 2011

For the last several years, CSH has conducted various studies related to widening projects along the Queen Ka'ahumanu Highway, which largely overlap the Walsh and Hammatt (1995) project corridor. One of these projects was an archaeological inventory survey for proposed Phase II widening (Monahan et al. 2011; see Figure 20). During this survey, additional sites were documented that were not included in the Walsh and Hammatt (1995) study. SIHP 28814 (lava tube) and SIHP 28815 (*pāhoehoe* excavation), both pre-Contact sites, were documented in the vicinity of the far southeastern corner of the airport property, just north of the Ka'iminani Drive intersection at the highway (see Section 4.3 and Appendix A). No further work was recommended for these sites (Monahan et al. 2011:237).

The same year, CSH completed a draft data recovery and preservation plan for some of the sites previously recorded in the Phase II widening corridor (Altizer and Monahan 2011a). Two sites directly adjacent to the present project area, SIHP 19943 and SIHP 19945, had been recommended for data recovery under the Walsh and Hammatt (1995) study, and SIHP 19945 (petroglyphs) had been recommended for preservation (see Section 4.2.12). The data recovery tasks have since been fulfilled (the primary author of this report was a participant).

Native Hawaiian Organizations (NHOs) have held a high degree of involvement in the Queen Ka'ahumanu widening project. After the data recovery tasks were completed, these organizations requested that CSH investigate some additional features. The resulting historic properties have not yet been assigned State site numbers, and the results of this archaeological work have not yet been finalized. However, it can be said that the recently-documented sites in the vicinity of the far southeastern corner of the airport property include *pāhoehoe* excavations and a basalt basher artifact. These features may or may not be impacted by widening-related grading; collection has been recommended for the basher artifact and a recommendation of no further work has been made for the *pāhoehoe* excavations.

4.3 Sites Previously Recorded Within the Project Area

Historic properties previously recorded within the project area lie almost entirely within the Intermediate Zone (beginning at approximately 300 meters inland). This means that the concentrated site areas representing coastal settlements and activity areas fall outside of (though adjacent to) the current study area; the density of sites in the project area is lower. A good deal has been written about the archaeological remains located at the coast of ʻOʻoma and Kalaoa 1-5 (see Rosendahl and Kirch 1975, Rosendahl 1980, Cordy 1981 and 1985, Clark 1984, Barrera 1985, Roberts and Roberts 2001, among others), and the 2010 Master Plan Update (1-47) provides a brief but generally accurate summary of this area. The reader is referred to these sources for further information on the coastal sites, which include a habitation site called the Kalaoa Permanent House (SIHP 10205) that has been added to the National Register of Historic Places (Site 92001552).

Dye and Prasad (2000:iii) write of the lack of a thorough and accurate accounting of all of the historic properties that have been documented within the airport property, attributing this situation to problems with the early surveys, particularly the incomplete Ching et al. (1968-9) study:

> 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.

The current research seeks to identify the sites known to exist within the airport property (and more importantly within the short-term improvement areas) as best as possible based on the information contained in past reports and that could be presently found at the SHPD Hilo office. The site numbers given throughout this report are prefixed "50-10-27-."

The vast majority of the historic properties previously documented on airport property *are not* located within or immediately adjacent to the short-term improvement areas. These include a portion of the well-known Māmalahoa Trail (SIHP 00002) and some actively preserved sites including a petroglyph field (SIHP 00500) and a segment of steppingstone trail (SIHP 26737), among others. Other previously-identified sites have been documented to their maximum potential and have subsequently been impacted by development at the airport.

Information regarding the sites previously identified on airport property is presented in Table 9. This information includes the State site number; other site numbers used, if any; the *ahupuaʻa* in which the site is located; the previous study or studies during which the site was identified;

Table 9. Sites Previously Recorded in the Project Area

SIHP No. (50-10-27-)	Other Site No.	*Ahupuaʻa*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
?	Kalaoa T1	Kalaoa	Ching and Rosendahl (1968)	Lava Tube	Habitation/ activity area	Pre-Contact	None given	Data Recovery	Unknown
?	Haleohiu T2	Haleʻōhiʻu	Ching and Rosendahl (1968)	No Site Descrip-tion (in C and R 1968)	None given	None given	None given	Data Recovery	Likely present/ undisturbed
?	Kau T1	Kaʻū	Ching and Rosendahl (1968)	Complex	None given	None given	None given	Data Recovery	Likely present/ undisturbed
?	Kau T2	Kaʻū	Ching and Rosendahl (1968)	No Site Descrip-tion (in C and R 1968)	None given	None given	None given	Data Recovery	Likely present/ undisturbed
?	**1**	**Hāmana-mana**	**Dye and Prasad 2000**	**Circular alignment**	**None given**	**None given**	**No Longer Signif-icant**	**No further work**	**Likely present/ undisturbed; possibly in proposed DOA Inspection Facility "Site A"**

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
?	7	Hāmana-mana	Dye and Prasad 2000	Circular alignment	None given	None given	No Longer Signif-icant	No further work	Likely present/ undisturbed
?	8	Hāmana-mana	Dye and Prasad 2000	Circular alignment	None given	None given	No Longer Signif-icant	No further work	Likely present/ undisturbed
?	9	Hāmana-mana	Dye and Prasad 2000	Circular alignment	None given	None given	None given	None given	Likely present/ undisturbed
?	10	Hāmana-mana	Dye and Prasad 2000	C-shape structure	None given	None given	None given	None given	Likely present/ undisturbed
?	T1	Mahai'ula	Reineke 1930; Carpenter et al. 1998	Paved Trail	Trans-portation	None given	D	Preservation	Likely present/ undisturbed
?	T3	Mahai'ula	Carpenter et al. 1998	Stepping-Stone Trail	Trans-portation	None given	D	Preservation	Likely present/ undisturbed
?	T10	Mahai'ula	Carpenter et al. 1998	*Ahu*/ Platform	Possible *Ko'a*	Likely pre-Contact	D, E	Detailed recording/ mapping	Likely present/ undisturbed
?	T11	Mahai'ula	Carpenter et al. 1998	Stepped Platform	Temporary Habitation	None given; likely pre-Contact	D	Detailed recording/ mapping/ testing	Likely present/ undisturbed
?	T12	Mahai'ula	Carpenter et al. 1998	C-Shape	Temporary Habitation	None given; likely pre-Contact	D	Detailed recording/ mapping	Likely present/ undisturbed

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
?	2	**Hāmana-mana**	**Dye and Prasad 2000**	**Circular alignment**	**None given**	**None given**	**None given**	**None given (fell outside of 2000 study area)**	**Likely present/ undisturbed; possibly in proposed DOA Inspection Facility "Site A"**
?	3	**Hāmana-mana**	**Dye and Prasad 2000**	**Circular alignment**	**None given**	**None given**	**None given**	**None given (fell outside of 2000 study area)**	**Likely present/ undisturbed; possibly in proposed DOA Inspection Facility "Site A"**
?	4	**Hāmana-mana**	**Dye and Prasad 2000**	**Circular alignment**	**None given**	**None given**	**None given**	**None given (fell outside of 2000 study area)**	**Likely present/ undisturbed; possibly in proposed DOA Inspection Facility "Site A"**
?	5	**Hāmana-mana**	**Dye and Prasad 2000**	**Circular alignment**	**None given**	**None given**	**None given**	**None given (fell outside of 2000 study area)**	**Likely present/ undisturbed; possibly in proposed DOA Inspection Facility "Site A"**
?	6	Hāmana-mana	Dye and Prasad 2000	Circular alignment	None given	None given	None given	None given	Likely present/ undisturbed

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Significance Evaluation	Recommendation	Current Status
00245/ 10202	223/Trail VII (Ching et al. 68-9); D16-16 (Cordy 1985)	Kalaoa	Ching et al. 1968-69; Cordy 1985	Trail	Transportation	None given	None given	None given	Unknown—likely undisturbed
00246	255/Trail VI (Ching et al. 68-9); D16-15 (Cordy 1985)	Kalaoa	Ching et al. 1968-69; Clark 1984; Cordy 1985	Trail (*'Opihi*)	Transportation	None given	None given	None given	Unknown—likely undisturbed
00302	D16-23 (Cordy 1985)	Kalaoa	Ching et al. 1968-69; Cordy 1985	Trail (Cairn Marked)	Transportation	None given	None given	None given	Unknown; likely disturbed
00373	Trail X (Ching et al. 68-9); D15-19 (Cordy 1985)	Kalaoa	Ching et al. 1968-69; Cordy 1985	Trail (Stepping-stone)	Transportation	None given	None given	None given	Unknown; likely disturbed
00487, 00495, 00501, 00502	Trail II (Ching et al. 68-9); D16-20 (Cordy 1985)	Kalaoa	Ching et al. 1968-69; Cordy 1985	Trail (Stepping-stone, Cairn Marked)	Transportation	None given	None given	None given	Unknown; likely disturbed

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Significance Evaluation	Recommendation	Current Status
?	T13	Mahai'ula	Carpenter et al. 1998	Pool	Bathing	Modern / Indeterminate	D	Preservation	Likely present/ undisturbed
?	T14	Mahai'ula	Carpenter et al. 1998	Complex	Temporary Habitation	None given	D	Detailed recording/ mapping	Likely present/ undisturbed
?	95; T15	Mahai'ula	Reineke 1930; Carpenter et al. 1998	Enclosure	Temporary Habitation	Indeterminate	D	Detailed recording/ mapping	Likely present/ undisturbed
?	95; T56	Mahai'ula	Reineke 1930; Carpenter et al. 1998	Paved Trail	Transportation	None given	D	Preservation	Likely present/ undisturbed
?	T68	Mahai'ula	Carpenter et al. 1998	Anchialine Pool	Aquaculture/ Bait Gathering	None given; likely pre-Contact	D	Preservation	Likely present/ undisturbed
?	94, 95; T70	Mahai'ula	Reineke 1930; Carpenter et al. 1998	Kawili Point Complex	Multiple	Mixed	C, D	Testing	Likely present/ undisturbed
00002	--	Multiple; in PA, 'O'oma, Kalaoa	Multiple; see Barrera 1993	Trail	Transportation	Historic	A, C, D, E	Consultation / mitigation with SHPD before disturbance	One section remains in PA in between existing runway and taxiway
00185	183 (Ching et al. 68-9); D16-17 (Cordy 1985)	Kalaoa	Ching et al. 1968-69; Clark 1984; Cordy 1985	Trail (Stepping-stone)	None given	None given	None given	None given	Unknown—likely undisturbed

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
10676	--	Kalaoa	Barrera 1987b, 1990; Dye and Prasad 2000	*Ahu*	Possible trail marker	Indeter-minate	No Longer Signif-icant	No further work	Destroyed (confirmed by Dye and Prasad 2000)
10677	Kalaoa T2 (Ching and Rosen-dahl 1968)	Kalaoa	Ching and Rosendahl 1968; Barrera 1987b, 1990; Dye and Prasad 2000	Lava tube	Temporary habitation	Likely pre-Contact	No Longer Signif-icant	No further work	Likely present/ undisturbed
10678	--	Kalaoa	Barrera 1987b, 1990; Dye and Prasad 2000	Lava tube	Likely explora-tory	Pre-Contact	No Longer Signif-icant	No further work	Likely present/ undisturbed
10679	Kalaoa T3, T4 (Ching and Rosen-dahl 1968)	Kalaoa	Ching and Rosendahl 1968; Barrera 1987b, 1990; Dye and Prasad 2000	Lava tube	Temporary habitation	Pre-Contact	No Longer Signif-icant	No further work	Likely present/ undisturbed
10680	--	Kalaoa	Barrera 1987b, 1990; Dye and Prasad 2000	Two *pāhoehoe* excava-tions	None given	Likely pre-Contact	No Longer Signif-icant	No further work	Likely present/ undisturbed
15259	--	Kalaoa	Barrera 1993	Pebble concen-tration	Indeterm-inate	Indeterm-inate	No Longer Signif-icant	No further work	Likely present/ undisturbed

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
00500	D16-21 (Cordy 1985)	Kalaoa	Probably Ching et al. 1968-69 or Ching 1971; Bonk 1979; Cordy 1985	Petroglyph Field	None given	None given	None given	Preservation	Actively preserved
00600, 00603, 00630	Haleohiu T1	Hale'ōhi'u	Ching and Rosendahl (1968); Rosendahl 1973	Trail and enclosure complex	None given	None given	None given	Data Recovery	Likely destroyed—could not be relocated by Rosendahl 1973
00701	Complex D; Kau T3	Ka'ū	Ching and Rosendahl 1968; Rosendahl 1973	Complex (Kau T3 = lava tube)	Habitation and related	Likely pre-1868	None given	"Closer investi-gation"	Unknown; likely disturbed (at least partially)
06961	D15-77; Cordy 1985)	Kalaoa	Barrera 1979	Enclosure	Temporary Habitation	Likely historic	None given	Avoidance or data recovery	Unknown; likely disturbed
06987	D16-22 (Cordy 1985)	Kalaoa	Barrera 1980; Cordy 1985;	Complex	Temporary Habitation	Indeter-minate	None given	No further work	Destroyed
10306	--	Kalaoa	Barrera 1987a; Dye and Prasad 2000	Complex	None given	None given	No Longer Signif-icant	No further work	Destroyed (confirmed by Dye and Prasad 2000)
10675	--	Kalaoa	Barrera 1987b, 1990; Dye and Prasad 2000	*Pāhoehoe* excavation	Indeter-minate	Likely pre-Contact	No Longer Signif-icant	No further work	Destroyed (confirmed by Dye and Prasad 2000)

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
28569	--	Kalaoa	Clark et al. 2011	Complex	Habitation, quarry, storage, agriculture, access, etc.	Pre-Contact	D	No further work	Unknown; likely disturbed
28814	--	Kalaoa	Monahan et al. 2011	Lava tube	Indeterm-inate / possible water catchment	Pre-Contact	D	No further work	Likely present/ undisturbed
28815	--	Kalaoa	Monahan et al. 2011	*Pāhoehoe* Excavation	Quarrying	Pre-Contact	D	No further work	Likely present/ undisturbed

SIHP No. (50-10-27-)	Other Site No.	*Ahupua'a*	Past Study	Site Type	Site Function	Site Age	Signif-icance Eval-uation	Recommend-ation	Current Status
15260	--	Kalaoa	Barrera 1993	Complex	Habitation	Indeterm-inate	D	Information missing	Likely present/ undisturbed
19943	--	Kalaoa	Walsh and Hammatt 1995; Monahan et al. 2011; Altizer and Monahan 2011	Lava tube	Temporary habitation	Pre-Contact	D	Preservation	Present
19944	--	Kalaoa	Walsh and Hammatt 1995	Mounds	Markers	None given	D	Data recovery	Present
19945	--	Kalaoa	Walsh and Hammatt 1995; Monahan et al. 2011; Altizer and Monahan 2011	Petro-glyphs	Symbolic Expression	Pre-Contact	D, E	Preservation	Present
26737	--	Hāmana-mana	Namamura et al. 2009; Clark and Mintmier 2010	Trail (Stepping-stone)	Trans-portation	Pre-Contact	C, D, E	Preservation	Actively preserved
26738	--	Hāmana-mana	Namamura et al. 2009; Clark and Mintmier 2010	Complex	Agricul-ture	Pre-Contact	D	No further work	Unknown; likely disturbed
26868	--	Kalaoa	Escott and Keris 2009	Complex	Likely explorat-ory	Pre-Contact	D	No further work	Likely present/ undisturbed
28568	--	Kalaoa	Clark et al. 2011	Rock-shelter	Habitation	Early historic	D	No further work	Unknown; likely disturbed

site type, function and age; significance determinations[1]; recommendations for further work; and current status. Sites that overlap a present short-term improvement area are bolded. Full site descriptions are given in Appendix A, compiled from past reports.

Figure 21 is an overlay of the map included in the Ching et al. (1968-69) preliminary report; although it is of limited use because the accompanying site descriptions are missing, it is useful for understanding overall site distribution, particularly in the northeastern portion of the property. Ching (1971) included a map in his report for the survey of the Kailua-Kawaihae Road Corridor (Map 20) that depicts approximate locations of all features found during past surveys in the region (Figure 22). This map, which probably drew heavily from the Ching et al. (1968-69) study for the airport environs:

> ...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 [Dye and Prasad 2000:9].

Like the earlier Ching et al. (1968-69) map, the 1971 map is useful for identifying areas of heavier site concentration. The site distribution map from Ross Cordy's *Working Paper* (1985; Figure 23) synthesizes the result of the surveys in 'O'oma and Kalaoa completed up to 1985 (this necessitated a standardization of site numbering). Cordy included only sites for which descriptions and other basic information exists; for this reason, the Ching et al. (1968-69) non-trail sites are not included. Seven sites are shown right along the southwestern edge of the airport boundary; the southern-most four of these were covered in the Barrera (1985) study, and therefore definitely fall outside of the airport bounds. Since Cordy lists only Bishop Museum and State site numbers for the other three sites, D15-21 (SIHP 10209), -88 (SIHP 5605), and -89 (5602), it is highly likely that they were documented during an earlier museum study for NELHA, such as Rogers-Jourdaine (1978), which would also place these sites out of the airport property.

An attempt has been made to create a single map showing all of the known, previously-recorded sites within and immediately surrounding the project area (Figure 24, plus insets Figure 25 and Figure 26). (This map does not include the sites identified on the Cordy 1985 map which were not identified during later airport studies, and it does not depict the bulk of the sites at the coast between Keāhole Point and Wawaioli Beach.) This was accomplished by combining site location information as best as possible from distribution maps included in reports from previous studies. Figure 24 was then overlain with the current project and short-term improvement areas with the goal of understanding the proximity of known sites to the short-term improvement areas. This map should be considered an approximation, given the inaccuracies inherent in site location reporting on the earlier maps.

[1]Cultural resource significance is evaluated and expressed as eligibility for listing on the National and/or Hawai'i Register. To be considered eligible for listing on the National and/or Hawai'i Register a cultural resource should possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet one or more of the following broad cultural/historic significance criteria: "A" reflects major trends or events in the history of the state or nation; "B" is associated with the lives of persons significant in our past; "C" is an excellent example of a site type/work of a master; "D" has yielded or may be likely to yield information important in prehistory or history; and, "E" (Hawaii Register only) has traditional cultural significance to an ethnic group, includes religious structures and/or burials.

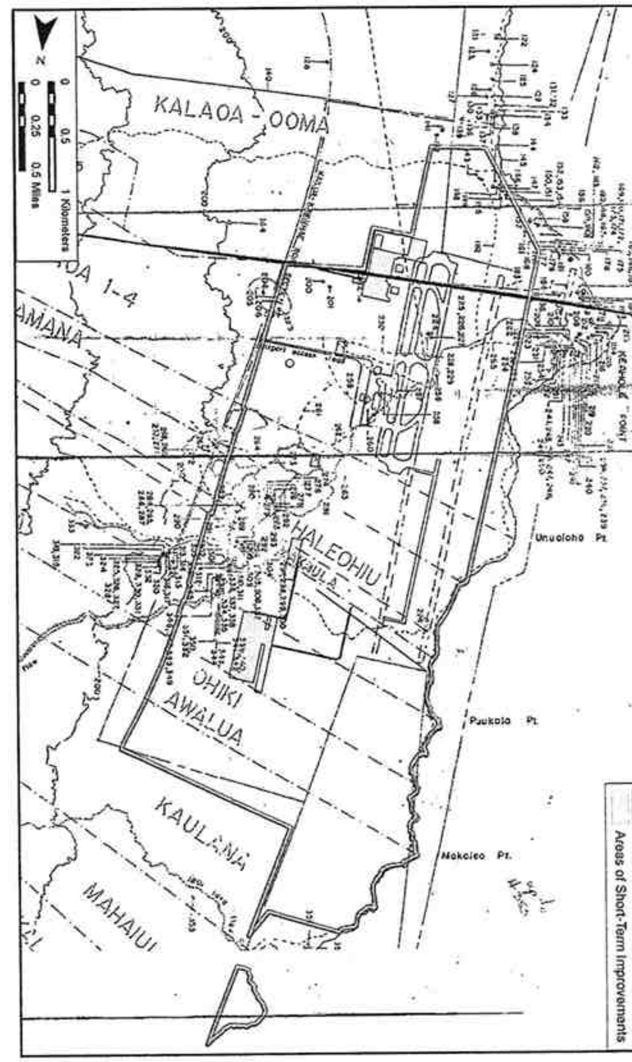


Figure 21. Site distribution map from Ching et al. 1968-69, showing the locations of features found during that survey in relation to the current project area (map should be considered an approximation)

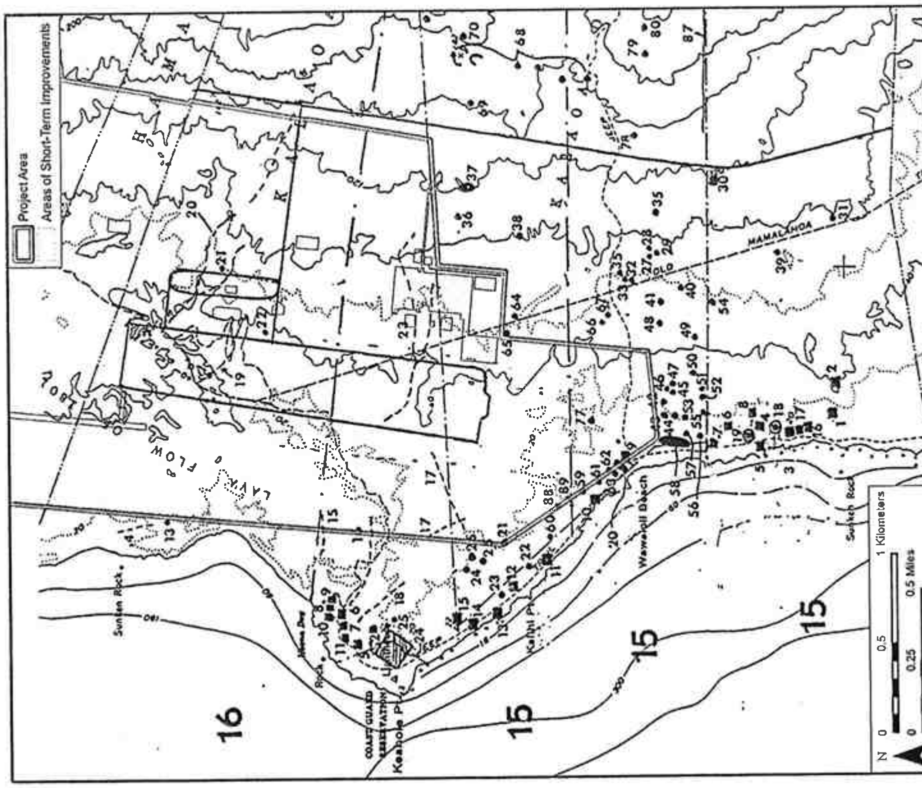
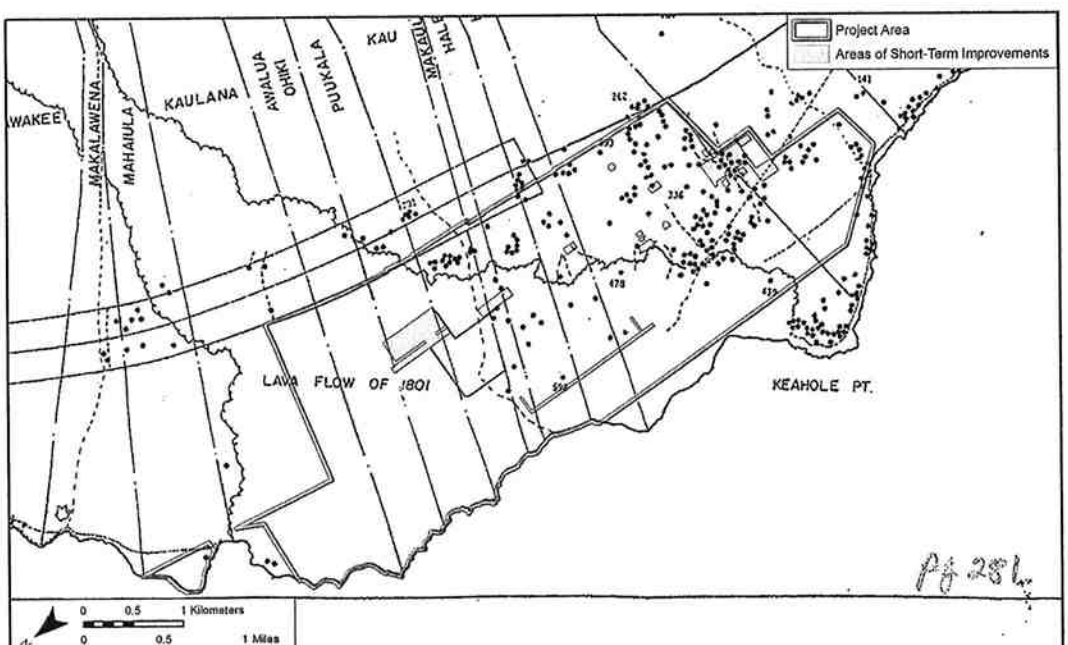


Figure 23. Site distribution map from Cordy (1985), showing the locations of many of the sites found during earlier studies in relation to the current project area



Pg 284

Figure 22. Feature distribution map from Ching (1971), showing the approximated locations of features identified in earlier studies in relation to the current project area (map should be considered an approximation)

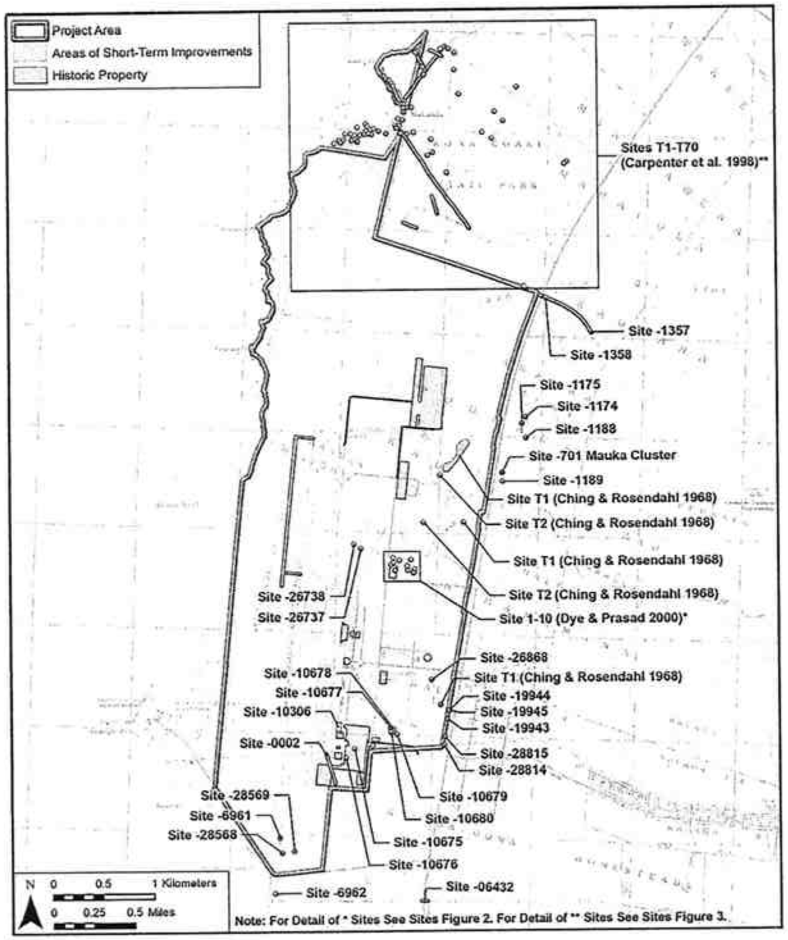


Figure 24. Portion of the 7.5-minute US Geological Survey topographic map, Keāhole (1996) and Makalawena (1996) Quadrants, showing the locations of sites documented within (and some immediately adjacent to) the current project area

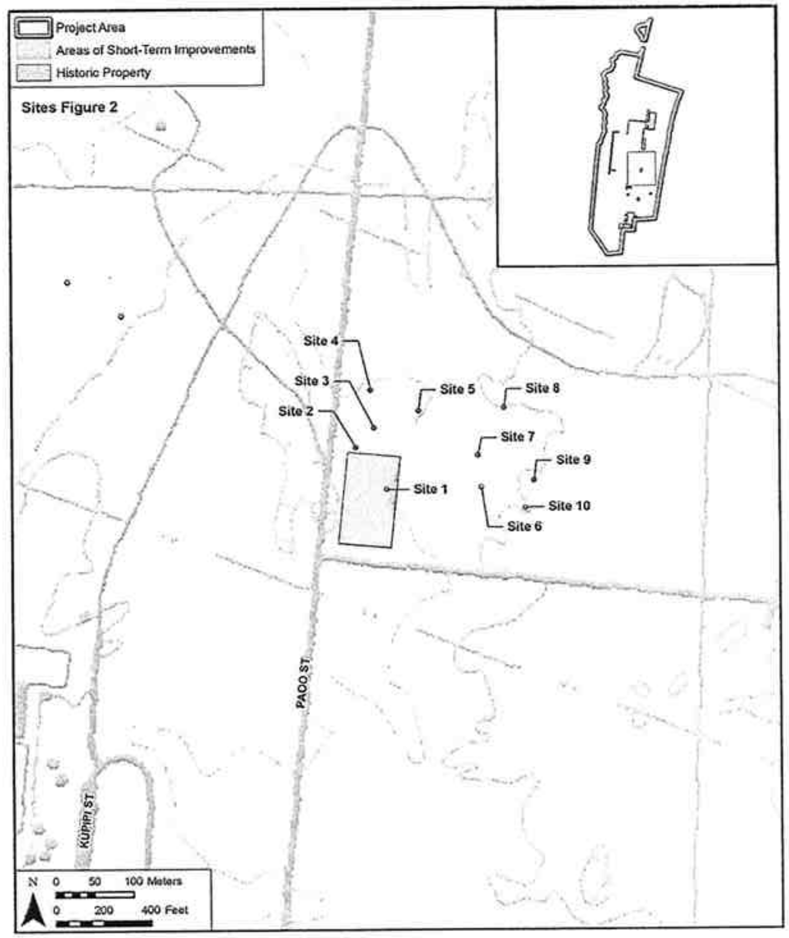


Figure 25. Inset of Figure 24 above, showing the locations of the features documented by Dye and Prasad (2000) in relation to the present proposed DOA Inspection Facility Site A (in pink)

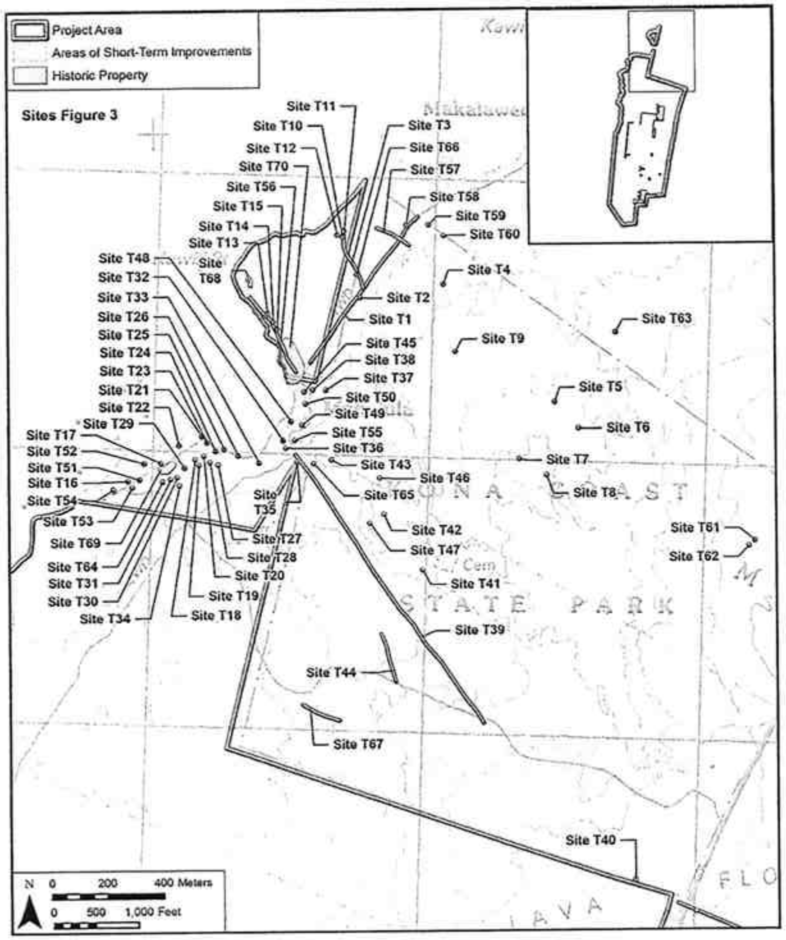


Figure 26. Inset of Figure 24 above, showing the locations of features documented by Carpenter et al. (1998) in relation to the northernmost portions of the current project area

4.4 Summary

The results of previous archaeological studies within and adjacent to the airport property have supported the settlement patterns of the Kekaha as introduced in Section 3.3 and Table 2. We know from early, large-scale studies that overlapped the airport (e.g., Ching and Rosendahl 1968, Ching et al. 1968-69, Ching 1971, Rosendahl 1973) that numerous archaeological features were located within the project area, though many have since been destroyed by airport- or highway-related development or cannot be correlated with sufficient descriptive or locational data. Although the data from these earlier studies is imprecise and incomplete, it gives an overall picture of site distributions both on and off of the 1801 lava flow that dominates much of the property.

More recent studies have tended to focus on discrete areas at the airport, where further development has been proposed and undertaken. It has been during these studies that sites (many of which were likely noted during the problematic, earliest surveys) were documented in a more thorough and presently-useful fashion. However, given their limited nature, these studies only comprise a portion of the total airport property, meaning that there are many more essentially undocumented sites assumed to still exist within the project area. A complete survey of the airport property would go a long way toward fleshing out the archaeological record within.

As Table 9 shows, only five previously-documented sites overlap a present short-term improvement project (Potential Site "A" for DOA Inspection Facility). All five of these sites, for which State site numbers could not be found, were at least cursorily recorded by Dye and Prasad in 2000. Only one of these sites, temporary site number 1, was documented thoroughly as it was the only site of the five to strictly fall within the 2000 study area. A recommendation of no further work was made for this site. The four nearby features are similar in nature, but appear to have not yet been completely documented. The lack of previously-recorded sites within the other short-term improvement areas underscores the extent of previous land disturbance in these areas (e.g., the proposed Terminal Modernization Phase 1, General Aviation Apron Expansion or High Pressure Hydrogen Fuel Storage and Fuel Station), or their situation on previously unsurveyed portions of the airport property (e.g., the proposed Helicopter General Aviation facility or Potential Site "B" for DOA Inspection Facility).

The majority of sites that have been documented within the airport property are typical of their locations within the Intermediate Zone. These sites consist of temporary habitations or shelters (often modified outcroppings or lava tubes), midden scatters, *pāhoehoe* excavations, trails, mounds, and other features associated with the types of activities summarized by Walsh and Hammatt (1995; see Table 2). Examples of both pre-Contact and historic era sites have been documented, and some sites show evidence of use throughout multiple time periods. Furthermore, the survey for Kekaha Kai State Park to the north (Carpenter et al. 1998) documented numerous features within the Coastal Zone at the disconnected Kawili Point portion of the airport property. These features reflect the habitation and ocean-resource exploitation activities known to occur within this zone throughout pre-Contact and historic times.

Section 5 Potential for Encountering Historic Properties

A synthesis of known land-use patterns, geological/lava flow data, an account of the extent of construction-related disturbance to date, and results of previous archaeological studies at the airport provides a basis for estimating the likelihood of encountering historic properties throughout the project area. Figure 27 represents a synthesis of this data. This map classifies the likelihood of encountering archaeological remains into three groups: low, moderate and high. *The limits of the zones shown on this map should be considered approximations only.* Some degree of disturbance (including existing roadways) may be present within areas shown as moderate- to high-sensitivity, while relatively small, undisturbed areas may also be found within the low sensitivity zones. Future improvements at the property should be evaluated on a case-by-case basis.

As Figure 27 shows, the potential for archaeological remains in undisturbed areas throughout the project area is generally moderate to high. The areas of highest potential are those undeveloped portions of the project area situated on older lava flows that have not been mitigated by recent archaeological study. Historic properties have been recorded in nearly every inventory survey conducted at the airport and nearby areas on these older flows, as indicated in Section 4.

Areas with a high potential for the presence of archaeological features include the northern-, eastern- and southern-most portions of the property. The Mahai'ula Bay-Kawili Point area to the north largely escaped the 1801 lava flow, and many features were preliminarily documented here during the archaeological reconnaissance for the Kekaha Kai State Park (Carpenter et al. 1998). While much of the project area is dominated by the 1801 lava flow, the majority of the eastern portion along Queen Ka'ahumanu Highway consists of 1,500 to 11,000 year old flow areas, where Ching et al. (1968-69) and Ching (1971) cursorily identified significant site concentrations (see Figure 21 and Figure 22). In the eastern corner of the property south of Keāhole Street and east of Road N (Pāo'o Street), Barrera (1987b, 1990) documented significant lava tube sites at which some of the earliest radiocarbon dates in the region have been documented; though these particular sites have been mitigated, they serve to underscore the archaeological significance of undocumented sites that may be present in the vicinity. Little recent survey work has been completed in the southern portions of the property adjacent to the runway and NELHA, which are underlain by 1,500-5,000 year old flows; a limited study undertaken last year documented two multi-feature sites complexes in this area (Clark et al. 2011). Furthermore, the southwestern airport boundary lies directly adjacent to the very high concentrations of coastal sites at Keāhole Point and Wawaioli Beach.

In addition, a few small areas of undisturbed land situated amongst the present airport facilities and associated disturbed areas are likely or known to contain historic properties. These include: a section of older flow east of U'u Street and south of Keāhole Street, bisected by Road N (along which the route for the proposed AC Chilled Water Line has been considered); the area between the car rental facilities and the main airport parking lot where SIHP 00500 is located; and the undisturbed areas between the existing taxiway and runway.

Within these portions of the property undisturbed by the 1801 lava flow and modern development, the types of sites that might be encountered include: temporary or recurrent

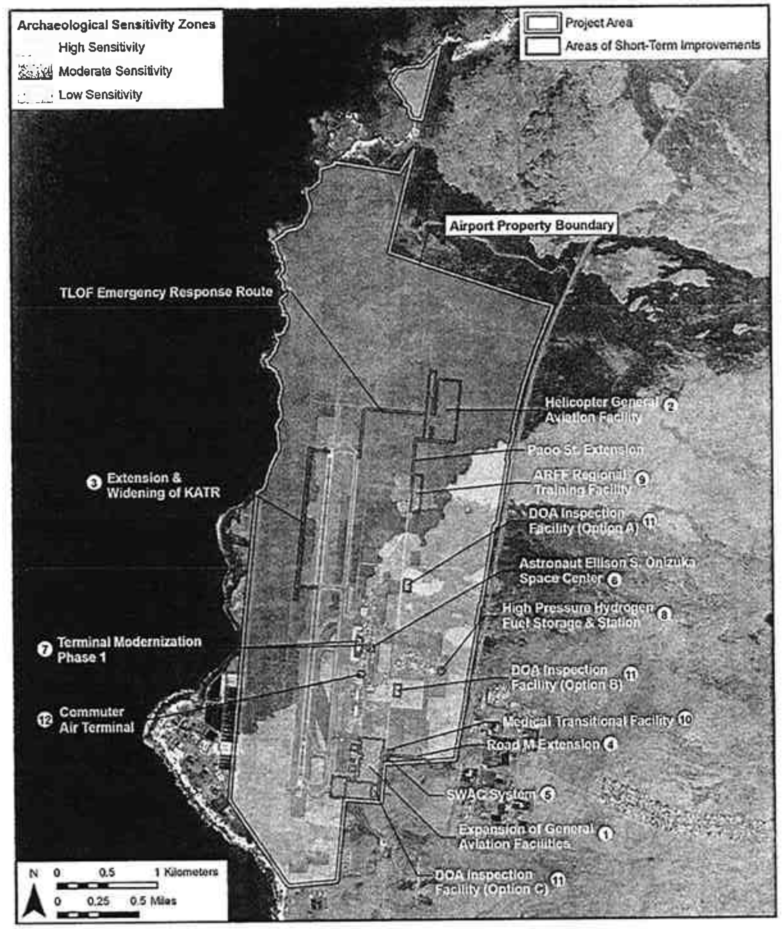


Figure 27. Aerial photo (Google Earth 2010) showing approximated zones of archaeological sensitivity throughout the project area (outlined in blue), and in relation to the short-term improvement areas (outlined in red)

habitations (characterized by surface structures or modified outcrops or lava tubes); limited agricultural activity areas including *pāhoehoe* excavations and minimal soil enclosures; *mauka-makai* trails connecting coastal residences and upland agricultural areas, with branch trails extending to specific use areas within the project area lands; petroglyphs; and burial sites utilizing features of the terrain, including lava tubes and cracks. Sites that may be encountered along the coast in the northern portion of the project area include: permanent or temporary habitations and associated activity areas; lateral and/or *mauka-makai* trails; modified anchialine ponds; storage and agricultural pits; petroglyphs; salt manufacturing areas; religious structures such as *heiau* or *ko'a* (fishing shrines); burial sites, and historic-era structures, roads/trails, etc.

Zones of moderate sensitivity are of less concern, though these also represent potential site areas. Zones of moderate sensitivity include the undeveloped portions of the property underlain by the 1801 lava flow, and areas at the airport situated off of the 1801 flow but that have been mitigated by older archaeological studies (typically those completed more than 15-20 years ago, but not including the Ching and Rosendahl 1968 or Ching et al. 1968-69 studies). Historic-era sites can be expected on the 1801 lava flow, and on more than one occasion pre-Contact sites have been found in *kīpuka* in this flow (see Nakamura et al. 2009; SHPD correspondence dated October 28, 1992 and August 15, 1995 in Appendix B). Sites that have been found within *kīpuka* include pre-Contact trail segments, mounds, modified outcrops, enclosures and other structures. Portions of the property off of the 1801 flow that were covered by older archaeological studies tend to be grouped into this zone due to inaccuracies in reporting, obsolete methodologies, and/or lack of known mitigation (if warranted).

The zones of lowest archaeological sensitivity are those within developed or heavily-disturbed portions of the property. Some of these areas can be seen on aerial photographs, and others were documented during the present field inspection. Also included in this group are areas that have been subjected to relatively recent archaeological study (generally completed within the last 15 years), as the sites within these study areas have been mitigated. One notable exception is the Carpenter et al. (1998) reconnaissance survey at Kawili Point, under which the numerous features identified there were only cursorily documented.

Section 6 Results of Fieldwork

6.1 Overview

The current project fieldwork took place over four days in March 2012. A pedestrian inspection was conducted at each individual short-term improvement area. These inspections focused on obtaining an adequate understanding of the landscape/terrain, areas of prior impact, potential archaeologically sensitive areas and/or features, and the locations of previously-recorded sites in relation to the proposed improvement areas. For the four areas subject to Section 106 compliance (Improvement Areas 1, 6, 7 and 12), fieldwork sought to definitively document the need (or lack thereof) for further archaeological study. A detailed accounting of the results at each improvement area, including potential historic properties identified within, is presented in Section 6.2.

Furthermore, the fieldwork sought to enhance the results of the background research in terms of creating a model for predicting archaeological sensitivity throughout the overall airport property (see Section 5). This was accomplished with documentation of general observations made during vehicular survey along existing airport and coastal roads, and a cursory pedestrian inspection of the Mahai'ula Bay-Kawili Point area. The results of this more generalized inspection are given in Section 6.3.

Figure 28, Figure 29 and Figure 30 show the locations of the archaeological features identified during the current inspection. These features are described in further detail in the context of the areas at which they were found throughout the airport. Photographs of these features are also included.

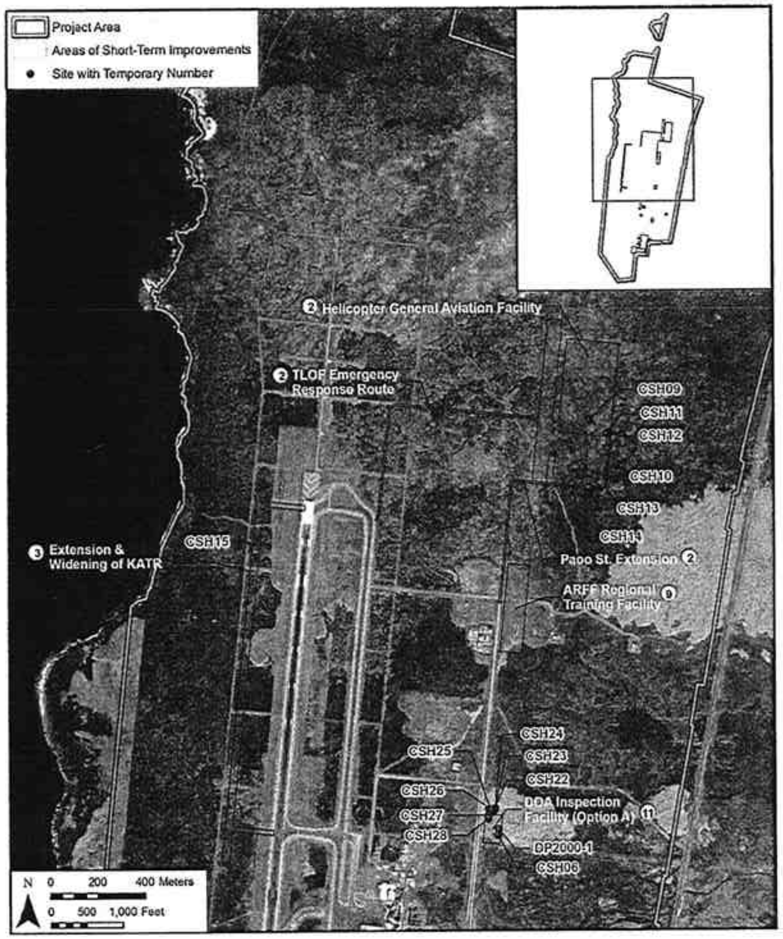


Figure 28. Aerial photo (Google Earth 2010) of the portion of the project area to the north of the main airport facilities, showing the locations of archaeological features noted during the present field inspection

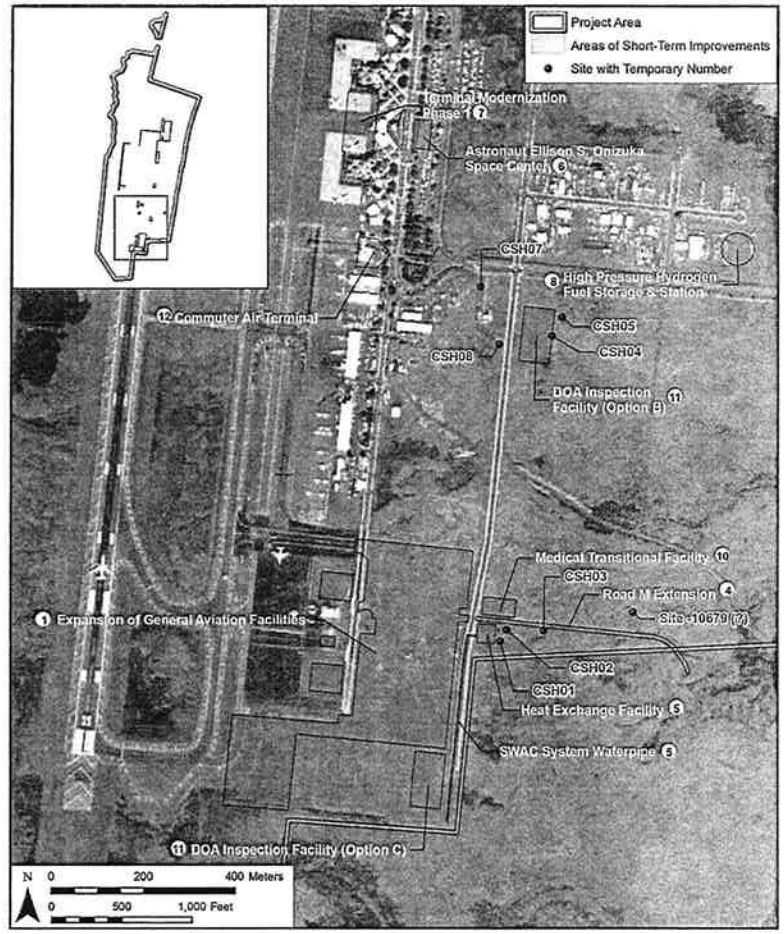


Figure 29. Aerial photo (Google Earth 2010) of the portion of the project area to the east and south of the main airport facilities, showing the locations of archaeological features noted during the present field inspection

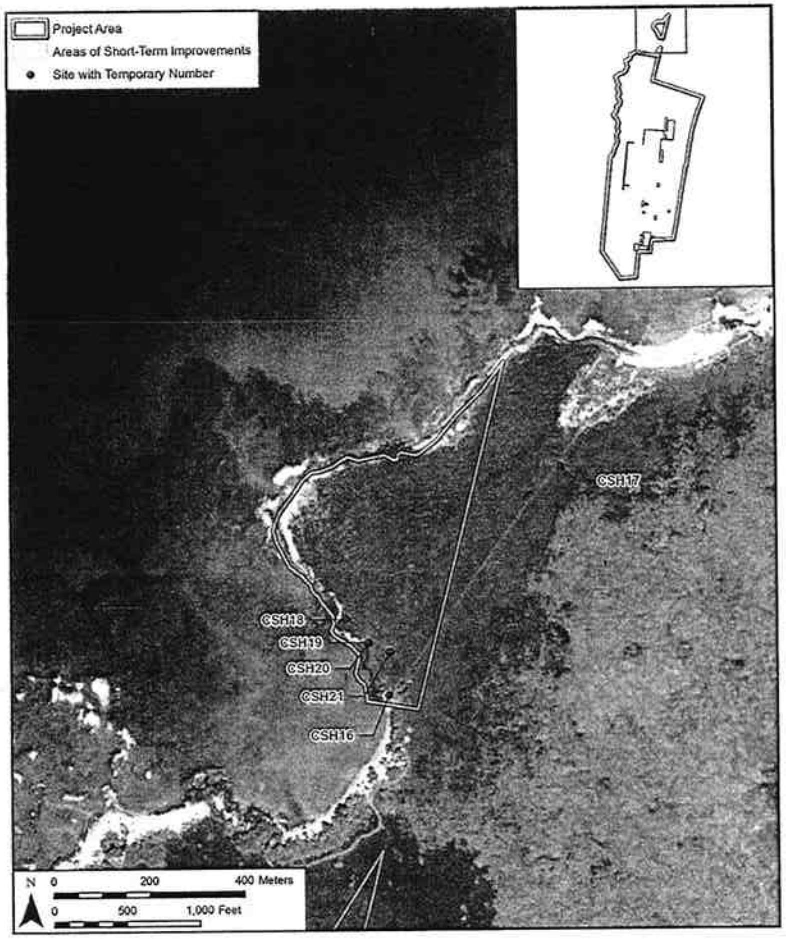


Figure 30. Aerial photo (Google Earth 2010) of the Kawili Point portion of the project area, showing the locations of archaeological features noted during the present field inspection

6.2 Short-Term Improvement Areas

6.2.1 General Aviation Apron Expansion (Short-Term Improvement Area 1)

This approximately 40-acre improvement area is largely situated along the *mauka* side of U'u Street, although portions of it fall *makai* of the street and within the AOA (see Figure 1). These latter portions are fenced off from the public as they are within or directly adjacent to active landing and taxi areas (Figure 31). Though surrounded by undeveloped lands to the north, east and south, all of the areas covered by the proposed General Aviation Apron Expansion are presently disturbed. These areas have been completely graded and some portions are paved (Figure 32 and Figure 33). They are currently being used for general aviation activities, parking, and storage. As a result, no historic properties are present within this improvement area.

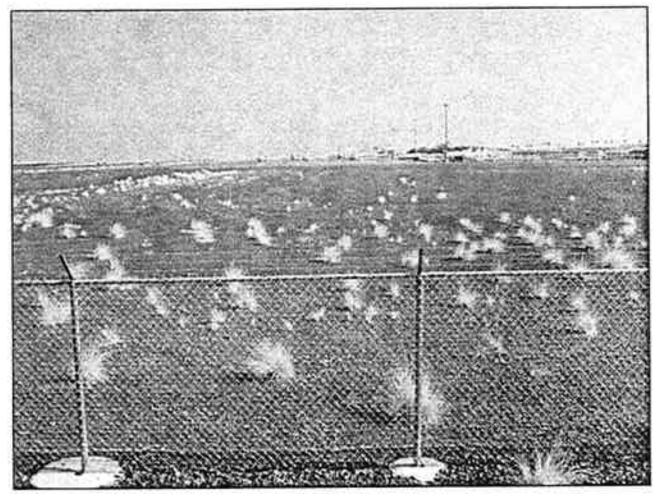


Figure 31. Photo showing the fenced-in AOA portion of Improvement Area 1; view to the north

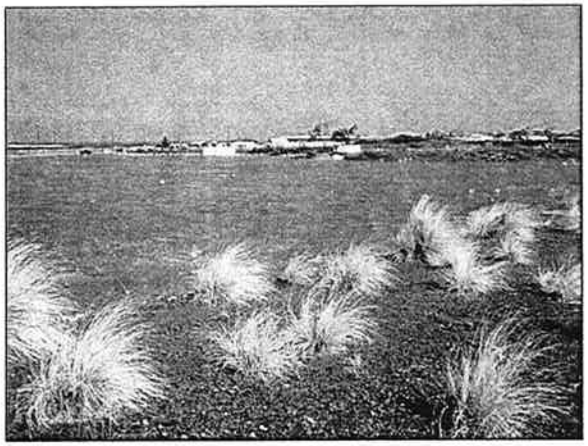


Figure 32. Photo showing the northern-most section of the unfenced, public portion of Improvement Area 1; view to the northwest

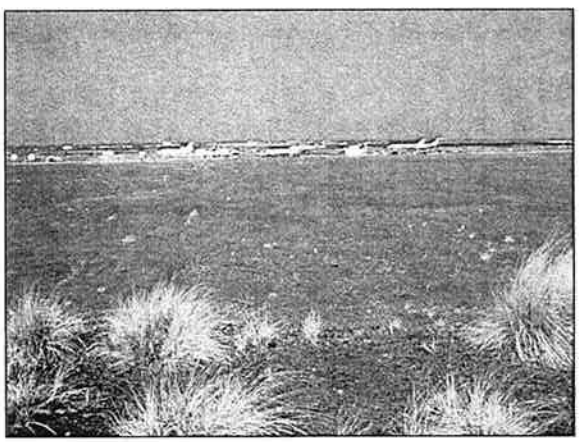


Figure 33. Photo of the southern section of the unfenced, public portion of Improvement Area 1; view to the west

6.2.2 Helicopter General Aviation Facility (Short-Term Improvement Area 2)

The proposed Helicopter General Aviation Facility comprises approximately 50 acres northeast of the end of Road N, and includes the proposed TLOF Emergency Response Route and Pāo'o Street (Road N) extension (see Figure 1). This area is situated completely on the 1801 lava flow. The generally undeveloped area is easily accessed from Queen Ka'ahumanu Highway by a jeep road that leads to the coast; this road, visible on aerial photos, traverses the southwestern portion of the project area (see Figure 7, Figure 34).

The proposed TLOF Route and Pāo'o Street extension corridors were inspected with a single pedestrian transect each. The southern leg of the TLOF Route required security escort, as this segment fell within the fenced AOA. No archaeological features were encountered along these road corridors (Figure 35 through Figure 37).

During the inspection of the main General Aviation area, six modified areas were encountered (CSH 09 through CSH 14; see Figure 28). CSH 09 represents a cairn or *ahu* comprised of four upright *pāhoehoe* slabs (Figure 38). No associated pit or "quarry" was identified near this feature, which has been constructed in a somewhat unusual manner by leaning the slabs against one another. However, these slabs were likely quarried in the general vicinity, as evidenced by the presence of features CSH 10 through CSH 14. These five features appear to be *pāhoehoe* slab quarry areas. The excavations are generally quite shallow (less than 10 cm deep), and of variable length and width (Figure 41). These features lend a "peeled" appearance to the flow areas on which they are situated (Figure 39 and Figure 40). At some of the features, none of the resulting slab material is present (see Figure 39); elsewhere, it has been stacked along the side of the quarry feature (Figure 40); and at others, a few overturned slabs are present (Figure 42 and Figure 43).

These features are somewhat atypical of the ubiquitous pre-Contact *pāhoehoe* excavations that are found throughout this region. Traditional excavation features have been found during past studies on the older lava flow areas at and in the vicinity of the airport (see Barrera 1987b, Escott and Keris 2009, Monahan et al. 2011). Usually, traditional *pāhoehoe* excavations have been created along blisters or other places in the lava flow with hollow areas underneath. Often the excavated materials are more blocky than slablike and tend to be scattered around the pit feature haphazardly. Given the location of CSH 09 through CSH 14 on the historic 1801 flow, these features cannot be pre-Contact in nature. The manner of excavation that they exhibit (i.e. shallow with little to no hollow areas exposed, no soil presence, excavated material typically stacked or removed) point to a more modern nature. It is a common modern practice throughout this area of Kona to quarry *pāhoehoe* slabs for use in landscaping and construction projects. Further support of this interpretation is the relative ease of access to these features via the jeep trail crossing this improvement area, and the presence of modern trash scattered throughout. Further study of these features may help to determine whether or not they are of historic or modern age. No *kīpuka* or other features were encountered within this improvement area.

Figure 34. Photo showing the largely undisturbed terrain within Improvement Area 2; view to the northeast

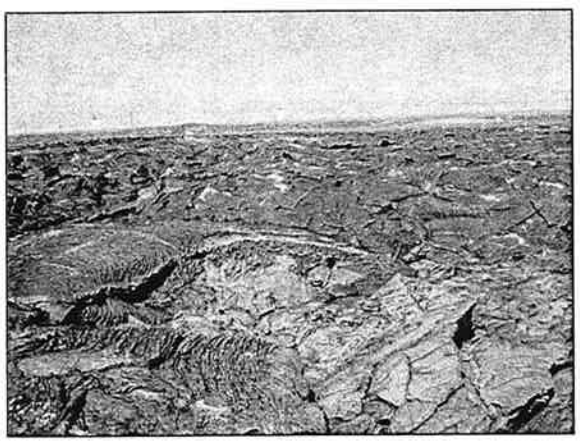


Figure 35. Photo showing the fence dividing the public and AOA portions of the TLOF Emergency Response Route at Improvement Area 2; view to the west

Figure 36. Photo of the terminus of the TLOF Emergency Response Route at the northern end of the existing taxiway; view to the south

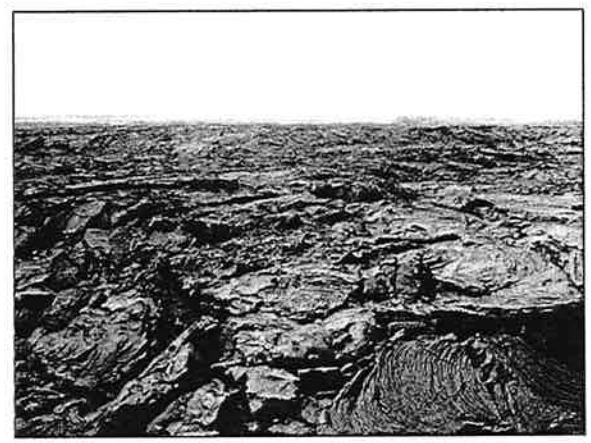


Figure 37. Photo showing the vicinity of the proposed Pāʻo Street Extension at Improvement Area 2; view to the south

Figure 38. Photo of CSH 9 mound in Improvement Area 2; view to the east

Figure 39. Photo of CSH 12 *pāhoehoe* excavation in Improvement Area 2; view to the northeast

Figure 40. Photo of CSH 14 *pāhoehoe* excavation in Improvement Area 2; view to the northwest

Figure 41. Photo of CSH 10 *pāhoehoe* excavation in Improvement Area 2; view to the northeast

Figure 42. Photo of one of the CSH 11 *pāhoehoe* excavations in Improvement Area 2; view to the east

Figure 43. Photo of one of the CSH 11 *pāhoehoe* excavations in Improvement Area 2; view to the east

6.2.3 Kona Auxiliary Training Runway (KATR) (Short-Term Improvement Area 3)

This improvement area covers approximately 14 acres adjacent to and west of the existing runway along an existing paved perimeter road on the 1801 flow (see Figure 1, Figure 44). Numerous areas of construction-related disturbance are present, including short, gravel roadways connecting the perimeter road to the runway and large graded areas directly adjacent to the runway (Figure 45). The southern end of the proposed KATR (approximately 500 ft) has been graded flat (Figure 46).

One site, CSH 15, was discovered in a crevice during the inspection of the northern end of the proposed KATR (see Figure 28). This site represents a midden scatter that includes such readily-identifiable marine species as *'opihi* or limpet (*Cellana spp.*), cowrie *(Cypraea spp.)*, and drupa or *pūpū (Drupa spp.)* (Figure 47). While this deposit may be related to past construction activity in the vicinity, the more traditional variety of species present (as opposed to the presence of, say, just '*opihi*), lend to an interpretation of an older date. The deposit is located on the 1801 lava flow and therefore cannot be pre-Contact in age, but it may be historic. The coastline is only several hundred meters to the west of the existing perimeter road.

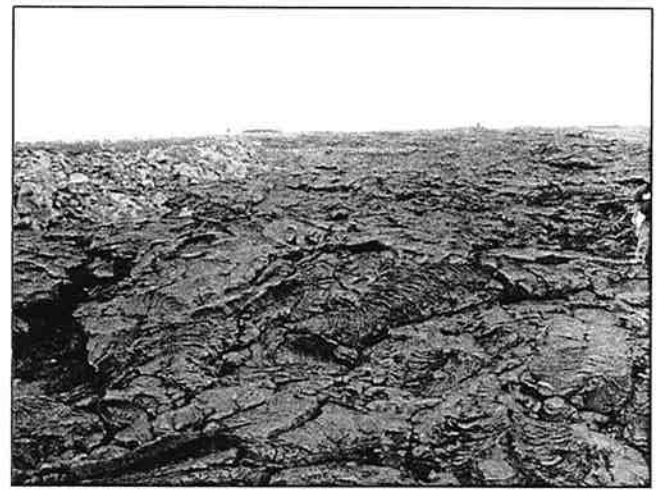


Figure 44. Photo showing the vicinity of Improvement Area 3; note the disturbance along the far left and the existing roadway visible at the top right corner of the photo; view to the south

Figure 45. Photo of the northern corner of Improvement Area 3, showing one of the gravel access roads connecting the perimeter road to the existing runway; view to the east

Figure 46. Photo showing the disturbed area comprising the southern end of Improvement Area 3; view to the south

Figure 47. Photo of the midden scatter (CSH 15) found at Improvement Area 3; view to the west

6.2.4 Road M (Short-Term Improvement Area 4)

The portion of the proposed Road M corridor within the airport property was inspected in its entirety; this approximately 1,500-ft long corridor comprises approximately two acres. The corridor begins directly *mauka* of the existing paved Road N, and passes between the proposed Medical Transitional Facility and Heat Exchanger Site (see Figure 1). The areas closest to Road N show signs of disturbance, likely related to the construction of that road (Figure 48). The remainder of this improvement area consists of undulating 1,500 to 3,000 year-old lava flow supporting grasses and scattered shrubs and trees (Figure 49).

Two features were identified outside of but immediately adjacent to the corridor (CSH 02 and CSH 03; see Figure 29), both along its western half. CSH 02 is a single *pāhoehoe* excavation located just northeast of the proposed Heat Exchanger Site (see Figure 29). The excavated pit exploits a natural fissure in the lava flow, and is approximately one meter long (Figure 50). Excavated materials have been placed around the feature. CSH 03 consists of a circular alignment similar to those identified by Dye and Prasad (2000) further north along Road N (Figure 51). Furthermore, the large cave system (SIHP 10679) initially documented by Barrera (1987b) was observed from this corridor (see Figure 29, Figure 52). Despite fairly thorough coverage of the corridor presently and during past studies, there is a potential for additional historic properties within this improvement area.

Figure 48. Photo showing the partially-disturbed western terminus of Improvement Area 4; a portion of Improvement Area 11 is visible in the background; view to the northwest

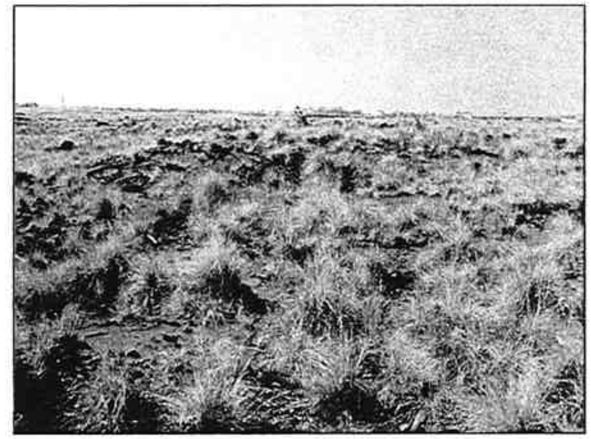


Figure 49. Photo showing the eastern terminus of Improvement Area 4 at the NELHA property boundary; view to the south

Figure 50. Photo of CSH 02 *pāhoehoe* excavation near Improvement Area 4 (and Improvement Area 5—Heat Exchanger Site); view to the east

Figure 51. Photo showing the CSH 03 circular alignment feature near Improvement Area 4; view to the east

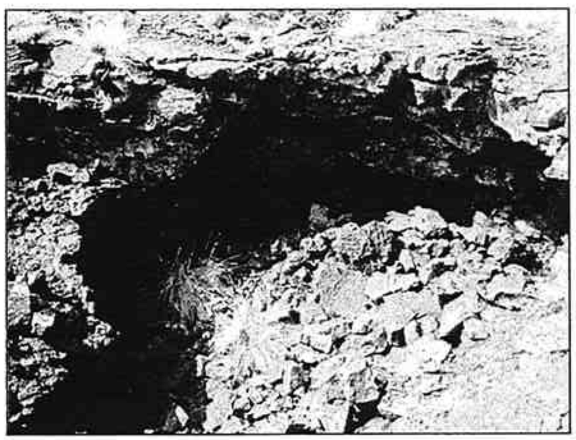


Figure 52. Photo showing one of the large lava tube openings just north of Improvement Area 4, likely belonging to SIHP 10679; view to the southwest

6.2.5 Seawater Air Conditioning (SWAC)/AC Chilled Water Line (Short-Term Improvement Area 5) and Adjacent Heat Exchanger Site

For the SWAC/AC Chilled Water Line and Heat Exchanger Site (Area 5), the water lines were originally proposed to run along a section of the property line at the southern end of the property to Road N, then along Road N to Keāhole Street, then on to the terminal area (see Figure 10). CSH was informed by Wilson Okamoto that the water lines will likely follow a different route, though the proposed location of the Heat Exchanger Site would not be affected. CSH did a cursory inspection of the water line routes and the Heat Exchanger Site as shown on Figure 10, as no alternative water line routes had been identified as of the date of inspection, in order to gain an understanding of the potential for archaeological remains in this portion of the project area.

The SWAC Water Line route shown on Figure 10 runs just inside the project boundary at the edge of the same heavily disturbed area at which the General Aviation Apron Expansion and DOA Inspection Facility Site "C" areas are situated. Given the level of disturbance here, no historic properties are present, though there is a potential for features just outside the airport property to the east on the undisturbed 1,500 to 3,000 year-old flow. The SWAC Water Line ends at the proposed Heat Exchanger Site, which consists of less than one-half acre directly adjacent to the proposed Road M and Medical Transitional Facility along Road N (see Figure 1).

The Heat Exchanger Site has been disturbed somewhat along its *makai* edge adjacent to Road N (Figure 53 and Figure 55). However, the majority of this area is undisturbed 1,500 to 3,000 year-old lava flow (Figure 54). CSH 02 and a complex consisting of at least four *pāhoehoe* excavations were identified just beyond the eastern boundary of the Heat Exchanger Site (CSH 01; see Figure 29 and Figure 56). These pits are of variable size and at each feature a substantial amount of extracted rock material has been placed nearby on the surface. Despite fairly thorough coverage of this site presently and during past studies, there is a potential for additional features of this type within this improvement area.

The proposed AC Chilled Water Line exits the Heat Exchanger Site and extends toward the airport terminal area. Figure 10 shows this water line extending along the *makai* side of Road N and the south side of Keāhole Street. The present inspection covered a corridor approximately 30-40 feet wide along the *makai* and southern sides of these roads, respectively, in order to gain an understanding of this general area. Disturbance likely related to road construction is present along most of the inspected corridor, though it is typically confined to the closest ten feet or so (Figure 57). The 1,500 to 3,000 year-old lava flow beyond this disturbance is essentially intact, aside from a building, driveway, parking area, and adjacent bulldozed area associated with a communication tower. On this section of older flow, two site complexes were identified: CSH 07 and CSH 08.

CSH 07 is a complex consisting of two *pāhoehoe* excavations of variable size along the south side of Keāhole Street (see Figure 29). The excavated materials, some overturned, have been scattered around the two pit features (Figure 58 and Figure 59).

CSH 08 is a complex with several distinct features located atop a rise in the flow along Road N (see Figure 29). The complex covers an area roughly 40 m long north-south by 20 m wide

Figure 53. Photo showing the disturbed *makai* portion of the Heat Exchanger Site (Improvement Area 5), with Road N and existing General Aviation facilities in the background; view to the west

Figure 54. Photo showing the vicinity of the Heat Exchanger Site (Improvement Area 5) along Road N; view to the southwest

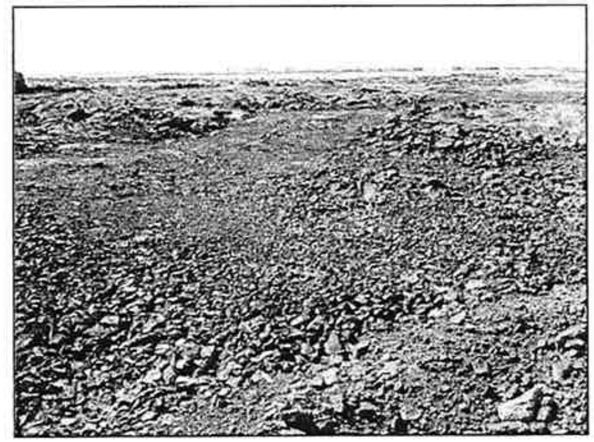


Figure 55. Photo showing disturbed areas within the Heat Exchanger Site (Improvement Area 5); view to the south

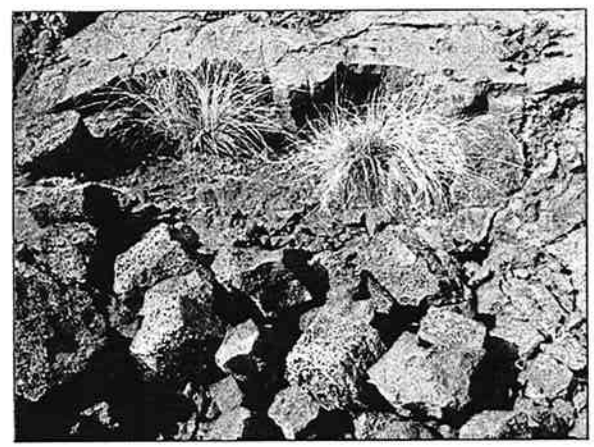


Figure 56. Photo of one of the CSH 02 *pāhoehoe* excavations near the Heat Exchanger Site (Improvement Area 5); view to the southwest

Figure 57. Photo of the *makai* shoulder of the southern end of Road N, along which the AC Chilled Water Line (Improvement Area 5) has been proposed; view to the south

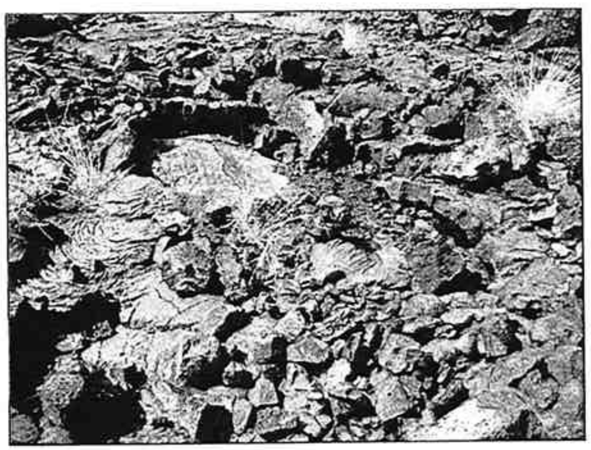


Figure 58. Photo of the eastern-most CSH 07 *pāhoehoe* excavation along the southern shoulder of Keāhole Street (Improvement Area 5); view to the northwest

Figure 59. Photo of the western-most CSH 07 *pāhoehoe* excavation along the southern shoulder of Keāhole Street (Improvement Area 5); view to the west

east-west. It includes a low wall (up to approximately 50 cm high) forming a rough enclosure along the western side of the upper-most portion of the outcrop (Figure 60). Along the southern side of this upper outcrop area, a small circular enclosure is present, measuring approximately 75 cm across and exhibiting up to two courses of stacking (Figure 61). Directly north and northwest of this enclosure is an ample midden deposit (Figure 62). Cobble-sized chucks of coral are scattered around the outcrop. The presence of scattered rock material and the somewhat collapsed appearance of the larger enclosure may indicate disturbance at this site. The view of the surrounding areas is quite good from this upper outcrop. Of note is the fact that another, somewhat similar complex identified during the present study (CSH 05, see Section 6.2.11.2) is in direct line of sight from this site (Figure 63).

Directly beneath the upper outcrop area is an overhang containing another midden deposit (Figure 64). Additional modifications and/or artifacts may be present within the overhang, as it was only very briefly inspected. Just north of this overhang and the upper outcrop is a lower outcrop; on the *pāhoehoe* exposure here several areas of pecking were noted (Figure 65).

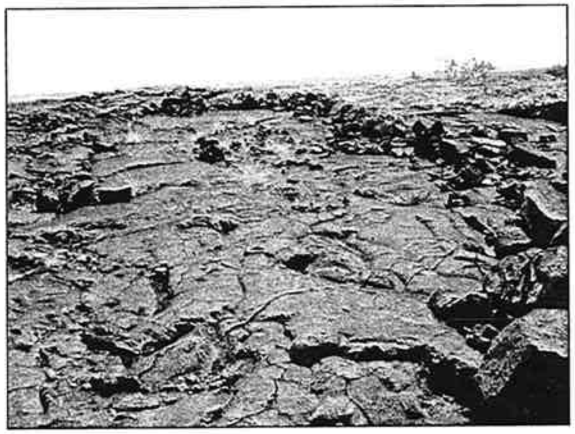


Figure 60. Overview photo of the *pāhoehoe* outcrop along the *makai* shoulder of Road N on which most of CSH 08 is situated (Improvement Area 5); note the large, low enclosure along the right and rear sections of the outcrop; view to the south

Figure 61. Photo of the smaller, circular enclosure at CSH 08 (Improvement Area 5); view to the west

Figure 62. Photo of a portion of the midden scatter at CSH 08 (Improvement Area 5); note the presence of coral; view to the east

Figure 63. Photo showing the eastern edge of the CSH 08 (Improvement Area 5) outcrop, with the CSH 05 outcrop at Improvement Area 12-B visible in the far center background; view to the northeast

Figure 64. Photo of the overhang entrance beneath the CSH 08 outcrop (Improvement Area 5); view to the east

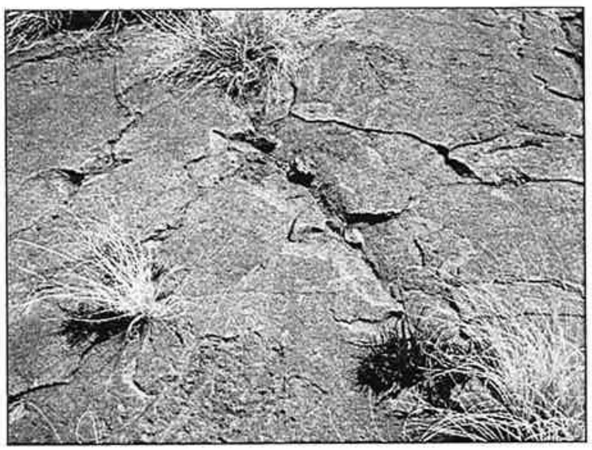


Figure 65. Photo of the pecked area at CSH 08 (Improvement Area 5); view to the south

6.2.6 Relocated Onizuka Space Center (Short-Term Improvement Area 6)

The proposed new location for the Onizuka Space Center falls within the main airport parking area, comprising approximately one-half acre in the vicinity of the old rental car facilities (see Figure 1, Figure 66). No historic properties are present within this developed area.

Figure 66. Photo taken from the SIHP 00500 petroglyph preserve toward the new Onizuka Space Center (Improvement Area 6, in the existing parking lot); note the existing Onizuka Space Center as the tall, white building in the background); view to the west

6.2.7 Terminal Modernization Phase 1 (Short-Term Improvement Area 7)

Like that for the new Onizuka Space Center site, the inspection of the proposed Terminal Modernization Phase 1 locations required little effort. The expansion areas overlap roughly three acres of existing airport facilities, including the present site of the Onizuka Space Center (see Figure 1; Figure 67 through Figure 69). No historic properties are present within these developed areas.

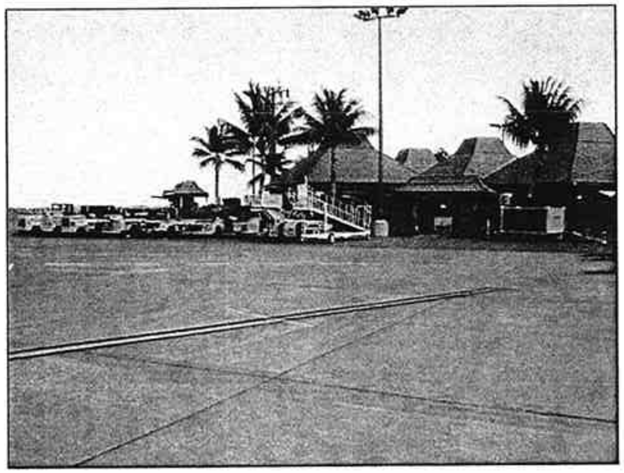


Figure 67. Photo of existing tarmac facilities within Improvement Area 7; view to the north-northwest

Figure 68. Photo of existing United Airlines baggage facilities within Improvement Area 7; view to the south

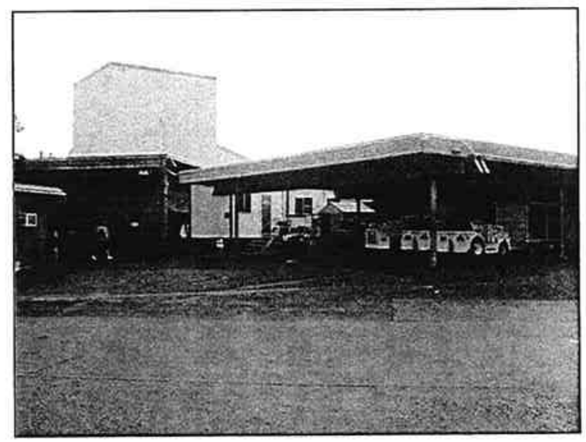


Figure 69. Photo of existing Hawaiian Airlines baggage facilities within Improvement Area 7; view to the east

6.2.8 High Pressure Hydrogen Fuel Storage and Fueling Station (Short-Term Improvement Area 8)

The proposed High Pressure Hydrogen Fuel Storage and Fueling Station is situated on approximately one acre in a completely graded area presently used by the rental car facilities for parking (see Figure 1, Figure 70). Between this area and the Queen Ka'ahumanu Highway is undisturbed 1,500 to 3,000 year-old *pāhoehoe* flow. Given the level of disturbance, no archaeological features were observed at this location, though there is a good potential for features immediately to the east, including a portion of a trail that appears on the Cordy (1985) map (see Figure 23).

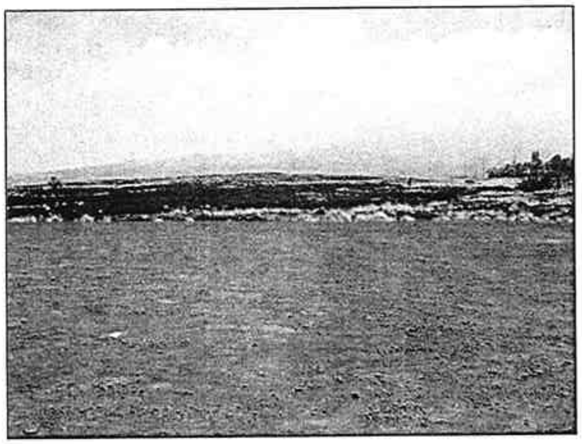


Figure 70. Photo of the disturbed Improvement Area 8 site; view to the northeast

6.2.9 Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility (Short-Term Improvement Area 9)

This approximately 8.5-acre improvement area is situated *mauka* along the restricted, northern end of Road N, across from the waste-water treatment facility on the 1801 lava flow (see Figure 1). The proposed ARFF Regional Training Facility is roughly bisected by Hāpu'upu'u Street, which leads to an existing burn facility, control tower, etc. Roughly three-quarters of the portion of this improvement area south of Hāpu'upu'u Street has been completely graded (Figure 71), though a small section of undisturbed lava flow is present at the far southeastern corner (Figure 72). Debris associated with burn activities were noted within this half of the improvement area (Figure 73), and a strong odor of creosote was noted. The portion north of Hāpu'upu'u Street is largely undisturbed (Figure 74). To the east there is an existing fenced fire rescue training facility; the western-most portion of the fence line extends into the project area. This area also may be presently used as a sort of firing range, as evidenced by scattered clay and glass fragments and spent ammunition (Figure 75). A very thorough inspection of this improvement area resulted in no findings.

Figure 71. Photo overlooking a portion of the disturbed, southern half of Improvement Area 9, with Road N and the vegetation surrounding the Waste Water Treatment Plant visible in the top right corner; view to the south

Figure 72. Photo showing the undisturbed southeastern corner of Improvement Area 9, with the existing fenced fire rescue training facility visible in the background; view to the east

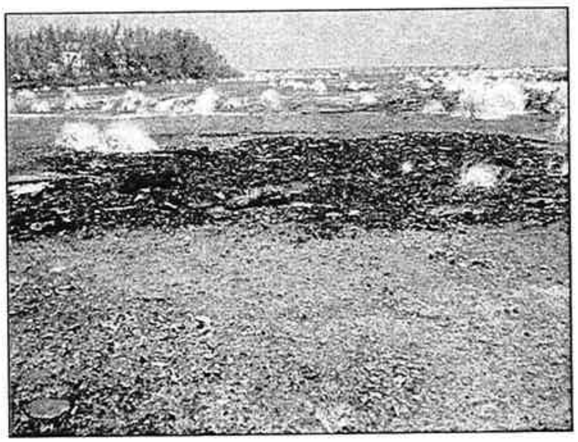


Figure 73. Photo showing an area of burned debris within the disturbed southern half of Improvement Area 9; view to the west

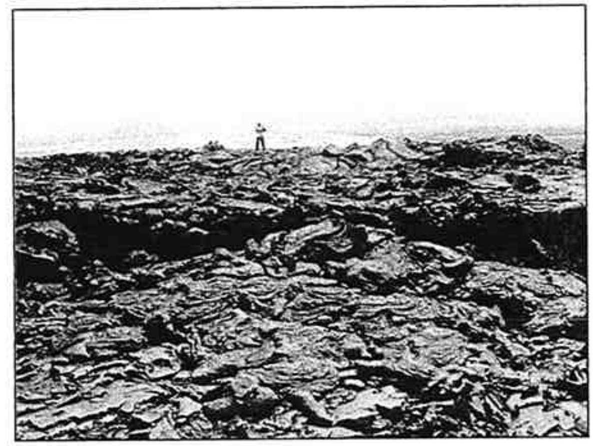


Figure 74. Photo overlooking the essentially undisturbed northern portion of Improvement Area 9; view to the north

Figure 75. Photo of a rubbish scatter likely related to firing target practice in Improvement Area 9; view to the east

6.2.10 Medical Transitional Facility (Short-Term Improvement Area 10)

The inspection of this area (situated on less than one acre; see Figure 1) occurred along with the Road M and Heat Exchanger Site inspections. Like those areas, the portion of this site closest to Road M has been disturbed, although the majority is undisturbed 1,500 to 3,000 year-old flow (see Figure 48). No archaeological features were identified during a thorough inspection of this entire improvement area.

6.2.11 State of Hawai'i Department of Agriculture (DOA) Inspection Facility (Short-Term Improvement Area 11)

This improvement area comprises three separate, two-acre candidate sites, discussed individually below.

6.2.11.1 Site "A"

The DOA Inspection Facility Site "A" is situated along the *mauka* side of Road N in a pocket of 3,000 to 5,000 year-old *pāhoehoe* lava flow that was partially surveyed by Dye and Prasad (2000) (see Figure 1, Figure 20). The portion of this site adjacent to Road N has been disturbed (Figure 76), and a gravel road (Road P) defines the southern boundary. This undulating lava flow area supports a substantial amount of vegetation (mostly grasses), and a large outcrop dominates the southeastern corner of the site (Figure 77).

Dye and Prasad (2000) documented a single feature within the present bounds of DOA Site "A", and cursorily documented an adjacent handful of similar features that fell outside of the 2000 Phase II Emergency Generator project area (see Section 4.2.14). These features were temporarily numbered 1 through 5, and they all consisted of circular alignments, which sound similar in style to those identified by Ching and Rosendahl in 1968 at Site 600 (refer to Section 4.2.2). During the present inspection, feature 1 (Figure 78) was relocated with certainty—this is the alignment that was thoroughly documented close to Road P (appears as DP2000-1 on Figure 28). Additionally, a total of seven similar features were presently encountered further north in the vicinity of the Dye and Prasad (2000) feature 2 through 5 cluster (see Figure 28). While blue flagging tape remnants were noted at a couple of these features, no permanent site tags or other identifiers were present. Given that more features were noted in this area during the current inspection than under the earlier study, and given that the four alignments noted here by Dye and Prasad (2000) were not described or photographed, it has proven impossible to precisely correlate those four features identified during both studies. Therefore, these features have all been assigned temporary CSH numbers. Two of these, (CSH 27 and CSH 28; Figure 79 and Figure 80, respectively) appear to lie within the bounds of DOA Site "A", while the remaining five are located just north.

Furthermore, a *pāhoehoe* excavation (CSH 06, Figure 81) was noted along an outcrop in the southeast corner of the site, in proximity to Dye and Prasad's (2000) circular alignment feature 1 (see Figure 28).

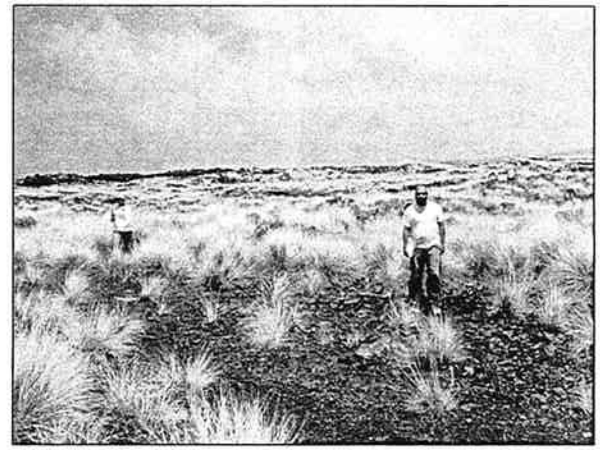


Figure 76. Photo of the disturbed portion of Improvement Area 11-A adjacent to Road N; view to the northeast

Figure 77. Photo overlooking Improvement Area 11-A; view to the south

Figure 78. Photo of the circular alignment feature documented by Dye and Prasad (2000) as Temporary Site 1 (Improvement Area 11-A); view to the east

Figure 79. Photo of circular alignment feature CSH 27 (Improvement Area 11-A); view to the northeast

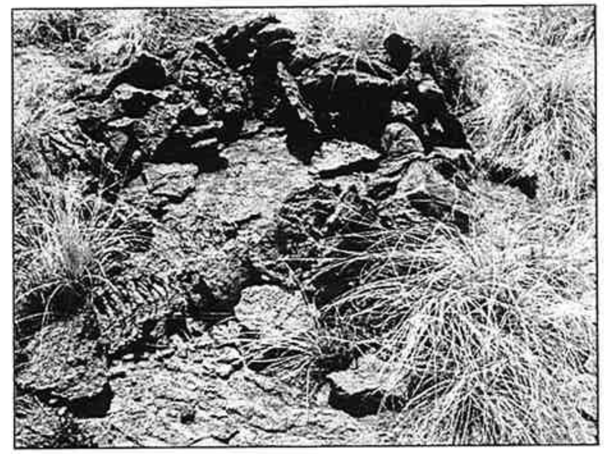


Figure 80. Photo of circular alignment feature CSH 28 (Improvement Area 11-A); view to the southwest

Figure 81. Photo of CSH 06 *pāhoehoe* excavation (Improvement Area 11-A); view to the east

6.2.11.2 Site "B"

Site B is located on the *mauka* side of Road N just south of the Keāhole Street intersection (see Figure 1). The westernmost portion of this site has been heavily disturbed, particularly at the southwest corner, where a dozer road cuts through the site and dozer scarring is evident across the ridge directly adjacent to the road (Figure 82); CSH 08 is situated on this same ridge across Road N to the west. The undisturbed inner and eastern portions of this site consist of somewhat rough to extremely smooth 1,500 to 3,000 year-old *pāhoehoe* flow (Figure 83). One archaeological feature complex (CSH 04) was encountered along the eastern boundary of DOA Site "B", and another (CSH 05) is situated just outside to the east (see Figure 29).

CSH 04 is a complex consisting of at least three *pāhoehoe* excavations of variable size extending *mauka* from the site boundary. CSH 05 includes several distinct features located along the west side of a portion of an outcrop or ridge measuring approximately 40 m long north-south and 15 m wide east-west (Figure 84). This ridge creates a natural windbreak, and several small overhangs are present. Midden is scattered throughout the entire complex area; at least five distinct species were noted. At the base of the ridge, *pāhoehoe* excavations and a small constructed pit are present (Figure 85 and Figure 86). A single Hawaiian oyster shell was found nearby to the west.

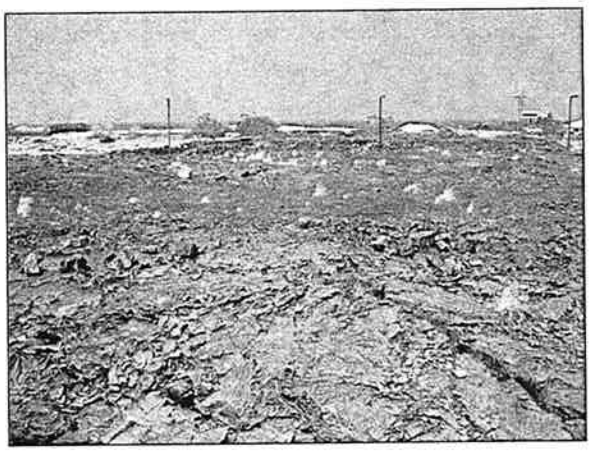


Figure 82. Photo showing the bulldozed areas along the *makai* side of Improvement Area 11-B; view to the west

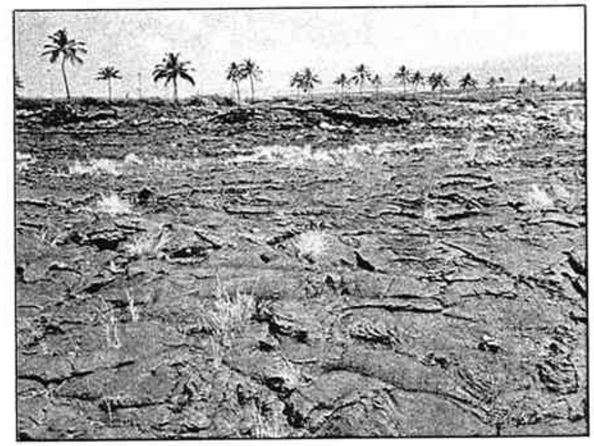


Figure 83. Photo overlooking the undisturbed portions of Improvement Area 11-B; the palm trees in the background line Keāhole Street; view to the northeast

Figure 84. Photo overlooking the CSH 05 feature complex (Improvement Area 11-B); view to the north

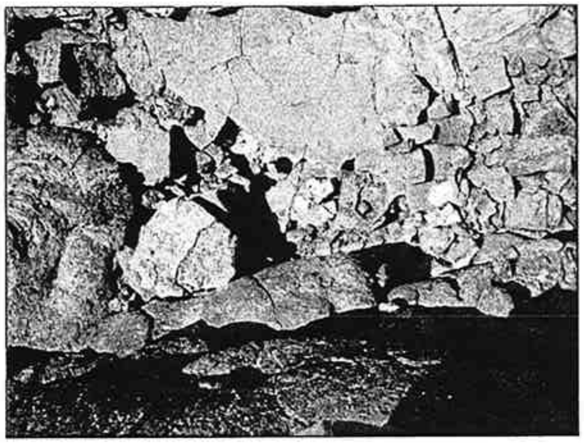


Figure 85. Overview photo of a *pāhoehoe* excavation feature located along the base of the outcrop at CSH 05 (Improvement Area 11-B)

Figure 86. Photo of the constructed pit feature located along the base of the outcrop at CSH 05 (Improvement Area 11-B); view to the northwest

6.2.11.3 Site "C"

The DOA Inspection Facility Site "C" is situated along the southern boundary of the airport property in the completely disturbed area at which the General Aviation Apron Expansion has been proposed (see Figure 1, Figure 87). The extensive disturbance has destroyed any archaeological features that may have once been present here, though some features may be present just outside of the airport property to the south and east on the undisturbed 1,500-3,000 year-old lava flow.

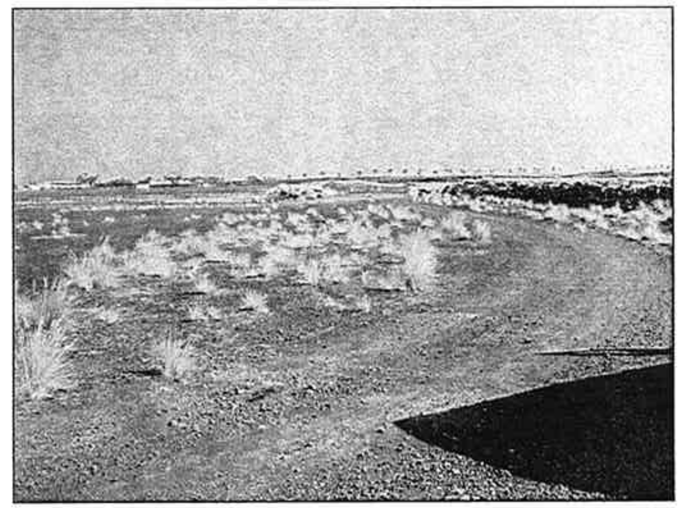


Figure 87. Photo overlooking the Improvement Area 11-C location; note the extent of disturbance up to the NELHA property line (indicated by the undisturbed lava flow in the top right corner); view to the northwest

6.2.12 Interior renovations of the existing ARFF Station for a new Commuter Terminal (Short-Term Improvement Area 12)

Improvement Area 12 consists of interior renovations to an existing building, located on less than one acre along U'u Street south of the present terminal facilties (see Figure 10). The building is situated within a completely disturbed/developed portion of the airport property. This improvement does not have the potential to impact any cultural resources.

6.3 Observations at Other Areas throughout the Airport Property

6.3.1 Petroglyhs (SIHP 00500)

The field crew visited the petroglyph field near the main parking lot area while inspecting the proposed Onizuka Space Center site. This site, SIHP 00500, was identified during some of the earliest studies at the airport (see Bonk 1979), and since set aside as a preservation area. The site consists of several anthropomorphic petroglyphs enclosed by a modern rock wall within an undeveloped section of 1,500 to 3,000 year-old lava flow between the present car rental facilities, the overflow parking lot, the main parking lots area, and Keāhole Street (see Figure 9, Figure 88 and Figure 89). A concrete sidewalk runs from the main parking lot to the rental car facility along the south side of the preservation area. It is encouraging to see this site so actively preserved.

6.3.2 Kawili Point

A relatively small, disconnected piece of the airport property is located at Kawili Point (see Figure 1). Between this piece of property and the bulk of the project area is Mahai'ula Bay and beach, controlled by Kekaha Kai State Park and accessed by a road extending *makai* from the Queen Ka'ahumanu Highway, or from the coastal jeep trail (Figure 90). The northern edge of the 1801 lava flow falls along the Mahai'ula beach area, meaning that Kawili Point was not affected by that eruption. This area is comprised of a very rugged, 3,000 to 5,000 year-old *'a'ā* lava flow (Figure 91); the only vegetation present is found directly adjacent to the shoreline.

During the field inspection the numerous features recorded first by Reineke (1930) and later by Carpenter et al. (1998) were generally observed. The archaeologists did not have the 1998 survey data in hand, so they took photos and GPS points on some of the features using temporary CSH numbering (see Figure 30). CSH 16 (taken at the collapsed historic windmill; Figure 92), CSH 20 and CSH 21 (Figure 93) all appear to correlate with features in the T70 site complex. CSH 17 was recorded outside of the project area at the intersection of the jeep road and a *mauka-makai* steppingstone trail that represents site T57. CSH 18 indicates the coastal steppingstone trail (T56) that extends through site complex T70 northwest along Kawili Point (Figure 94). CSH 19 represents the possible canoe shed recorded by Carpenter et al. (1998) as T15 (Figure 95). These sites all remain in generally the same condition as they were documented in 1998. Carpenter et al. (1998) had noted disturbance at several features that appeared to be attributed to high seas; this assessment was made during the current inspection as well. A large section of pipeline has washed ashore near the tip of the point, and the T-68 anchialine pond (Figure 96) was identified along the coral beach in this vicinity (no GPS point was taken at the pond). Sections of older-looking trail (T1) were noted along the jeep road connecting Mahai'ula to Makalawena (Figure 97).

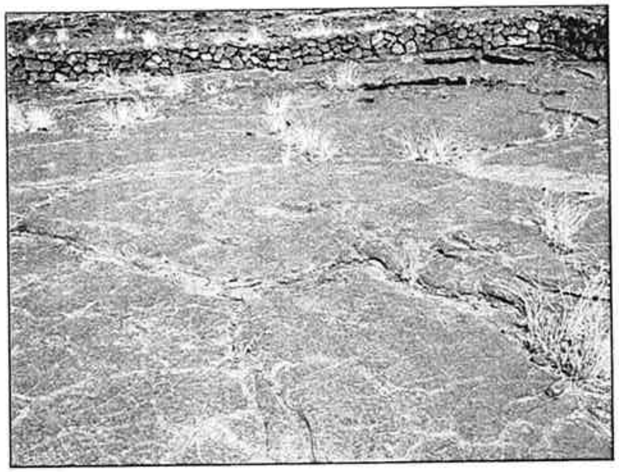


Figure 88. Photo overlooking the enclosed SIHP 00500 petroglyph field; view to the northeast

Figure 89. Overview photo of one of the SIHP 00500 petroglyphs

Figure 90. Photo of the jeep road from Queen Ka'ahumanu Highway that extends to Mahai'ula beach through the 1801 lava flow; view to the west

Figure 91. Photo overlooking the *'a'ā* lava terrain that comprises the Kawili Point portion of the project area, just north of Mahai'ula Bay and beach; view to the northwest

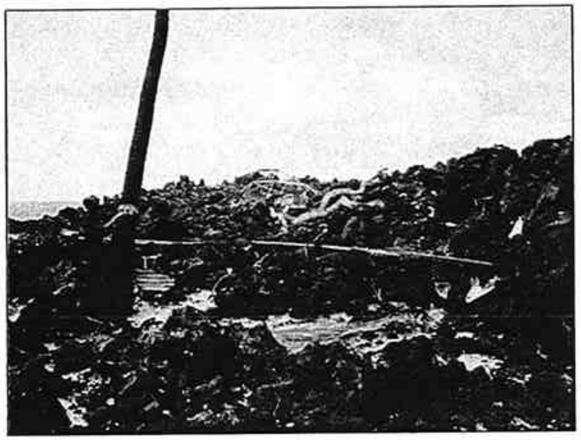


Figure 92. Photo overlooking the collapsed windmill (CSH 16) within the T70 site complex at Kawili Point; view to the west

Figure 93. Photo of a lava tube opening (CSH 21) within the T70 site complex (likely feature G1) at Kawili Point; view to the east

Figure 94. Photo showing a portion of the CSH 18 (T56) steppingstone trail that extends along Kawili Point and through the T70 site complex; Mahai'ula Bay is in the background; view to the east

Figure 95. Photo overlooking the possible canoe shed (CSH 19/T15) at Kawili Point; view to the north

Figure 96. Photo of the largest anchialine pond at Kawili Point (T68), with Mahai'ula Bay in the background; view to the south

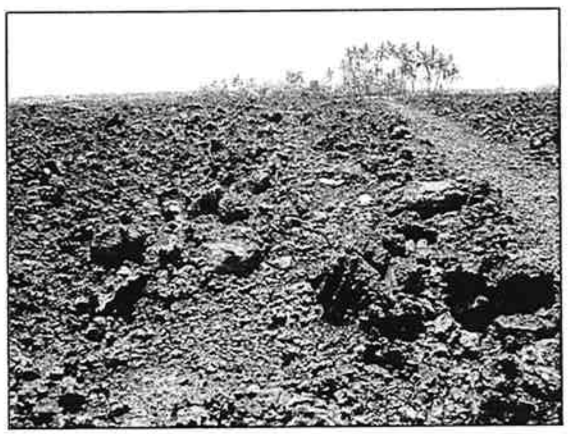


Figure 97. Photo showing an older trail running parallel to a section of the jeep road connecting Mahai'ula to Makalawena; Mahai'ula beach is indicated by the coconut palms in the background; view to the south

6.3.3 Vehicular Survey from Existing Roadways

Travel along existing airport roadways allowed for general observations of the project area intended to confirm the overall property predictive model created using background research and geological data. This vehicular inspection enabled the field crew to note areas of disturbance around the airport and inspect the coastline in the northern half of the property. While development-related disturbance was noted throughout the project area, it is generally confined to areas around the present airport facilities, roadways, fencelines, and runway/taxiway. Additional disturbance includes jeep roads extending from Queen Ka'ahumanu Highway toward the airport itself and to the coastline to the north.

One of these jeep roads was followed north from the proposed KATR to Kawili Point, allowing the field crew to inspect the coastline. The entire stretch of coast within the project area up to Mahai'ula Bay was covered by the 1801 eruption. No archaeological features were observed (aside from those found at Kawili Point and discussed above). The archaeologists were also looking for *kīpuka*, which could contain traditional sites, though none were observed during the vehicular survey.

The results of the vehicular survey essentially underscore the predictive model based on geological data and background research. That is, portions of undisturbed, older lava flows throughout the project area have a much greater probability of containing sites than the 1801 flow areas. The coastline, which is normally a very sensitive zone archaeologically, is of less concern for the present project area, given the presence of the 1801 lava flow over much of it. Naturally, this evaluation does not apply to the Kawili Point area, and it should be emphasized that a lack of features and/or *kīpuka* along the vehicular survey route *does not* mean that these are not present elsewhere within the 1801 flow.

Section 7 Summary and Recommendations

7.1 Summary

The current study has attempted to satisfy two objectives: first, to evaluate the potential for archaeological features within the 12 proposed short-term improvement areas at KOA, make recommendations regarding the need for further work at each of these, and in doing so support the Section 106 process for the four areas receiving federal funding; and second, to create a predictive model for the overall airport identifying zones of archaeological sensitivity, that can be useful for longer-term development strategies. For the latter objective, geological data (i.e., lava flow data) was combined with the results of extensive background research and confirmed by the current fieldwork. Background research included traditional and historical accounts and Māhele data from this specific portion of Kekaha, modern land usage, and a comprehensive accounting of previous archaeological work at the airport. The body of previous archaeology at and around the airport supplies a traditional settlement pattern for this region and site distribution data specific to the airport area.

A significant portion of the project area has been completely disturbed by airport-related development—any sites once present in these areas have been obliterated. Mitigation has been undertaken for some of these sites, particularly those identified during more recent studies. Few features were identified on the 1801 lava flow areas; these features are all of indeterminate age. A greater potential for the presence of sites on the older, intact flows was evidenced by the discovery of numerous archaeological features in the improvement areas situated in these sections of the property. These features include *pāhoehoe* excavations, alignments, enclosures, midden scatters, modified outcrops and overhangs, and a constructed pit, all of which can be related to transitory land use as practiced (both historically and prehistorically) in the Intermediate Zone. The substantial presence of a wide array of features at Kawili Point supports the traditional pattern of coastal settlement.

7.2 Recommendations

Several of the proposed short-term improvement areas are not recommended for further work, based on their situation in areas characterized by extensive levels of past disturbance and/or development. These improvement areas include: the proposed General Aviation Apron expansion (Improvement Area 1); relocated Onizuka Space Center (Improvement Area 6); Terminal Modernization Phase 1 (Improvement Area 7); High Pressure Hydrogen Fuel Storage and Fuel Station (Improvement Area 8); the DOA Inspection Facility Site "C" (Improvement Area 11); and interior renovations of the existing ARFF Station for a new Commuter Terminal (Improvement Area 12).

A lack of findings during 100% coverage of the proposed ARFF Regional Training Facility (Improvement Area 9), which is located on both disturbed and undisturbed portions of the 1801 lava flow, precludes the need for further study at this location.

Given their situation over older lava flow areas containing archaeological features, the proposed Road M route (Improvement Area 4) and the DOA Inspection Facility Sites "A" and

"B" (Improvement Area 11) are recommended for further study. While Improvement Area 4 has been subjected to past archaeological survey (Barrera 1987b), features were found immediately adjacent to the corridor that were not documented during that survey; depending on the finalized APE of the corridor, these features may be impacted by construction, and additional features might be present. No further work is recommended for the Medical Transitional Facility (Improvement Area 10), as thorough coverage of this site yielded no finds.

The Helicopter General Aviation facility (Improvement Area 2) and Kona Auxiliary Training Runway (Improvement Area 3) are situated on a largely undisturbed 1801 flow areas. Features of indeterminate age were encountered during the inspection in these improvement areas. Inventory survey is recommended for these improvement areas in order to thoroughly document and better analyze the features observed during the inspection and to definitively rule out the presence of other potential historic properties.

The SWAC/AC Chilled Water Line (Improvement Area 5) represents a somewhat complex situation, given the inclusion of the Heat Exchanger Site, and that the water line route has not been finalized. CSH has been advised that this route is likely to change, but no alternative routes have yet been identified. While the APE of this improvement area presently includes all of its component parts, approaching these components separately may require less archaeological study in the future. The presently proposed Heat Exchanger Site will require archaeological inventory, due to the discovery of previously-undocumented features in the immediate vicinity. According to the client, the location of this facility is not subject to change. The recommendations given here for the water lines are based on the routes shown on the project site plan (Figure 10). It is recommended that the water lines be confined to previously-disturbed areas, such as the existing road shoulders, or to the vicinity of the disturbed terminal/General Aviation areas. If this can be managed, further study along these routes will likely not be necessary. However, if the water line extends across undisturbed areas, such as that found between Road N and U'u Street to the north of the General Aviation Apron Expansion area, inventory survey will be necessary. If the currently-depicted route is chosen, further survey will only be necessary if the water line footprint extends beyond previously-disturbed roadways or road shoulders.

Table 10 summarizes the recommendations for each of the proposed short-term improvement areas. Based on the results of the archaeological inspection of the various proposed locations for the DOA Inspection Facility (Improvement Area 11), Site "C" is recommended for development based on its situation in an area of prior disturbance and lack of potential to impact historic properties.

The APE of the federally-funded improvement areas are not fluid, or subject to change. However, CSH has been informed that the APEs of the other eight proposed improvements are still considered to be somewhat fluid. The specific recommendations given for these improvement areas are only applicable to the locations that were currently inspected; if the APEs of these improvement areas do indeed change, further evaluation will be necessary. The overall archaeological predictive model outlined in Section 5 would be useful for planning in this circumstance.

Table 10. Summary of Project Recommendations for the Short-Term Improvement Areas

Short-Term Improvement Area	Geology	Extent of Prior Disturbance	Archaeological Features Present	Further Work Recommended
1- General Aviation Apron Expansion	N/A	Entire Area	No	None
2- Helicopter General Aviation	1801 flow	Minimal	Yes	Inventory Survey Prior to Construction
3- Kona Auxiliary Training Runway (KATR)	1801 flow	Approximately 20% of area	Yes	Inventory Survey Prior to Construction
4- Road M	1,500-3,000 BP* flow	Very minimal	Immediately Adjacent	Inventory Survey Prior to Construction
5- SWAC/ AC Chilled Water Line/ Heat Exchanger Site	1,500-3,000 BP flow; N/A	Variable	Yes	Inventory Survey for the Heat Exchanger Site, and potentially for the water line APEs as well
6- Onizuka Space Center	N/A	Entire area	No	None
7- Terminal Modernization Phase 1	N/A	Entire area	No	None
8- High Pressure Hydrogen Fuel Storage/Station	N/A	Entire Area	No	None
9- Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility	1801 flow	At least 50% of area	No	None
10- Medical Transitional Facility	1,500-3,000 BP flow	Minimal	No	None
11A- DOA Inspection Facility	3,000-5,000 BP flow	None	Yes	Inventory Survey Prior to Construction
11B- DOA Inspection Facility	1,500-3,000 BP flow	Minimal	Yes	Inventory Survey Prior to Construction
11C- DOA Inspection Facility	N/A	Entire area	No	None
12- Interior renovations of existing ARFF Station for new Commuter Terminal	N/A	Entire area	No	None

*BP = Before Present

7.2.1 Summary of Recommendations for Short-Term Improvements Subject to Section 106 Compliance

Given the requirement of Section 106 compliance for four of the short-term improvement areas, the fieldwork sought to definitively document the need (or lack thereof) for further archaeological studies at these areas. These improvement areas included: the General Aviation Apron expansion (Improvement Area 1); relocation of the Onizuka Space Center (Improvement Area 6); the Terminal Modernization Phase 1 (Improvement Area 7); and interior renovations of the existing ARFF Station for a new Commuter Terminal (Improvement Area 12). During the current inspection, it was determined that all of these Improvement Areas (1, 6, 7 and 12) are located at completely disturbed/developed areas at the airport (see Section 6.2). Therefore, there is absolutely no potential for disturbance to historic properties.

7.2.2 General Airport Property/Long-term Development

CSH recommends that the predictive model provided herein be used as a planning guide for further development projects at the airport, including those long-term improvements proposed in the 2010 Master Plan Update. It is generally recommended that development be confined to areas of lower sensitivity; however, the constraints of such a recommendation are recognized.

Figure 27 provides an approximation of sensitivity zones throughout the project area. Areas of least archeological sensitivity occur where the land has been previously disturbed, or in areas completely covered and mitigated by recent studies. Furthermore, the portions of the property overlapping the 1801 lava flow can be considered lower risk, although preliminary archaeological inspections or assessments of proposed development areas would be necessary, as archaeological features are known to exist in these areas, particularly within *kīpuka*.

Areas with greater sensitivity are situated in older flow areas, and would likely require an inventory survey. These include: the areas within, *makai* and south of the southern portion of the existing runway and taxiway; the undisturbed areas between the parking lot and car rental facilities, and an area east of U'u Street and south of Keāhole Street; much of the eastern portion of the project area; and the entire Kawili Point portion of the property. Many of the long-term improvements proposed in the Master Plan overlap these areas of higher sensitivity (see Figure 9 and Figure 27). When and if these proposed improvements reach a more critical stage in planning, it is advised that a professional archaeologist and/or the SHPD be contacted in order to specifically evaluate the need for and level of further study at that particular portion of the airport property. Preliminary field inspections at future proposed improvement areas could rule out the need for an inventory survey, if a lack of archaeological features can be sufficiently documented therein.

Development does not appear to be anticipated for the Kawili Point area. It is highly recommended that this area be subjected to the archaeological work recommended by Carpenter et al. (1998), and that it be ultimately left undeveloped and preserved as an integral component of the pre-Contact and historic settlement at Mahai'ula Bay.

Section 8 References Cited

Altizer, Kendy, and Christopher M. Monahan
2011 *PRELIMINARY DRAFT Archaeological Data Recovery and Preservation Plan for the North Segment of the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, North Kona District, Hawai'i Island TMK: (3) 7-3-009 & 7-3-043.* Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Barrera, William, Jr.
1979 *Keahole Airport Emergency Service Roads: Archaeological Survey, Kalaoa, North Kona, Hawaii.* Chiniago, Inc., Kamuela, Hawai'i.

1985a *Ke-ahole Point, Hawaii: Archaeological Reconnaissance (Revised Version).* Chiniago, Inc., Kamuela, Hawai'i.

1985b *'O'oma II, Hawai'i: Archaeological Reconnaissance.* Chiniago, Inc., Kamuela, Hawai'i.

1987a *Ke-ahole Airport, Hawaii: Archaeological Survey of Five Areas Proposed for Airport Expansion.* Chiniago Inc., Kamuela, Hawai'i.

1987b *Ke-ahole Airport, Hawaii: Archaeological Survey of South Ramp & Ground Transportation Expansion.* Chiniago Inc., Kamuela, Hawai'i.

1989 *Archaeological Data Recovery at the Host Park and NELH, Kalaoa and O'oma Ahupua'a, North Kona, Hawaii Island*: DLNR Submittal Version. Chiniago, Inc., Kamuela, Hawai'i.

1990 *Kalaoa, North Kona, Hawaii Island: Archaeological Data Recovery for Keahole Airport Expansion.* Chiniago, Inc., Kamuela, Hawai'i.

1992 *Kalaoa North Kona, Hawaii Island Archaeological Inventory Survey for the Church of Jesus Christ of Latter Day Saints.* Chiniago Inc., Kamuela, Hawai'i.

1993 *Kalaoa, North Kona, Hawaii Island: Archaeological Documentation of Māmalahoa Trail and Immediate Vicinity at Keahole Airport.* Chiniago, Inc., Kamuela, Hawai'i.

1995 *Kalaoa North Kona, Hawaii Island: Archaeological Data Recovery for the Church of Jesus Christ of Latter Day Saints.* Chiniago Inc., Kamuela, Hawai'i.

Barrère, Dorothy B.
1994 *The King's Mahele: The Awardees and Their Lands. Dorothy B. Barrère, Compiler, Hilo, Hawai'i.* Ms. on file, Historic Preservation Division, State of Hawaii Department of Land and Natural Resources, Honolulu, Hawai'i.

Bonk, William J.
1979a *An Archaeological Survey at the Keahole Airport, Kalaoa, North Kona, Hawai'i.* University of Hawai'i, Hilo, Hawai'i.

1979b *Addendum: An Archaeological Survey at the Keahole Airport, Kalaoa, North Kona, Hawai'i.* University of Hawai'i, Hilo, Hawai'i.

Borthwick, Douglas K., Brian L. Colin, and Hallett H. Hammatt
1992 *Archaeological Inventory Survey of the 24-Acre Parcel in the Ahupua'a of Makaula, in the District of North Kona, Island of Hawai'i (TMK 7-3-3:07 & 17).* Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Chinen, Jon J.
1958 *The Great Māhele: Hawaii's Land Division of 1848.* University of Hawaii Press, Honolulu, Hawai'i.

Ching, Francis
1971 *The Archaeology of South Kohala and North Kona from the ahupua'a of Lalamilo to the ahupua'a of Hanamanama: Surface Survey Kailua-Kawaihae Road Corridor (Section III).* Department of Land and Natural Resources, Division of State Parks, Honolulu, Hawai'i.

Ching, Francis Jr., and Paul Rosendahl
1968 *Archaeological Surface Survey of the Kailua-Kawaihae Road (Section II, Honokōhau to Keahole Point) and the Keahole Point Airport.* Department of Land and Natural Resources, Division of State Parks, Honolulu, Hawai'i.

Ching, Francis, Jr., Deborah Cluff and Thomas Riley
1968-1969 Preliminary *Report of Archaeological Surface Survey and Salvage Operations at Keahole, North Kona, Hawaii Island. Section II Keahole Point Airport, Kailua-Kawaihae Road.* Report prepared for Department of Transportation, Airports Division and Highways Division. The Department of Land and Natural Resources, Division of State Parks.

Carpenter, Alan B., Maurice Major, and Martha Yent
1998 *Archaeological Reconnaissance Survey, Kekaha Kai State Park, Mahai'ula Section, Kaulana and Mahai'ula Ahupua'a, North Kona, Island of Hawai'i.* State of Hawai'i Department of Land and Natural Resources, Division of State Parks.

Clark, Matthew R., and Robert B. Rechtman
2005 *Archaeological Inventory Survey of TMK: 3-7-3-7:39 and 3-7-3-46:105, 'O'oma 1st and 2nd Ahupua'a, North Kona District, Island of Hawai'i.* Rechtman Consulting, Hilo, Hawai'i.

Clark, Matthew R., Dylan S. Amerine, J. David Nelson, Christopher S. Hand, Mark J. Winburn, Kasey A. McCune, Robert B. Rechtman, Ph.D.
2004 *Addendum: Archaeological Inventory Survey of the Kaū Development Area (TMK: 3-7-2-05:1 por.), Kaū Ahupua'a, North Kona District, Island of Hawai'i (Revised).* Rechtman Consulting, Hilo, Hawai'i.

Clark, Stephan
1984 *An Archaeological Reconnaissance of Natural Energy Laboratory Hawaii (NELH) Property, Keahole Point, North Kona, Hawai'i.* Bernice P. Bishop Museum, Honolulu, Hawai'i.

Clark, Stephan D., and Sara Collins
2011 *Archaeological Assessment in Support of Installation of a Duct Bank for the New Airport Traffic Control Tower, Hamanamana Ahupua'a, North Kona District, Island of Hawai'i, State of Hawai'i (TMKs: [3]7-3-043: 001 [por.]; 7-3-043:045).* Pacific Consulting Services, Inc., Honolulu, Hawai'i.

Clark, Stephan D., and Patrick McCoy
2009 *Archaeological Assessment in Support of the Federal Aviation Administration's Very High Frequency, Omni-Directional Range (VOR) Facility at the Kona International Airport, Kalaoa 5 Ahupua'a, North Kona, Hawai'i Island, State of Hawai'i.* Pacific Consulting Services, Inc., Honolulu, Hawai'i.

Clark, Stephan D, and Melanie Mintmier
2010 *Historic Preservation Plan for a Pre-Contact Trail Segment, Site 50-10-27-26737, at the Kona International Airport, Keahole Point, Hamanamana Ahupua'a, North Kona District, Island of Hawai'i, State of Hawai'i (TMK: 3-7-3-043:001).* Pacific Consulting Services, Inc., Honolulu, Hawai'i.

Clark, Stephan D, Paul Titchenal and Sara Collins
2011 *Archaeological Inventory Survey of Two Borrow-Pit Areas at the Federal Aviation Administration's New Very High Frequency Omni-Directional Range (VOR) Facility at the Kona International Airport, Kalaoa 5 Ahupua'a, North Kona District, Hawai'i Island, State of Hawai'i (TMK: [3] 7-3-43: Por.03).* Pacific Consulting Services, Inc., Honolulu, Hawai'i.

Cleghorn, Paul
1998 *Archaeological Investigations for the Proposed University Center at West Hawai'i North Kona, Hawai'i Island.* Pacific Legacy, Inc., Kailua, Hawai'i.

Corbin, Alan B.
2000 *Archaeological Data Recovery Excavations at SIHP Sites 1916 and 18028, The Natural Energy Laboratory of Hawaii Project Area, Land of 'O'oma II, North Kona District, Island of Hawai'i (TMK: 3-7-3-09:4).* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Cordy, Ross
1981 *A Study of Prehistoric Social Change: The Development of Complex Societies in the Hawaiian Islands.* Academic Press, New York, New York.

1985 *Ooma & Kalaoa Ahupua'a, Kekaha, North Kona. Working Paper 1, Hawaii Island Archaeology.* Historic Sites Section, Division of State Parks, Department of Land & Natural Resources, State of Hawai'i, Honolulu.

1986a Field Check 'O'oma 2, North Kona, Hawai'i. Historic Sites Section, Division of State Parks, Department of Land and Natural Resources, State of Hawai'i, Honolulu, Hawai'i.

1986b *Field Check of Some Sites in the NELH Property: Kalaoa 5 Ahupua'a, Keahole Point, North Kona, Hawai'i.* State Historic Preservation Division, Kapolei, Hawai'i.

1987 *Archaeological Fieldcheck, TMK 7-3-28:5, Uplands, Kalaoa 3, North Kona, Hawaii Island.* Historic Sites Section, Division of State Parks, Department of Land and Natural Resources, Honolulu, Hawai'i.

Cordy, Ross, Joseph Tainter, Robert Renger, and Robert Hitchcock
1991 *An Ahupua'a Study: The 1971 Archaeological Work at Kaloko Ahupua'a North Kona, Hawai'i: Archaeology at Kaloko-Honokohau National Park.* Western Archaeological and Conservation Center Publications in Anthropology, No. 58.

Coulter, John Wesley
1931 *Population and Utilization of Land and Sea in Hawaii, 1853.* B.P. Bishop Museum Bulletin 88, Bishop Museum Press, Honolulu, Hawai'i.

Davis, Bertell D.
1977 *Archaeological Survey of the Proposed Agricultural Park at Ke-ahole, North Kona, Hawai'i Island.* Archaeological Research Associates, Honolulu, Hawai'i.

Donham, Theresa
1987 *Archaeological Survey and Testing, 'O'oma II Resort Project Area. Land of 'O'oma II, North Kona, Island of Hawaii (TMK: 3-7-3-09:4).* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Drolet, Robert, and Allan Schilz
1991 *Archaeological Inventory Survey, O'oma 2, North Kona, Hawaii Island.* Ogden Environmental and Energy Services Co., Honolulu, Hawai'i.

Dowden, Sheryl and Donna K. Graves
1992 *Archaeological Inventory Survey, Helco Keāhole Parcel Project Area, Lands of Kalaoa 1-4, North Kona District, Island of Hawai'i (TMK 7-3-49:36).* Paul H Rosendahl, Inc., Hilo, Hawai'i.

Dye, Thomas S. and Usha Prasad
2000 *Archaeological Update and PASH Rights Interviews for Kona International Airport at Keāhole.* International Archaeological Research Institute, Inc., Honolulu, Hawai'i.

Ellis, William
2004 *Journal of William Ellis: A Narrative of an 1823 Tour Through Hawai'i with Remarks on the History, Traditions, Manners, Customs and Language of the Inhabitants of the Sandwich Islands.* Mutual Publishing, Honolulu, Hawai'i.

Emerson, J. S.
1888 Map of "Akahipuu Section of Kona, Hawai'i (Honokōhau to Haleohiu)," by J. S. Emerson. Hawai'i Land Survey Division, Registered Map No. 1446. On file at Hawai'i Land Survey Division, Department of Accounting and General Services, Honolulu, Hawai'i.

1891 Kailua section of Kona (Hamanamana to Puapuaa), by J. S. Emerson. Registered Map No. 1280. On file at Hawai'i Land Survey Division, Department of Accounting and General Services, Honolulu, Hawai'i.

Escott, Glenn G., and Suzan Keris
2009 *An Archaeological Inventory Survey of 5.423 Acres for the Proposed Onizuka Space Center, Kalaoa 3rd Ahupua'a, North Kona District, Island of Hawai'i, Hawai'i [TMK (3) 7-3-043:003 por.]*. Scientific Consultant Services Inc., Honolulu, Hawai'i.

Escott, Glenn G., and Robert L. Spear
2009 *An Archaeological Assessment of 11.36 Acres Located at the Kona International Airport, Kalaoa 3rd Ahupua'a, North Kona District, Island of Hawai'i [TMK: (3) 7-3-043:por.]*. Scientific Consultant Services Inc., Honolulu, Hawai'i.

Google Maps
2011 Google satellite images, Keāhole Point Area, North Kona, Hawai'i. Electronic Document, http://maps.google.com/, access date unknown.

Hammatt, Hallett H.
1987 *Archaeological Reconnaissance of a 15-Acre Parcel, Kealakehe, Kona, Hawaii (TMK 7-4-17:30)*. Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Hammatt, Hallett H., and William H. Folk
1980 *Archaeological Excavations within the Proposed Keahole Agricultural Park, Kalaoa-'O'oma, Kona, Hawaii Island*. Archaeological Research Center, Inc., Lawa'i, Hawai'i.

Hammatt, Hallett H., D. Shideler, and D.K. Borthwick
1987 *Archaeological Survey and Test Excavations of a 15-Arce Parcel, Kealakehe, Kona, Hawaii (TMK: 7-4-17:30)*. Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Haun, Alan, and Dave Henry
2000 Archaeological Inventory Survey TMK:3-3-3:03, Land of O'oma 1, North Kona District, Island of Hawaii. Haun & Associates, Kea'au, Hawai'i.

2002 Archaeological Data Recovery, Sites 22740, 22741-Feature E, and 22749, Land of O'oma, North Kona District (TMK: 3-7-3-05:4, Lot 54A). Haun & Associates, Kea'au, Hawai'i.

2003a Archaeological Inventory Survey TMK: 3-7-3-23:88, Land of Kalaoa 3rd North Kona District, Island of Hawai'i. Haun & Associates, Kea'au, Hawai'i.

2003b Archaeological Inventory Survey TMK:7-3-7:40 and 41, Land of 'O'oma 1, North Kona District, Island of Hawaii. Haun & Associates, Kea'au, Hawai'i.

2003c Archaeological Inventory Survey TMK: 3-7-3-10:29, Land of Kalaoa 4th, North Kona District, Island of Hawai'i. Haun & Associates, Kea'au, Hawai'i.

Haun, Alan E., Henry, Jack D. and Dianne M. Berrigan
2003 *Archaeological Data Recovery Sites 5748, 5749, 5750, 5753, 5755, 5756, 5761, 5762, 5764, 5771,5773, and 5774. Puuhonua Subdivision Parcel Land of Kalaoa 5, North Kona District, Island of Hawai'i (TMK: 3-7-3-10:por. 27)*. Haun and Associates, Kea'au, Hawai'i.

2006 *Archaeological Data Recovery Sites 23825, 23831, 23832, 23835, 23836, and 23839, TMK: (3)-7-3-7:40 and 41, Land of 'O'oma 1, North Kona District, Island of Hawai'i, Island of Hawai'i*. Haun & Associates, Kea'au, Hawai'i.

Hawai'i TMK Service
Tax Map Keys (3) 7-2-005, 7-3-043. On file at Hawai'i TMK Service, 222 Vineyard Street, Suite 401, Honolulu, Hawai'i.

Henry, Jack D., Susan T. Goodfellow, and Kepa Maly
1993 Archaeological Assessment Study Kailua to Keahole Region State Lands LUC Project, Lands of Makaula, Hale'ohi'u, Kalaoa 1-4, Kalaoa-'O'oma, and 'O'oma 2, North Kona District Island of Hawaii. Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

'Ī'ī, John Papa
1959 *Fragments of Hawaiian History*. Bishop Museum Press, Honolulu, Hawai'i.

Kalima, Lehua
1992 *Appendix A: Historical Documentary Research*. In Dowden and Graves *Archaeological Inventory Survey Helco Keahole Parcel Project Area*. PHRI, Hilo, Hawai'i.

Kamakau, Samuel Mānaiakalani
1979 Ka po'e kahiko: *the people from old*. Bishop Museum Press, Honolulu, Hawai'i.

1992 *Ruling Chiefs of Hawaii (Revised Edition)*. Kamehameha Schools Press, Honolulu, Hawai'i.

Kelly, Marion
1971 *Kekaha: 'Aina Malo'o, Historical Survey and Background of Kaloko and Kuki'o Ahupua'a, North Kona, Hawaii*. Department of Anthropology Report 71-2, Bishop Museum, Honolulu, Hawai'i.

Kirch, Patrick V.
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawaii Press, Honolulu, Hawai'i.

Maguire, Eliza D.
1994 *Kona Legends*. Seventeenth Printing. Petroglyph Press, Ltd., Hilo, Hawai'i.

Masterson, Ian, and Hallett H. Hammatt
1997 *Archaeological Reconnaissance of a Proposed Reservoir Site, Mauka of the Keahole Substation, Kalaoa, Kona, Hawaii Island (TMK:7-3-10:33)*. Cultural Surveys Hawai'i, Kailua, Hawai'i.

McGerty, Leann, and Robert L. Spear
2000 *Final Addendum to: Archaeological Inventory Survey Kalaoa Mauka, North Kona, Island of Hawai'i: TMK: 7-3-05:98*. Scientific Consultant Services, Kailua, Hawai'i.

McGuire, Ka'ohulani, and Hallett H. Hammatt
2000 *A Traditional Practices Assessment for the Proposed Faulkes Telescope on 1.5 Acres of the University of Hawai'i Facility at Haleakala, Papa'anui Ahupua'a, Makawao District, Island of Maui (TMK 2-2-07:8).* Cultural Surveys Hawai'i, Kailua, Hawai'i.

Maly, Kepā
1994 "Historical Documentary Research." In *Preliminary Report, Archaeological Inventory Survey, Proposed Henry Street Extension Road Corridor, Lands of Keahuolu and Lanihau, North Kona District, Island of Hawai'i (TMK:3-7-4-08:Por.1; 3-7-5-03:Por.21).* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

1999 *Volume I: Pu'u Anahulu and Pu'u Wa'awa'a (Nāpu'u) at Kekaha – Kona, Hawaii. A Report on Archival-Historical Documentary Research, and Oral History Interviews; Cultural-Historical Documentation for Ahupua'a-Based Planning in the Lands of Pu'u Anahulu and Pu'u Wa'awa'a (Nāpu'u); District of Kona, Island of Hawai'i (TMK Overview Sheet 7-1).* Prepared for Hui 'Ohana Mai Pu'uanahulu a me Pu'uwa'awa'a. Hilt Hawai'i: Kumu Pono Associates, Hilo, Hawai'i.

Maly, Kepā and Onaona Maly
2003 *Kohanaiki Ma Kekaha Wai 'Ole O Nā Kona (Kohanaiki on the Arid Shores of Kona): A Report on Archival and Historical Documentary Research, and Oral History Interviews for the Ahupua'a of Kohanaiki, District of Kona, Island of Hawai'i (TMK 7-3-09:3, 14).* Kumu Pono Associates, Hilo, Hawai'i

Menzies, Archibald
1920 *Hawai'i Nei 128 Years Ago.* Edited by W.F. Wilson. The New Freedom Press, Honolulu, Hawai'i.

Mitchell, John Hipple
1903 Hawaiian Investigation: Report of Subcommittee on Pacific Islands and Porto Rico. United States Senate Report, Government Printing Office.

Monahan, Christopher M., Trevor Yucha, and Connie O'Hare
2011 *PRELIMINARY DRAFT: Archaeological Inventory Survey for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1-2 and Kealakehe, North Kona District, Hawai'i Island TMK: (3) 7-4-008, 7-3-009 & 7-3-043.* Cultural Surveys Hawai'i, Kailua, Hawai'i.

Nakamura, Keola, Valerie Park, Reid Yamasato, and Stephan D. Clark
2009 *Archaeological Inventory Survey and Limited Test Excavations in Support of a Proposed New Airport Traffic Control Tower and Parking Lot, Kona International Airport, Hamanamana Ahupua'a, North Kona District, Island of Hawai'i, State of Hawai'i (TMK: 3-7-3-043:001).* Pacific Consulting Services, Inc., Honolulu, Hawai'i.

Natural Energy Lab of Hawai'i Authority (NELHA)
N/D *About NELHA: NELHA History.* Electronic document, www.nelha.org/about/history.html, accessed January 2012.

O'Hare, C.R., and S.T. Goodfellow
1992 *Kohana-iki Resort, Phased Archaeological Mitigation Program, Phase II-Data Recovery. Land of Kohana-iki, North Kona District, Island of Hawai'i.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

O'Hare, C.R., and P.H. Rosendahl
1991 *Interim Report: Background, Summary of Findings, and General Significance Assessments and Recommended General Treatments. Archaeological Inventory Survey, Kalaoa View Estates Development Project.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Pukui, Mary Kawena
1983 'Ōlelo No'eau: *Hawaiian Proverbs and Poetical Sayings*. Collected, Translated and Annotated by Mary Kawena Pukui, Illustrated by Dietrich Varez, Bernice P. Bishop Museum Special Publication No. 71, Bishop Museum Press, Honolulu, Hawai'i.

Pukui, Mary Kawena, and Samuel H. Elbert
1986 *Hawaiian Dictionary.* 2nd Edition. University of Hawai'i Press, Honolulu, Hawai'i.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther Mook.ini
1974 *Place Names of Hawaii, 2nd edition.* University Press of Hawaii, Honolulu, Hawai'i.

Reinecke, John E.
1930 "Survey of Sites on West Hawaii." Bishop Museum Manuscript, Honolulu, Hawai'i.

Roberts, Alice K.S. and Stephen J. Roberts
2001 *Final Report: Archaeological Data Recovery for Sites: 50-10-27-10,211; 50-10-27-10,212; 50-10-27-10,213, for the Natural Energy Laboratory of Hawaii Authority, Kalaoa 5 Ahupua'a, Ke-āhole Point, North Kona District, Island of Hawai'i, Hawai'i, TMK 7-3-43-3.* Garcia and Associates, Honolulu, Hawai'i.

Robins, Jennifer, R. Chiogioji, J. Collins, I. Carlson, I. Masterson, and H. Hammatt
1993 *An Archaeological Inventory Survey of an approximately 82-Acre Subject Parcel in the Ahupua'a of Honokohau II, North Kona District, Island of Hawai'i (TMK 7-4-08: por.34).* Cultural Surveys Hawai'i, Kailua, Hawai'i.

Rogers-Jourdane, Elaine
1978 *Archaeological Reconnaissance Survey of NELH Facilities Area at Keahole Point, North Kona, Hawaii.* Bernice P. Bishop Museum, Honolulu, Hawai'i.

Rosendahl, Paul H.
1973 *Archaeological Salvage of the Keahole-Anaehoomalu Section of the Kailua - Kawaihae Road (Queen Ka'ahumanu Highway), Island of Hawai'i.* Bishop Museum Press, Honolulu, Hawai'i.

1980 *Intensive Archaeological Survey and Salvage Excavations at the Natural Energy Laboratory Hawaii (NELH) Site, Ke-ahole Point, North Kona, Hawaii Island: Final Report.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

2004 *Archaeological and Cultural Impact Assessment Study HELCO Keahole Generating Station Project Lands of Kalaoa 1-4, North Kona District, Island of Hawai'i (TMK: 3-7-3-49:36, 37).* Paul H Rosendahl, Inc., Hilo, Hawai'i.

Rosendahl, Paul, and Patrick Kirch
1975 *Archaeological Reconnaissance Survey of the Keahole Point Natural Energy Laboratory Site, North Kona, Hawai'i Island.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Sato, Harry H., Warren Ikeda, Robert Paeth, Richard Smythe, and Minoru Takehiro Jr.
1973 *Soil Survey of the Island of Hawaii.* U.S. Department of Agriculture and Univ. of Hawaii Agricultural Experiment Station, University of Hawaii, Honolulu, Hawai'i.

Schilt, Rose
1984 *Subsistence and Conflict in Kona, Hawaii. An Archaeological Study of the Kuakini Highway Realignment Corridor.* Report 84-1. Department of Anthropology, Bernice P. Bishop Museum, Hawai'i.

Schilz, A., K. Shun, S. Williams, and R. Nees
1993 *Archaeological Survey and Evaluation, Lands of Kau, North Kona, Hawai'i Island (Revised).* Prepared for Nansay Hawai'i, Inc., Kamuela, Hawai'i.

Schmitt, Robert C.
1973 *The Missionary Censuses of Hawaii.* Number 20, Pacific Anthropological Records, Department of Anthropology, Bernice P. Bishop Museum, Honolulu, Hawai'i.

Sherrod, David R., John M. Sinton, Sarah E. Watkins, and Kelly M. Brunt
2008 Geologic Map of the State of Hawai'i. Electronic Document, http://pubs.usgs.gov/of/2007/1089/, access date unknown.

Shideler, David, W. and Hallett H. Hammatt
2005 *Archaeological Field Inspection and Literature Review for 1,200+ Acres in Kaloko and Kohanaiki, North Kona, Hawai'i.* Cultural Surveys Hawai'i, Kailua, Hawai'i.

Soehren, Lloyd
1982 *Archaeological Reconnaissance Survey: Kalaoa 4, North Kona, Hawaii.* Kilo 'Aina, Captain Cook, Hawai'i.

2010 *A Catalog of Hawaiian Place Names. Compiled for the Records of the Boundary Commission and The Board Commissioners to Quiet Land Titles of the Kingdom of Hawai'i.* Collected and annotated by Lloyd J. Soehren. Online at the Ulukau Website, http://ulukau.org/cgi-bin/hpn?l=en.

Springer, Hannah K.
1989 *Appendix B: Regional Notes from Kekaha: Awakee. In Archaeological Reconnaissance Survey, Proposed Awakee Resort Development Project Area, Land of Awakee, North Kona, Island of Hawaii (TMK:3-7-2-04:3)*, by Theresa K. Donham. Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

State of Hawai'i
2012 "Airport History." *Kona International Airport at Keahole.* Electronic document, http://hawaii.gov/koa/airport-information/airport-history, accessed January 12, 2012

State of Hawai'i Department of Transportation (DOT)
2012 "Kona International Airport at Keahole." Hawaii Aviation: An Archive of Historic Photos and Facts. Electronic document, http://hawaii.gov/hawaiiaviation/hawaii-airfields-airports/hawaii/kona-international-airport-at-keahole, accessed January 12, 2012.

Telea, Lawrence, and Margaret Rosendahl
1987 *Archaeological Reconnaissance Survey: Kona Palisades Subdivision Parcel, Land of Kalaoa 4th, North Kona, Island of Hawai'i.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Thompson, K.W., and S.T. Goodfellow
1992 *Archaeological Mitigation Program, Kona Palisades Development Parcel, Phase II - Archaeological Data Recovery, Land of Kalaoa 4, North Kona District, Island of Hawaii.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Thompson, Kevin W., and Paul H. Rosendahl
1992a *Archaeological Sensitivity Study Keahole-Kailua and Keahole-Keamuku Transmission Line Sites: Districts of North and South Kona, and South Kohala. Island of Hawaii.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

1992b *Archaeological Sensitivity Study, Further Analyses and Evaluation of Proposed Corridors for Transmission Lines, Keahole to Kailua, North Kona District Island of Hawaii.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Thrum, Thomas G.
1922 Hawaiian Place Names, In, *A Dictionary of the Hawaiian Language* (originally published in 1865), pp. 625-674. Revised by Henry Parker, 1922. Board of Commissioners of Public Archives of the Territory of Hawai'i, Honolulu, Hawai'i.

U.S. Geological Survey Maps/ U.S. Department of War Maps. Available at USGS Information Services, Box 25286, Denver, Colorado
1928 USGS topographic map, Keahole Quadrangle.

1959 USGS topographic map, Keahole Pt. and Makalawena Quadrangles.

1977-78USGS Orthophotograph, Keahole Pt. and Makalawena Quadrangles.

1996 USGS 7.5 Minute topographic map, Keahole Pt. and Makalawena Quadrangles.

USGS Hawaii Volcano Observatory
1997 "Fishponds versus lava flows." *Volcano Watch.* Electronic document, http://hvo.wr.usgs.gov/volcanowatch/1997/97_07_25.html, accessed January 10, 2011.

Waihona 'Āina
2000 *The Māhele Database.* Electronic document, http://waihona.com, access date unknown.

Walker, Alan, T., and Alan E. Haun
1988 *Limited Archaeological Data Recovery, Kona Palisades Subdivision Parcel, Land of Kalaoa 4th, North Kona District, Island of Hawai'i.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Walker, Alan and Paul H. Rosendahl
1989 Archaeological Inventory Survey, Pu'uhonua Subdivision Development Parcel, Land of Kalaoa 5th , North Kona District, Island of Hawaii (TMK: 3-7-3-10:por 10). Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

1990a Archaeological Inventory Survey, Kona Palisades Development Parcel, Land of Kalaoa 4th, North Kona District, Island of Hawaii (TMK:3-7-3-05:12). Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

1990b Archaeological Inventory Survey, Kona Palisades Development Parcel, Land of Kalaoa 4th, North Kona District, Island of Hawaii (TMK:3-7-3-05:86). Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Wall, Walter E.
1914 Kukio-Maniniowali to Puukala Government Tracts. Walter E. Wall, Surveyor. Hawaii Territorial Survey Plat 304. On file at the Hawai'i Land Survey Division, Department of Accounting and General Services, 1151 Punchbowl St., Room 210, Honolulu.

Walsh, Patrick O., and Hallett H. Hammatt
1995 *An Archaeological Inventory Survey of the New Queen Ka'ahumanu Highway Right-of-Way between Palani Road and Keahole Airport within the Ahupua'a of Keahuolu, Kealakehe, Honokōhau, Kaloko, Kohanaiki, O'oma 2, Kalaoa-O'oma, and Kalaoa 1-4, Kekaha, North Kona District, Hawai'i Island.* Cultural Surveys Hawai'i, Kailua, Hawai'i.

Wilkes, Charles
1845 *Narrative of the U.S. Exploring Expedition, Volume IV.* Lea and Blanchard, Philadelphia, Pennsylvania.

Williams, Scott, Richard Nees, and Gwen Hurst
1993 *Data Recovery Plan, Lands of Kau Above 95 Ft Elevation, North Kona, Hawai'i Island (TMK: 07-02-05:01).* Ogden Environmental and Energy Services Co., Inc., Honolulu, Hawai'i.

Wolforth, Thomas
1999 *Monitoring - HELCO Keahole- Kailua 69kV Transmission Line: A Detailed Description of Māmalahoa Trail (50-10-27-2) Lands of Kalaoa 1-4, Kalaoa-O'oma Hmst., O'oma, Kohanaiki, Kaloko, Honokōhau, Kealekehe, & Keahuolu, North Kona, Hawaii.* Paul H. Rosendahl, Ph.D., Inc., Hilo, Hawai'i.

Wolforth, Thomas R., Chris Monahan, Kirk Johnson, Tyler Paikuli-Campbell and Robert L. Spear
2005 *Archaeological Inventory Survey of the Northern Portion of the Kaloko Heights Project in Kohanaiki and Kaloko Ahupua'a, North Kona District, Hawai'i, Island, Hawai'i: Settlement Pattern Investigations in the Southern Kekaha Middle Elevations [TMK 3-7-3-09:32).* Scientific Consultants Inc., Honolulu, Hawai'i.

Wyban, Carol Araki
1992 *Tide and Current: Fishponds of Hawai'i.* University of Hawaii Press.

Yent, Martha
1991 *Archaeological Reconnaissance Survey: Makaula-'O'oma Mauka Tract, North Kona, Island of Hawaii (TMK: 7-3-001:002).* Department of Forestry and Wildlife, Department of Land and Natural Resources, Honolulu, Hawai'i.

Appendix A Site Descriptions

8.1 Sites Assigned State Site Numbers

8.1.1 SIHP 50-10-27-00002 (Barrera 1993:5)

The Māmalahoa Trail [in the vicinity of the airport] is marked by two parallel sets of kerbing and measures 2.9 meters in overall width, with a pathway that measures 1.8 meters in width. It passes through the Keāhole Airport in a north-northwest to south-southeast direction and, as elsewhere along its considerable length, does not deviate from a remarkably straight course, and does not skirt around obstacles. Where low areas or rises in the bedrock were encountered a causeway or a ramp was constructed ... Short sections of low depressions in the trail were leveled with basalt pebbles ... Where the trail crosses smooth and level *pāhoehoe*, the kerbing tends to be somewhat informal ... Where it crosses low spots and has been built up into a ramp or a causeway, the kerbing is quite well constructed, perhaps in recognition of the added risk involved in straying from the trail at such points ... At these points each kerb consists of parallel upright slabs, the space between which is filled witll angular basalt pebbles and cobbles.

The surface of the trail shows no evidence of the sort of wear that is commonly seen on prehistoric foot trails across open *pāhoehoe*. This may be due to the relatively short period of use of this trail, but it might also be the result of the lack of traffic. Any movement between coastal communities during the historic period would probably have followed the prehistoric pattern of using existing foot trails closer to the coast. The Māmalahoa Trail might have been used relatively infrequently by persons whose aim was to by-pass the coastal communities. The lack of deterioration of the *pāhoehoe* surface also suggests quite strongly that horses were not the primary means of transportation along the trail. Additional possible evidence of the relatively infrequent use of the trail is present adjacent to Site 15260, where the shell midden scatter from the site extends onto the path of the trail ... The shells are whole, and clearly have not been fragmented by pressure from either animal or human feet. This argument only will only hold up if the adjacent shelter site dates from the prehistoric period. An alternative explanation might be that the shells were deposited by people who were making use of the adjacent shelter while in transit along the trail.

8.1.2 SIHP 50-10-27-00185

(Steppingstone trail west of southern end of runway [see Cordy 1985 map, Site D16-17]; no site description found.)

8.1.3 SIHP 50-10-27-00245, -10202 (Peterson in Ching et al. 1968-69:98)

Trail VII is also an *'Opihi* Shell trail. It begins at the *kiawe* cluster on Keāhole Point and heads in a westerly direction, not on the 1800-1801 flow, but near its edge ... it runs over old *pāhoehoe* and is marked every 10 meters or so with large *'opihi* shells. The trail also is notable by its brownish orange surface due to constant wear and weathering. Coral is also occasionally encountered on the trail.

8.1.4 SIHP 50-10-27-00246 (Peterson in Ching et al. 1968-69:95-96)

Trail VI, is an *'Opihi* Shell trail. It consists of *'opihi* shells placed every 5-10 meters. The shells are medium to large and are quite distinct on the black lava, as they have been bleached white by the sun. This type of trail is not particularly specified by Apple. For the present it will be included in the type "A" category, but it is recommended that this broad division be more sharply differentiated in order to facilitate a more precise analysis. This trail is approximately 47 meters north of where trail V begins at the edge of the *pāhoehoe* flow. That is, Trail VI runs in an east-west direction on top of the 1800-1801 flow, but not far from the edge. To the west, it leads to a group of *kiawe* trees at Keahole Point, and it apparently terminates 50 meters to the east.

8.1.5 SIHP 50-10-27-00302

(Cairn-marked trail crossing present airport facility [see Cordy 1985 map, Site D16-23]; no site description found.)

8.1.6 SIHP 50-10-27-00373 (Peterson in Ching et al. 1968-69:96-97)

Trail X [SIHP 50-10-27-00373; Cordy 1985 Site D16-19], is approximately 88 meters east of trail III, and runs slightly diagonal to it. The northern end of this steppingstone trail is covered by the 1800-1801 flow. Traveling in a south-east direction, the steppingstones of flat *'a'ā* lead across the rough *'a'ā* and end at an older *pāhoehoe* flow.

8.1.7 SIHP 50-10-27-00487, -00495, -00501, -00502 (Peterson in Ching et al. 1968-69:94)

Trail II [SIHP 50-10-27-00487, -00495, -00501, -00502; Cordy 1985 Site D16-20], beginning at the edge of the 1800-1801 flow and leading *mauka* across the *'a'ā*, is also composed of smooth, waterworn stones placed about 50 cm. apart. The steppingstones soon disappear, but the trail continues, marked by small *a'ā* and smoother surfaced lava, which having been worn and exposed is lighter in color than the surrounding lava. In critical places (i.e. over exceptionally rough *a'ā*) the steppingstones appear again. Approximately 5 meters off the trail to the north, is site 290, a cave in the *'a'ā*, evidently used as a shelter. The trail continues over an old *pāhoehoe* flow; portions made up of flat lava are found and then disappear.

8.1.8 SIHP 50-10-27-00500 (Bonk 1979b)

With regard to the Keāhole petroglyphs, this writer [Bonk] was especially concerned for it was thought that there may be "new", heretofore unknown, archaeological material in the area that for some reason was not noted during the field reconnaissance. As a result, Ms. P. Beggerly, of the Preservation Office, State of Hawaii, and Mr. F. Ching, former State Archaeologist and the person responsible for the archaeological survey of the area prior to airport construction, were both contacted on June 22, 1979. They both mentioned a small group of petroglyphs *mauka* of the airport parking lot. Ms. Beggerly promised to send a copy of a map and Mr. Ching gave very specific information on location.

On June 25, 1979 these petroglyphs were again located and examined ... [Figure 98]. As a result, this writer feels there is no cause for alarm, for the Airports Division of the State Department of Transportation has at some time in the past very thoughtfully seen fit to protect these carvings. A paved walkway connects the airport periphery road with the *pāhoehoe* slabs on which the glyphs

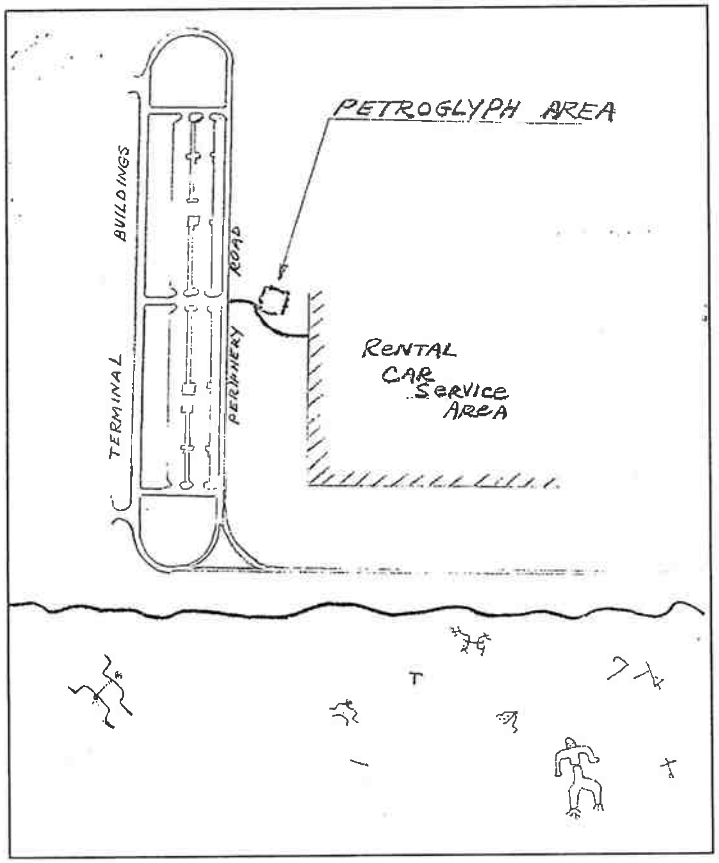


Figure 98. Map of SIHP 00500 from Bonk 1979b

are cut and this allows easy access. In addition, a stone wall, approximately two to three feet in height, forms an enclosure that serves to delineate, isolate, and thereby protect the area holding the carvings.

8.1.9 SIHP 50-10-27-00600, -00603, -00630 (Rosendahl 1973:11, 13)

Feature 600 – Foot Trail and Enclosures

According to unpublished survey records, this feature consisted of a prehistoric foot trail and four associated circular, low-walled enclosures. Features 600, 603, and 630 were not definitely located and possibly were destroyed by bulldozing activity in the area at the Keāhole end of the alignment. This activity took place sometime between the completion of survey work in January 1969 and the beginning of salvage work in 1973.

Feature 603 – Foot Trail

This feature was described as a prehistoric foot trail of crushed *a'ā* gravel, leading to a nearby *kīpuka*.

Feature 630 – Foot Trail

This prehistoric foot trail was the same as type Feature 603, and apparently joined it.

8.1.10 SIHP 50-10-27-00701/Complex D (Rosendahl 1973:3, 23, 29-30)

Complex D, the "Northern Feature Complex: Kau [Ching, n.d.], is two associated clusters of residential and related features located adjacent to the highway alignment near the Ke-āhole end. The most significant feature appeared to be a dwelling cave (Feature 701; also designated alternatively as T-3, 624, or 681) which had been partially salvaged earlier [Ching, n.d.]...

This complex is actually two clusters, totaling 62 features in all, located in a large, grassy *kīpuka* about 3400 ft (1037 meters) from the Keāhole end of the alignment...The *mauka* cluster (Features 701, and 701-1 to 701-27)...is situated c. 325 ft (100 meters) *mauka* of the alignment, at an elevation of 150 to 170 ft (46 to 52 meters); the *makai* cluster (Feature 701-28-701-61)...was found approximately 2300 ft (702 meters) WSW of the *mauka* cluster, *makai* of the alignment, at an estimated elevation of 80 ft (25 meters). The principal feature of the complex (Feature 701 – Dwelling Cave) had been partially salvaged during earlier survey work (Dec. 1968 to Jan 1969) conducted at the Ke-āhole end of the alignment [Ching, n.d.]. The major effort of the 1972 salvage work at Complex D was the completion of any necessary excavations at Feature 701 and test excavations of several other features...

[Description of cave and *mauka* features not given here since they are located east of the current project area.]

Complex D – *Makai* Cluster... [Figure 99]

Features 701-28, -34, -35, -37, -44, 56, -59 – Cairns (7)

These are all roughly circular, piled-stone cairns ranging from 20 cm to 1.7 meters in diameter and from 30 cm to 1.3 meters in height.

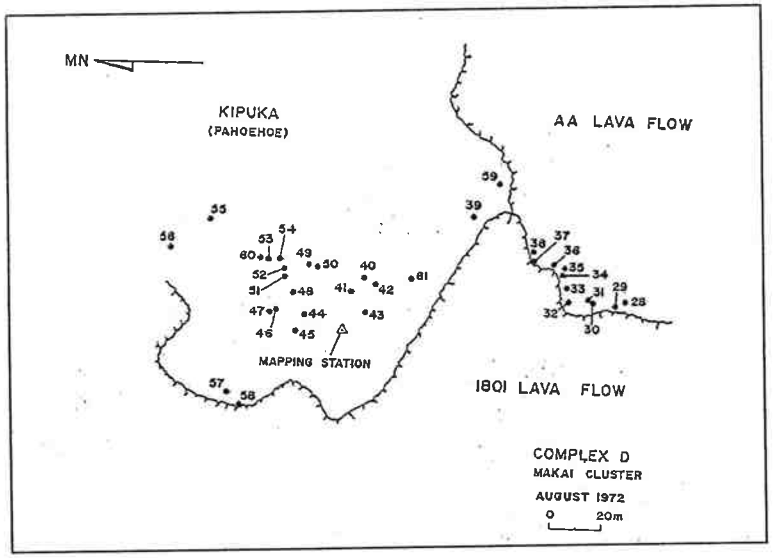


Figure 99. Map of SIHP 00701 "*Makai* Cluster" feature locations, from Rosendahl 1973:25

Feature 701-29 – Platform

This small, raised, stone-filled platform is 60 cm high, and measures 1.5 by 2 meters.

Features 701-30, -32, -38, -39, -43, -52, -55, -60 – C-Shaped Shelters (8)

These are very crude shelter structures, open on the *makai*-facing side. In shape they vary from simple C-shaped to angular, boxed c-shaped. They range in length from 1.5 to 3 meters, and have piled-stone walls ranging from 40 cm to 1 meter in height.

Feature 701-31 – Pavement

This small area, 1 by 2 meters, is cleared and roughly paved with stones.

Features 701-33, -48, -51 – Walls (3)

These three short wall sections are in generally poor condition, ranging from 1 to 2.5 meters in length and 30 to 60 cm in height.

Features 701-36, -42, -45, -49, -54, -57, -61 – Platforms (7)

These structures are all crude, raised stone platforms, often incorporating natural rock outcroppings, usually rectangular in shape, and ranging from 1.3 to 2.5 meters in width and from 2 to 5.3 meters in length. The elevated surfaces are from 10 to 100 cm above ground. All except 701-36 are partially dismantled, revealing similar stone fills and producing only a few pieces of cowry shell and sea-urchin remains.

Features 701-40 and -41 – Enclosures

These two, small, stone-walled, rectangular enclosures measure 1.3 by 1.5 meters and 1.3 by 2 meters, and have stacked-stone walls averaging 50 to 60 cm in height.

Features 701-46 and -47 – Cairns

These two oval-shaped structures, with base dimensions of 1 by 1.5 meters, are constructed of stones stacked 1.25 meters high.

Features 701-50 and -58 – Rock-filled Depressions (2)

These two shallow depressions are filled with small stones to form crude paved areas measuring 1.75 by 4 meters and 2 by 2.7 meters.

Feature 701-53 – Enclosure

This structure measures 3 meters square, with stacked-stone walls 75 cm high. A possible entrance on the N side is blocked by a collapsed wall.

The only portable artifacts found in the 61 features associated with Cave 701 were a fragment of basalt-cobble hammerstone from Features 701-20 [*mauka* cluster] and a small, volcanic glass core from Feature 701-61.

8.1.11 SIHP 50-10-27-06961 (Barrera 1979:3-4)

This is a crude habitation shelter located in an area of jagged *pāhoehoe* lava [Figure 100]. It measures 1.5 by 3.4 meters and stands to a height of 0.65 meter. It includes evidence of habitation, shellfish collection and food consumption. Although the permanence of residence cannot be firmly established with the evidence which is presently available, the crudeness of construction and the minimal amounts of midden materials present suggest that occupation was temporary. No dateable materials were recovered from the site, but its proximity to a habitation enclosure with historic materials [glass and metal fragments] in association, to which it may have been functionally related, suggests that is [sic] is of the same age. The boundaries of the site were determined by the extent of the cultural remains. Midden materials present consist only of a few shells of a limpet [*Cellana sp.*], a nerite [*Nerita picea*] and a drupe [*Drupa ricina*].

8.1.12 SIHP 50-10-27-06987 (from State of Hawai'i Register of Historic Places nomination form included with Barrera 1980 letter report)

Hawaii Island Site 50-10-27-6987 consisted of two adjacent C-shaped shelters manufactured of multiple-stacked *pāhoehoe* slabs, covering an area of 1.9 by 3.5 meters [Figure 101]. The most northerly of the two measured 1.6 by 1.8. meters and stood to a height of 0.4 meter. The other measured 1.7 by 1.8 meters and stood to a height of 0.5 meter. Both features were

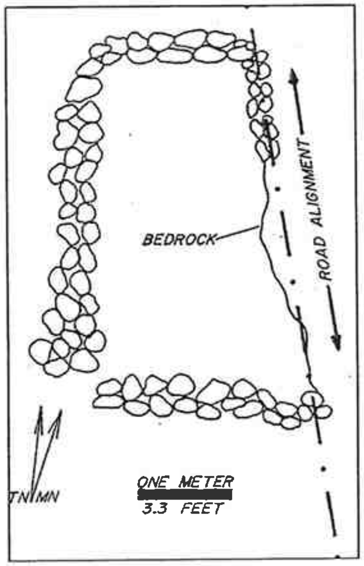


Figure 100. Plan map of SIHP 06961

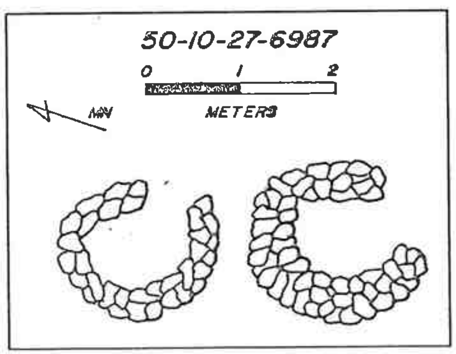


Figure 101. Plan view map of SIHP 06987 from Barrera 1980

completely dismantled in order to ascertain the nature of any archaeological deposits which might be located beneath them. The results were entirely negative; neither midden materials nor artifacts were found.

8.1.13 SIHP 50-10-27-10306 (Barrera 1987a:7-9)

This is a complex consisting of 11 features [Figure 102]. Midden remains or artifacts were absent, unless otherwise noted.

Feature A - This is a mound measuring 0.7 by 1.1 meters and standing to a height of 30 centimeters.

Feature B - This is a crude habitation shelter measuring 2.9 by 3.5 meters and standing to a height of 30 centimeters.

Feature C - This is a mound measuring 1.1 by 1.2 meters and standing to a height of 20 centimeters.

Feature D - This is a habitation shelter measuring 3 by 3 meters and standing to a height of 30 centimeters. Midden remains consist only of a few shells of a cowrie [*Cypraea caputserpentis*].

Feature E - This is a habitation shelter measuring 3.1 by 3.4 meters and standing to a height of 10 centimeters.

Feature F - This is a habitation shelter measuring 3 by 5.7 meters, and standing to a height of 20 centimeters.

Feature G - This is a habitation shelter measuring 2.9 by 3.6 meters and standing to a height of 20 centimeters.

Feature H - This is a habitation shelter measuring 2.4 by 2.6 meters and standing to a height of 30 centimeters.

Feature I - This is a mound measuring 80 by 90 centimeters and standing to a height of 60 centimeters.

Feature J - This is a habitation shelter measuring 2.5 by 3.8 meters and standing to a height of 40 centimeters. The only midden remains present are a few shells of a cowrie [*Cypraea caputserpentis*].

From Dye and Prasad (2000:9):

> The [Barrera 1987a] 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.

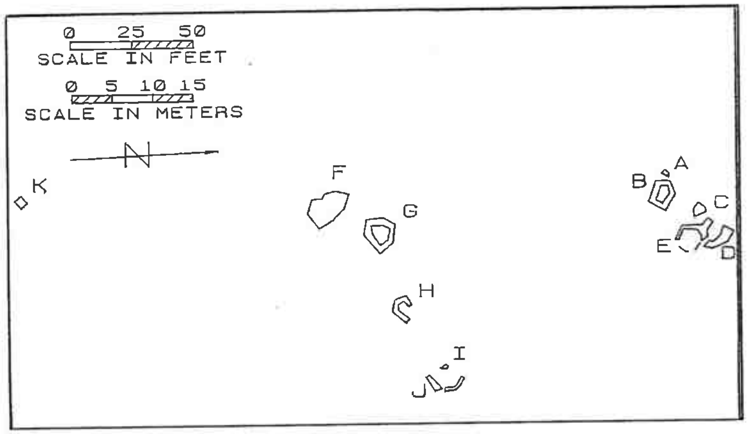


Figure 102. Plan map of SIHP 10306 from Barrera 1987a

8.1.14 SIHP 50-10-27-10675 (Barrera 1987b:2)

This is a hole excavated into the *pāhoehoe* bedrock measuring 1.2 by 1.4 meters and 0.7 meters in depth … No midden or artifacts were found in association with the site.

Its age and function are unknown, but it is probably prehistoric.

8.1.15 SIHP 50-10-27-10676 (Barrera 1987b:2-6)

This is a rock mound measuring 0.8 by 2.1 meters and standing to a height of 0.5 meters … It is constructed of basalt cobbles and slabs measuring between 15 by 20 and 25 by 35 centimeters. No midden or artifacts were found in association with the site.

Its age and purpose are unknown, although it may have functioned as a prehistoric trail marker.

8.1.16 SIHP 50-10-27-10677 (Ching and Rosendahl 1968, Barrera 1987b, 1990)

From Ching and Rosendahl 1968:12):

[T2] Located about 250 feet SE of the centerline, this lava tube cave consists of three small chambers of roughly equal size, aligned in a NE-SW orientation. The depression leading to the entrance has scattered deposits of shell material. The cave entrance leads down a short series of well built steps to the *pāhoehoe* floor of the central chamber. The NE chamber yielded more cultural material then the other two. This chamber was apparently walled up at one time, and now contains

the few remains of a very disturbed burial. Finds include human vertebrae and small bones, human teeth, very small glass beads (green, white, yellow and black), a possible *kōnane* game stone and two bone picks or awls. The middle chamber yielded two finds, a wana file and a human tooth, and the SW chamber, two possible coral rubbing stones and a possible pitching game stone (quoit).

From (Barrera 1987b:6):

This is a habitation cave with a living area measuring 5 by 10 meters and with a maximum ceiling height of 1.4 meters … Low lava tubes extend for approximately 10 meters from the two ends of the cave. An unidentified fern is growing in a moist area on the cave floor at one side of the site. An arrangement of stones forms a stairway providing access via the 5-meter drop into the cave through the roof. Midden remains are scarce to moderate and probably extend to a maximum depth of no more than ten centimeters. They consist of the shells of a cowrie (*Cypraea caputserpentis*), a limpet (*Cellana exarata*), a nerite (*Nerita picea*), and a toothed pearl (*Isognomon californicum*), plus sea urchin tests (*Echinodermata*), fishbone, fragments of coral, nuts of *kukui* (*Aleurites moluccana*), a pandanus key (*Pandanus odoratissimus*), fragments of desiccated wood, small quantities of ash and large quantities of charcoal. A small pile of debris indicates that the site has been vandalized.

The site probably functioned as a temporary shelter, and, based on dated sites along the coast near Keāhole Point, the period of utilization was probably sometime between the sixteenth and eighteenth centuries.

From Barrera (1990:7-11)

This is 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 [Figure 103]. 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. Low lava tubes extend for approximately 10 meters from either end of the cave. An unidentified fern is growing in a moist area at one side. 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. Five individual features were recorded:

Feature A - This is a stone mound measuring 1.2 by 2.9 meters [3.1 square meters] and standing to a height of 60 centimeters.

Feature B - This is an alignment of basalt rocks measuring 0.4 by 3.2 meters and standing to a height of 20 centimeters. A small bubble with a maximum ceiling height of about 40 centimeters is located adjacent to the feature.

Feature C - This is a stone mound measuring 1.2 by 3.8 meters [3.4 square meters] and standing to a height of 40 centimeters.

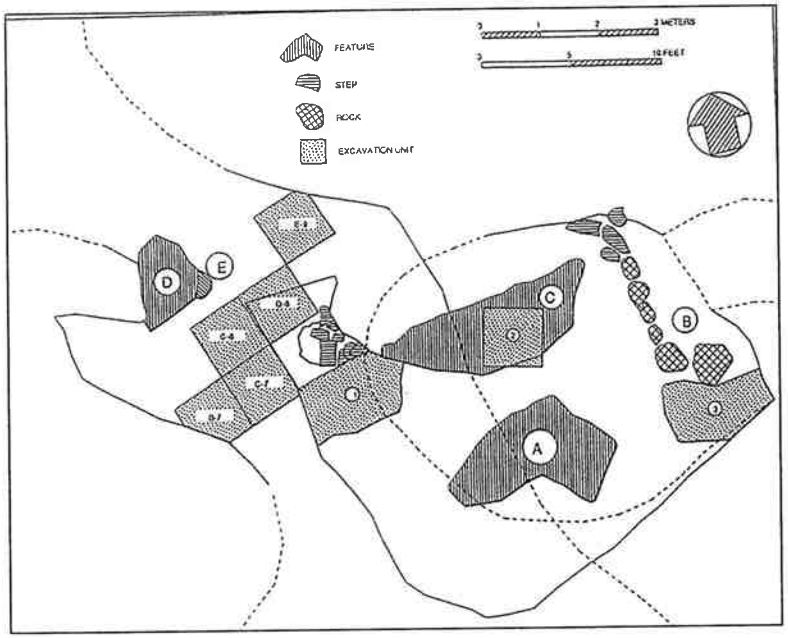


Figure 103. Plan map showing features and test units at SIHP 10677

Feature D - This is a stone mound measuring 1.0 by 1.7 meters [1.2 square meters] and standing to a height of 45 centimeters.

Feature E - This is a crude hearth consisting of a deposit of ash and charcoal measuring 0.25 by 0.50 meter situated adjacent to a fire-blackened upright basalt slab.

Midden remains were scarce and discontinuous, with no real concentrations that might properly be described as deposits. Materials were collected from four areas in the open section of the site:

• Excavation Unit 1 was a thin scatter of midden, no more than 5 centimeters in maximum depth, located adjacent to the entrance of the cave

• Excavation Unit 2 was a one meter square excavated in Feature C

• Excavation Unit 3 was situated so as to collect materials from beneath a small collapsed section of the lava bubble lip

• All of Feature A was dismantled and the materials beneath collected

Materials were collected from seven areas within the cave:

• Squares B-7, C-7, C-8, D-8 and E-9

• Feature D was dismantled and the materials beneath collected

• All of Feature E was excavated

Twenty-seven artifacts were recovered from the site. This includes three fishhooks [two of bone (one was Head Type 4) and one of pearlshell (Head Type 4)], five abraders [three of coral and two of echinoid spines], fifteen coral manuports, one piece of worked bone, one basaltic glass core, one basalt adze flake and one piece of burned wooden twig, probably a torch.

Thirteen of the artifacts were found in the cave interior [six of the coral manuports, all five of the abraders, the worked bone fragment and the wooden torch] and fourteen were found in the exterior [nine of the coral manuports, all three of the fishhooks, the basaltic glass core and the adze flake].

Radiocarbon analysis of charcoal from Excavation Unit C-8 suggests that the period of utilization of the site was between A.D. 1430 and A.D. 1650.

8.1.17 SIHP 50-10-27-10678 (Barrera 1987a, 1990)

From Barrera (1987b:6):

> This is a cave measuring 5 by 6 meters with a ceiling height of 2.1 meters. A low lava tube extends to the west from the main chamber. Entrance is via a human-excavated hole in the *pāhoehoe* bedrock ... below which is a pile of rocks placed for ease of access. The only midden present, and the only other evidence of human utilization at all, is a single unidentified marine shell on the bare floor of the site.
>
> The site's age and function are unknown, but it is probably prehistoric.

From Barrera (1990:11):

> This is a cave measuring 5 by 6 meter with a ceiling height of 2.1 meters. A low lave tube extends to the west from the main chamber. Entrance is via a human-excavated hole in the *pāhoehoe* bedrock, below which is a pile of rocks placed for ease of access. No midden or artifacts were found.

8.1.18 SIHP 50-10-27-10679 Ching and Rosendahl 1968, Barrera 1987a, 1990)

From Ching and Rosendahl (1968:13):

> [T3] This site, a possible refugee cave, is at the mouth of an extremely large lava tube. The tube itself appears to head toward the ocean, perhaps under the southern

part of the *pāhoehoe* upon which the airport is to be built. The low entrance to the cave has much scattered shell material.

The first 5 to 10 feet of the cave floor appeared to be fill, but after descending the pile of stone to the actual floor of the tube, we turned, and facing the entrance, it became apparent that the pile was actually a wall approximately 8 feet high, broken down at the top. Two coconut half shells (possible drinking cups) were found against the south wall of the tube on the leveled off portion of the built-up wall at the entrance.

The lava tube from this point on is very large, roughly 25 feet wide and averaging some 30 feet high. The tube extends *makai* for an estimated 750 to 800 feet, to a point where it radically constricts to a height of about 1 ½ feet and conveys a strong current of fresh air.

A coral saw was found about 100 feet from the entrance. On the floor, about 600 feet from the mouth, an *ahu* marked a small pool formed by water seepage dripping from the cave roof. A coconut shell half was discovered behind the ahu against the south wall of the tube, possibly having once been used as a catchment or cup. This shell half was similar to the two found at the entrance.

[T4] This large lava tube has not been explored extensively. It is roughly 25 feet high, and 25 feet wide. Its extent is not yet known.

The entrance is a 20 foot break into the tube on what is a relatively flat *pāhoehoe* flow. A large *noni* tree grows through the opening, and there is a heavy concentration of fern growing just inside the entrance.

Two geometric petroglyphs are found on the surface rock, one on either side of where one descends into the tube. Inside were found circular arrangements of rocks located where water drips from the ceiling. These possibly represent bases or supports for catchment vessels. Associated with these features are pieces of broken pottery, which may provide a basis for comparative dating.

From Barrera (1987b:10):

This is a lava tube extending for a distance of approximately 300 meters. It measures up to 6 meters in width and has a ceiling varying in height between about 0.5 and 3 meters. Midden remains, which were found as isolated specimens throughout the entire length of the site, consist of shells of a cowrie (*Cypraea mauritiana*), a limpet (*Cellana exarata*) and a nerite (*Nerita picea*), fragments of coral, a fragment of gourd (probably *Lagenaria siceraria*) and fragments of desiccated wood. No deposits of midden were found. Access to the site is through two places where the roof has collapsed, designated as Features A and B .... Human modifications consist of a crude stone wall immediately inside the seaward overhang of the easternmost entrance [Feature A] and four petroglyphs consisting of lettering at Feature B ... Because of its size and complexity the site could not be mapped in the time available.

The absence of any midden deposits and the distance from the coast suggest that the site was used as a temporary shelter. Based on dated sites along the coast near Keahole Point and the historic petroglyphs at Feature B, the period of utilization was probably sometime between the sixteenth century and the middle of the nineteenth century.

From Barrera (1990:11-25):

This is a lava tube, the utilized portion of which extends for a distance of approximately 210 meters and covers an area of about 2817 square meters (Figure 104 and Figure 105). 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 just west of Sample Location 2, the cave is only 40 centimeters high. Water constantly drips through the roof of the cave, primarily as a result of condensation. This dripping is most pronounced in the area between Sample Locations 2 and 10.

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 [96.4 square meters], across the constricted west end of which has been built a stone platform [Feature J]. This platform measures 2.8 by 4.0 meters [9.7 square meters] and stands to a height of 1.0 meter on the east side and 1.5 meters on the west. At some time [probably subsequent to the aboriginal occupation of the site] some of the rocks of the platform had been removed and stacked on top against the cave wall on the south side, apparently to provide easier access to the lava tube. The floor of the chamber is covered with rockfall, and midden remains are thinly scattered throughout the entire area. The only true midden deposit was found on the south side of the chamber just inside the drip line.

Access to the west end of the tube is gained through a large hole in the roof. A very large noni [*Morinda citrifolia*] tree is growing on the cone-shaped pile of rubble resulting from the roof collapse that formed this entrance.

Nine individual features were recorded, in addition to the platform:

Feature A - This is a stone mound measuring 1.2 meters in diameter and standing to a height of 1.0 meter. It is constructed of boulders measuring as much as 80 by 100 centimeters.

Feature B - This is a stone mound measuring 1.0 by 1.1 meter and standing to a height of 75 centimeters. It is constructed of boulders measuring about 40 by 50 centimeters. A single shell of a *Cellana sp.* was found adjacent to the feature.

Feature C - This is a stone cairn measuring 40 by 40 centimeters and standing to a height of 60 centimeters. Most of this height is accounted for by a single upright basalt slab.

Feature. D - This is a stone mound measuring 0.9 by 1.0 meter and standing 75 centimeters high. A single shell of a *Cellana* was found adjacent to the feature.

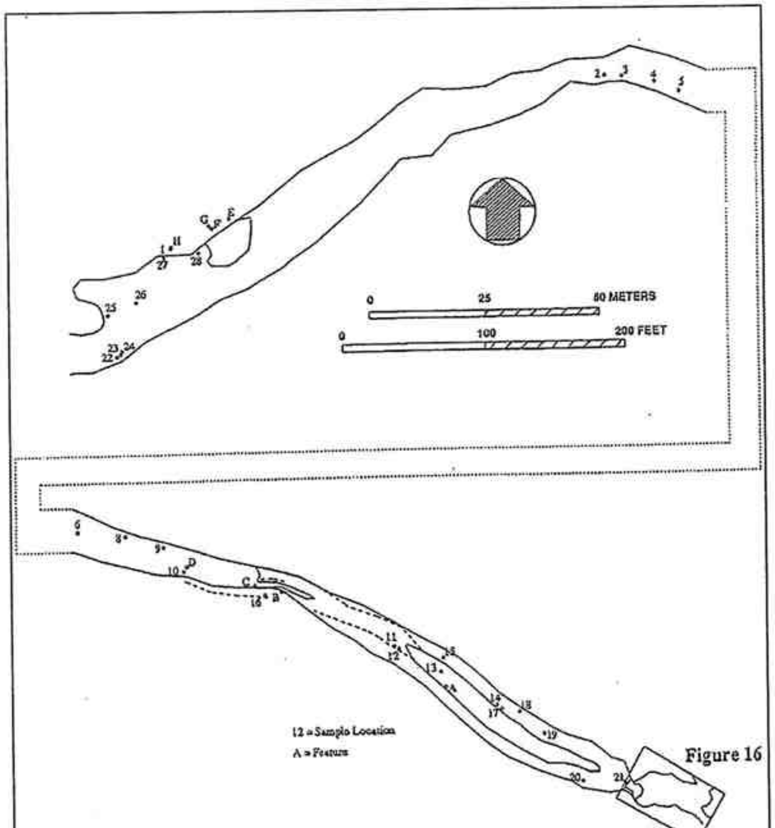


Figure 104. Plan map of SIHP 10679 from Barrera 1990:10

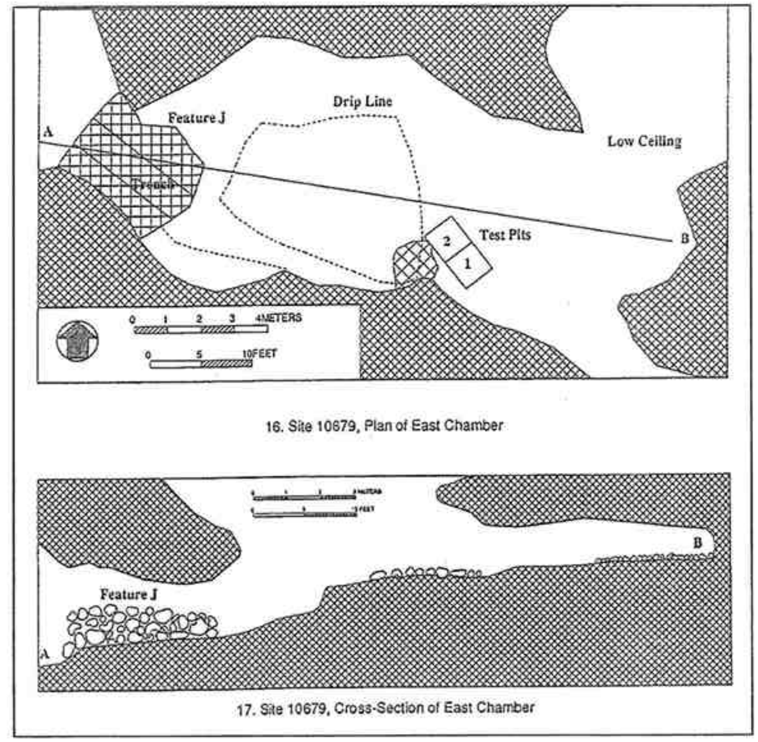


Figure 105. Figures showing portion of SIHP 10679 from Barrera 1990:11

Feature E - This is a petroglyph consisting of an oval with a bar across the narrow dimension. It measures 8 by 15 centimeters.

Feature F - This is a petroglyph consisting of an oval measuring 10 by 15 centimeters.

Feature G - This is a pecked area measuring 30 by 40 centimeters.

Feature H - This is a petroglyph consisting of a capital letter "A" measuring 12 by 20 centimeters.

Feature I -This is a petroglyph consisting of five alphabetic characters. The first is unclear, the remainder are "OIAN." It measures 15 centimeters in height and is 80 centimeters wide.

Feature H and I are so close together that it is possible that they represent a single word.

In addition to these formal features, other materials were found at various locations in the tube. These have been designated as Sample Locations...

...All of the charcoal samples were found either as individual occurrences or in thin, rather broad concentrations that suggest that they were deposited from burning torches. No evidence of hearths or firepits were observed in the lava tube interior.

Most, if not all, of the bird bones probably represent individuals who flew into the tube and were unable to find their way out. With the exception of the possible *Bulweria bulwerii* bones from Sample Location #15, which were found in association with crustacean remains, all of the bird bones were isolated from any possible cultural materials. The water-saturated condition of the bones and the fact that they were nestled in narrow cracks and crevices in the cave floor prevented complete collection of entire identifiable skeletons, but these were probably present.

The uniformly very large size of the *Cellana* and possible *Ostrea* remains and the scarcity of other midden shells in the tube interior suggest that these specimens were selected and transported to the site to be used as artifacts, probably as ladles or scoops for the collection of water.

In addition to the surface collection of materials from the sample locations, two test pits were excavated in the midden deposit in the east chamber and a trench was excavated through the platform.

Excavation Unit 1 produced no shell midden, 6.4 grams of *Aleurites moluccana* shell, 39.5 grams of unidentified wood twigs and one basalt abrader [Catalogue #1]. The fill was angular basalt cobbles in point to point contact, except for a shallow ash concentration resting on bedrock.

Excavation Unit 2 produced 9.9 grams of *Cellana* sp., 29.4 grams of *Aleurites moluccana* shell and 69.2 grams of unidentified wood twigs. The fill was angular basalt cobbles in point to point contact.

The trench in the platform produced 118.9 grams of *Cellana* sp., 10.2 grams of charcoal, 10.3 grams of *Cocos nucifera* shell, two clumps of unidentified grass weighing 0.4 gram, 0.7 gram of charred unidentified grass, 0.5 gram of charred unidentified vegetal material and 209.3 grams of unidentified wood twigs. The fill was angular basalt cobbles and boulders in point to point contact.

Twenty-six artifacts were recovered from the site. These include three abraders [one of basalt and two of coral], four manuports [three of coral and one of basalt], one adze preform fragment, one pearlshell fishhook blank and one pearlshell

fishhook tab, two pearlshell bonito lure fragments, two metal cans, one fireplow, ten torches and several plank fragments.

Radiocarbon age dating analyses were performed on two samples. A charcoal sample from Sample Location 5 indicates utilization of the site some time during the period from A.D.640 to A.D.1390. Charcoal from Sample Location 20 indicates a period of utilization sometime between A.D.781 and A.D.1385. These dates make this site perhaps the earliest in the area. Coastal remains in Kalaoa and Ooma studied in 1987 indicate temporary habitation from the middle of the sixteenth century [Barrera 1988a], and agricultural sites on the slope of Hualālai in Kohanaiki apparently date from the last quarter of the fifteenth century [Barrera 1988b]. Site 262, a lava tube with a wall restricting access located approximately 900 meters to the east at an elevation of about 60 meters was being utilized at the turn of the eighteenth century and Site 6418, a lava tube with interior petroglyphs located approximately 1500 meters to the east at an elevation of about 90 meters was in use between about A.D.1480 and the turn of the nineteenth century [Hammatt and Folk 1980].

The relatively scarce artifactual and midden remains at this site suggest that its use was only temporary, and it cannot properly be classified as a domestic site in the strict sense. The east end of the tube was probably used for temporary habitation by people in transit between inland agricultural fields on the slopes of Hualalai and the coast, who used the interior of the tube for the collection of drinking water. The west end of the tube was used only sporadically, again probably by people passing back and forth between the coast and the inland areas during both the historic and prehistoric periods. Evidence of historic period utilization of the tube was present in the form of metal cans in the east tube interior, again probably for collecting water, and petroglyphs consisting of lettering outside the entrance to the west end of the cave.

8.1.19 SIHP 50-10-27-10680 (Barrera 1987b:10)

This site consists of two excavations into the *pāhoehoe* bedrock, situated at a distance of 13 meters from each other.

Feature A- This excavation measures 1.7 by 4.6 meters and is 0.3 meters deep ...

Feature B-This excavation measures 0.8 by.1.4 meters and is 0.6 meters deep ...

Neither midden nor artifacts were found in association with the site.

The site's age and function are unknown, but it is probably prehistoric.

8.1.20 SIHP 50-10-27-15259 (Barrera 1993:5-6)

This is a roughly square concentration of waterworn basalt and coral pebbles measuring about 0.8 meter on a side ... The concentration is at the most only two fragments deep. The only shell found was a single bleached piece of unidentified shell containing many wormholes, suggesting that its occupant was deceased at the time of its collection and therefore the specimen does not represent food remains.

The function of this feature is unknown, but it seems likely that it was functionally associated with the Mamalahoa Trail in some way. It may have been the equivalent of a milepost, or might perhaps even represent a marker to measure the progress of trail construction.

8.1.21 SIHP 50-10-27-15260 (Barrera 1993:6)

This site includes four features covering an area of 11 by 25 meters [275 square meters] (Figure 106).

Feature A - This is a collapsed lava bubble … measuring 2.6 by 6.7 meters [16.3 square meters]. On the north side is a low sheltered area measuring 1.2 by 3.8 meters [2.5 square meters], and on the east side is an 80 centimeter high lava tube that extends for a distance of at least 6 meters. Midden remains are present, but sparse, and the deposit in most places is only one shell deep. The remains include the shells of *Nerita picea*, *Helcioniscus exaratus*, *Cypraea caputserpentis*, a fragment of a large *Conus* sp. and specimens of *Echinodermata*. Artifacts present include coral and waterworn basalt manuports, and a waterworn basalt boulder with a series of shallow grooves ground or pecked into its perimeter. Ash and charcoal are present in small quantities.

The feature is probably a temporary habitation shelter.

Feature B - This is a collapsed regular mound built of stacked angular basalt cobbles and boulders [Photograph 37]. It measures 1.8 by 1.8 meters [2.3 square meters] and at the time of recording stood to a height of 0.8 meter. Subsequent excavation revealed that the structure originally stood only 0.5 meter high, the remainder having been added recently. Midden remains nearby consist of the shells of *Cypraea caputserpentis*, *C. mauritiana*, *Nerita picea*, plus coral pebble manuports and one basalt flake.

The structure was dismantled to test for the presence of a human grave. This revealed that someone had recently added basalt cobbles to the top of the feature, giving it its rather crude appearance. A clump of very old plastic surveyor's ribbon [probably from an archaeological survey. undertaken during airport construction in 1969] was found beneath these added rocks, sitting on what must have been the surface of the structure at the time of that survey. The interior contained no evidence of a human grave, and it had not been constructed over any cavity in the underlying bed-rock in which a skeleton might have been located. Midden remains were present on the *pāhoehoe* surface beneath the structure; these undoubtedly represent a continuation of the general midden scatter found over the site area as a whole.

Feature C - This is a concentration of angular basalt pebbles and cobbles … measuring 2.9 by 2.9 meters [7.8 square meters] and standing to a height of between .15 and .25 meter.

The feature may have been the foundation for a habitation structure; or might have been the location of a work area of some sort.

Feature D - This is an irregular mound … measuring 0.9 by 1.4 meter [1.0 square meter] and standing to a height of 0.5 meter. It is constructed of stacked angular basalt pebbles, cobbles and slabs on the edge of a 1.5 meter high bedrock bluff.

The function of this feature is unknown.

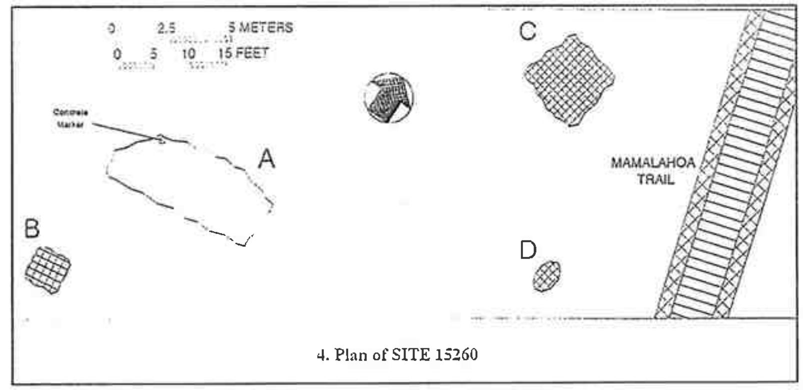


Figure 106. Plan map of SIHP 15620 (from Barrera 1993:5)

The interpretation of function for the site depends entirely on its age, which is at present not known. If it is prehistoric in age, it would represent a fairly unusual habitation complex because of its location in tlle barren zone between the coast and tlle uplands. If it is historic in age, it prob— [REMAINDER OF SITE DESCRIPTION MISSING].

8.1.22 SIHP 50-10-27-19943 (from Altizer and Monahan 2011:132)

SIHP# 50-10-27-19943 was first formally described by CSH in 1995 (Walsh and Hammatt 1995) ... The site was revisited during the archaeological inventory survey by Monahan et al. (2011) and found to be in the same physical condition … The site was described by Walsh and Hammatt (1995:39, 42) as follows:

> Site 19943 is a utilized lava tube located within undulating, gently seaward sloping *pāhoehoe* terrain. The lava tube is oriented *mauka-makai* (northwest-southeast). Access to the tube is gained from an entrance formed by a ceiling collapse . . . The lava tube entrance is located 160 feet (49 m.) from the *makai*, or eastern edge of the present highway pavement.

The lava tube (Figure 107) contains four interior features including a mound, an alignment, an ash deposit and a surface scatter of midden. See Appendix B of the report by Monahan et al. (2011) for detailed descriptions and dimensions of these features. One 1.0 m^2 hand-excavated test unit was dug into the mound (Feature A) "to determine the presence or absence of human remains" (Walsh and Hammatt 1995:42). No human skeletal remains or cultural materials of any kind were identified in excavation.

Walsh and Hammatt (1995) recommended SIHP# 19943 eligible for the National and State Registers of Historic Places under criterion D for its information relevant to prehistory and history. Monahan et al. (2011) concurred with this significance recommendation. The site was recommended for data recovery by Walsh and Hammatt (1995); however, the Final Archaeological Treatment Plan (1999) called for "interim protection" only with no data recovery. Monahan et al. (2011) recommended preservation for this site in order to save potential subsurface deposits for future investigators that may possess superior archaeological techniques compared with current standards.

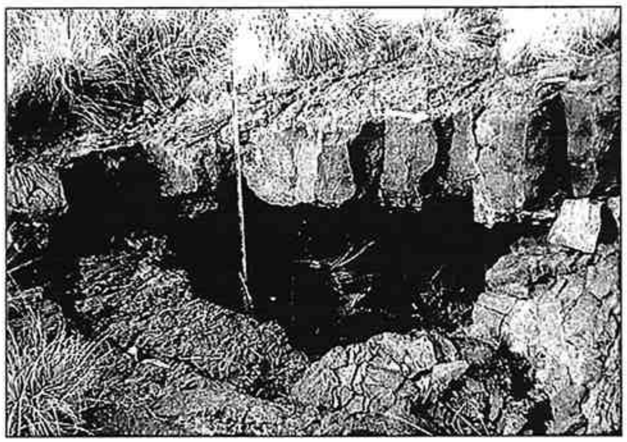


Figure 107. Photo of SIHP 19443 from Altizer and Monahan 2011:133; view to the west

8.1.23 SIHP 50-10-27-19944 (from Walsh and Hammatt 1995:56)

Description: Site 19944 consists of two mounds designated features A and B (Figure 108). The mounds are situated at the interface of a *pāhoehoe* and an *'a'ā* lava flow. The mounds are aligned in a roughly north-south direction and are 4.7 m. apart (center to center). Both are constructed of loosely piled small boulders, cobbles and pebbles.

Feature A mound is the northernmost and largest of the two mounds. It measures 1.2 m. NIS by 1.45 m. E/W with a maximum height of 0.35 m. This feature was tested for the presence of human remains (see Testing Results section following). Feature B mound is smaller, measuring 1.2 m. NIS by 1.0 m. E/W with a maximum height of 0.35 m.

This site is located approximately 6.0 m. *makai* of 19945 petroglyphs, and may have functioned as a marker for the petroglyph site, or perhaps a marker for a nearby trail, although a trail has not been identified in close proximity to this site during this or previous archaeological surveys.

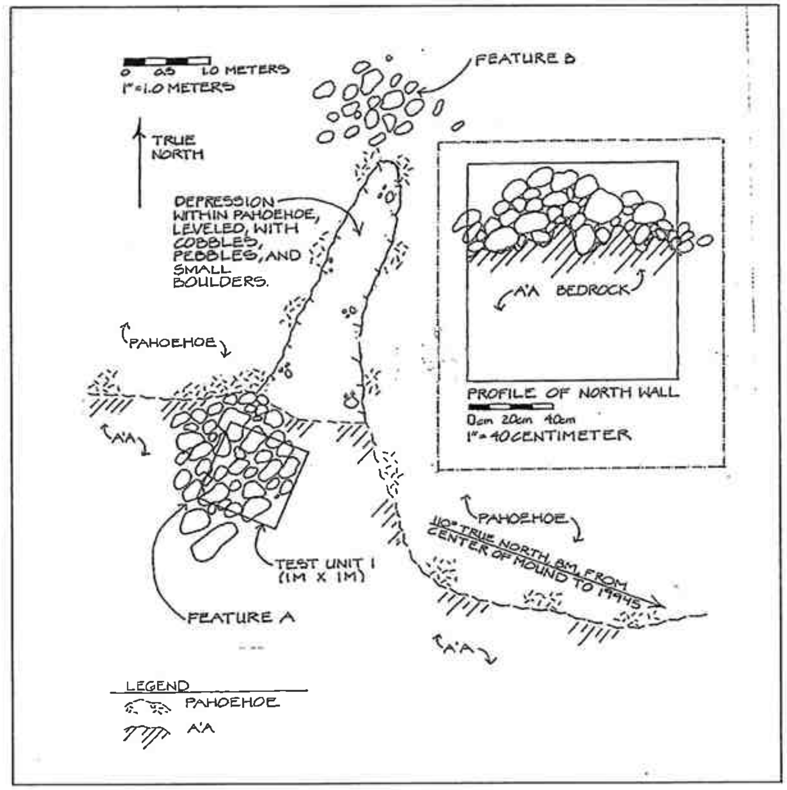


Figure 108. Plan map and test unit profile drawing of SIHP 19944 from Walsh and Hammatt 1995:57

Testing Results

A single 1.0 m^2 test unit, designated Test Unit 1, was hand excavated within Feature A mound to determine the presence or absence of human remains. The test unit was placed over the east-central portion of the mound ... Excavation consisted of dismantling a 1.0 m^2 portion of the mound structure to bedrock, which was encountered between 0.25 and 0.35 m. below the mound surface ...

The mound was found to be loosely constructed of small boulders, cobbles and pebbles resting directly on the undulating *'a'ā* lava surface. No soil strata were encountered. No human remains were encountered. A possible coral abrader and a small amount of midden was found at the base of the mound within the *'a'ā* bedrock. The midden consisted of 1.9 gms. of *kukui* endocarps, 1.7 gms. snakehead cowry (*Cypraea caputserpentis*), and 1.7 gms. sea urchin (Echinoderm).

Based on the testing results, the location of the site, and the lack of formalized architecture, this site is interpreted as a marker, most likely built to mark the location of the nearby petroglyphs, or a presently indistinguishable trail. The midden may reflect a single or temporary use of the site or possibly a ritual offering.

8.1.24 SIHP 50-10-27-19945 (from Altizer and Monahan 2011:134)

SIHP# 50-10-27-19945 was first formally described by CSH in 1995 (Walsh and Hammatt 1995) ... The site was revisited during the archaeological inventory survey by Monahan et al. (2011) and found to be in the same physical condition (Figure 109). The site was described by Walsh and Hammatt (1995:47) as follows:

> Site 19945 consists of two petroglyph figures, designated Feature A and B, located on a low, horizontal *pāhoehoe* outcrop. The petroglyphs appear to be mostly pecked although some incising may have been employed. The figures are both human representations of the basic lineal type.
>
> *The petroglyphs are in good condition although there is a natural crack in the pāhoehoe* which partially extends through both figures. This site may be associated with Site 19944 mounds ... located 8.0 m. *makai*, which have been interpreted as markers.

Walsh and Hammatt (1995) recommended SIHP# 19945 eligible for the National and State Registers of Historic Places under criterion D for its information relevant to prehistory and history and criterion E (Hawai'i register only) for its cultural significance to Native Hawaiians. Monahan et al. (2011) concurred with this significance recommendation. The site was recommended for preservation "to the extent possible within the proposed highway widening plans" and "those portions of [the site] that cannot be avoided [should] be included in a program of data recovery" (Walsh and Hammatt 1995:57). The Final Archaeological Treatment Plan (1999), however, called for "interim protection" only for SIHP# 19945. Monahan et al. (2011) recommended preservation for this site.

Figure 109. Photo of SIHP 19945 from Altizer and Monahan 2011:135

8.1.25 SIHP 50-10-27-26737 (from Nakamura et al. 2009: 13-14, 28)

Site 50-10-27-26737 (Site 26737) is a segment of a linear steppingstone trail located within an *'a'ā kīpuka* surrounded by the historic *pāhoehoe* lava flow (Figure 110 and Figure 111). The *kīpuka* is amorphous in shape and measures about 11.0 m in diameter.

This site is located adjacent to the project's east boundary and just north and west of a bulldozed area at the project's southeast portion ... The trail segment is oriented roughly east/west and consists of a roughly-level *'a'ā* base of large pebbles to small cobbles ranging in size from 3.0 to 5.0 cm.

Embedded approximately 0.30 to 1.0 m apart on the trail's *'a'ā* lava base are eight rounded coral steppingstones (in the size range of large cobbles to small boulders). The coral steppingstones have relatively flat, even surfaces and measure 25.0 to 48.0 cm in diameter. One of the eight steppingstones at the east end of the trail has been partly obscured beneath a boulder adjacent to the pushed bulldozed section.

The trail segment measures approximately 6.50 m in length (E/W); the *'a'ā* base of the trail measures about 1.70 m wide (N/S). The exterior south side of the trail is bordered by medium *'a'ā* boulders, while the exterior north side is bordered by *'a'ā* cobbles. The *'a'ā* boulders and cobbles appear to be placed. The trail segment is disturbed by the existing *pāhoehoe* lava flow and by bulldozing, and ends at a bulldozed pushed pile on the east and the *pāhoehoe* flow to the west.

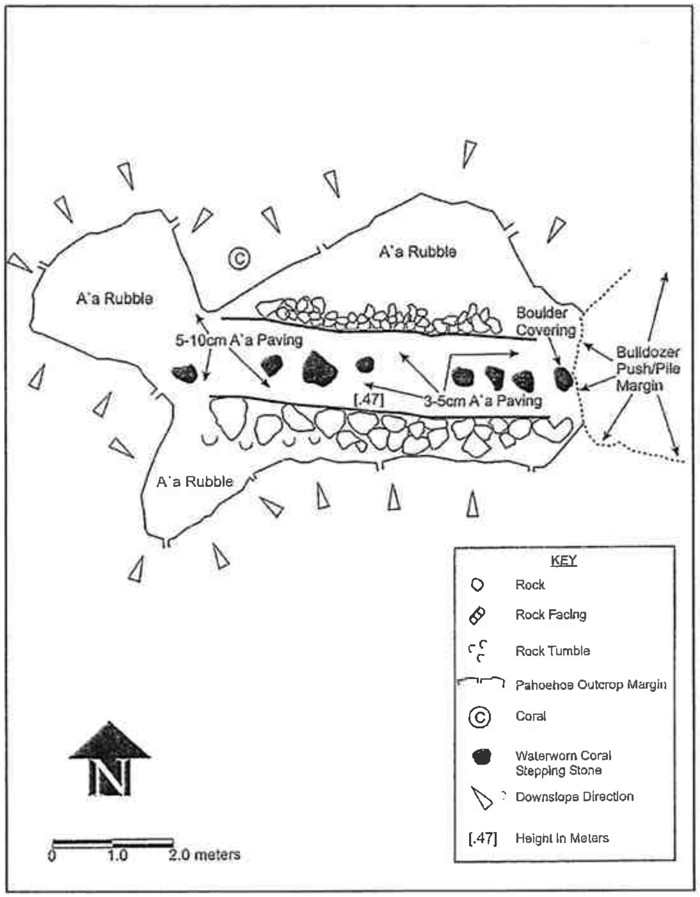


Figure 110. Plan map SIHP 26737 (from Nakamura et al. 2009:15)

Figure 111. Photo of SIHP 26737 (from Nakamura et al. 2009:16)

The intact segment of the trail, however, is in good condition. A small piece of coral located 1.70 m NNE from the trail's west end is present on the surface of an elevated *pāhoehoe* outcrop...

...Site 26737 , the steppingstone trail segment, is interpreted as a pre-Contact Hawaiian site, based on the construction technique and the presence of this type of trail ("Type A") in four of the districts of Hawai'i Island, including North and South Kona, Ka' ū, and Puna (Apple 1965). In his typology for Hawaiian trails, Apple (1965: Appendix 2) characterized "Type A" trails as follows:

1. Have many turns and a one-man width.
2. If on the coast, they follow shoreline configurations skirting inland around major land obstacles such as cliffs.
3. Coast-inland trails (*mauka-makai*) present within each *ahupua'a*.
4. *Kapu* (taboo) areas are not crossed by these trails.
5. Over soil areas, there is a recognizable trace with some deep ruts.
6. Over *'a'ā* flows, steppingstones are present, usually of smooth, waterworn stones (*'ala*).
7. Over *pāhoehoe* flows, usually no trace (followed easiest and shortest route); associated with filled crevices, low spots with causeways of rock (*kīpaepae*) with *pāhoehoe* slab steppingstones; occasional piles of rocks to mark trail; sometimes associated with petroglyphs.

The Site 26737 trail segment is interpreted as part of a probable *mauka-makai* transportation corridor. Its western extent and much of the eastern extent were obliterated by the 1801 *pāhoehoe* lava flow from Hualālai Volcano. While the age of this steppingstone trail cannot be ascertained through radiocarbon dating, it is a safe assumption that it was built later in the cultural sequence of Hawaiian occupation rather than in the earlier periods of Hawaiian settlement and occupation.

8.1.26 SIHP 50-10-27-26738 (from Nakamura et al. 2009:17, 20, 22, 28)

Site 26738 consists of four features - a wall segment (Feature 1), two excavated pits (Feature 2), and a cleared area (Feature 3) (Figure 112) -located within a small *'a'ā kīpuka* in the central portions of the project area just north of a bulldozed road running NE/SW (see Figure 3). This *'a'ā kīpuka* is amorphous in shape and measures 8.5 m (N/S) by 10.0 (EIW).

The wall segment is positioned along the west margin of the *kīpuka* and bends south abutting the *pāhoehoe* flow at the south end. Except for two faced segments on the north end, the majority of the wall is collapsed ... The wall is constructed of *'a'ā* cobbles and small boulders stacked three to five courses high along the north and one to three courses high along the south. It measures 6.8 m long (NE/SW) and 0.85 m wide. The wall ranges in height from 0.40 to 0.75 m, with lower portions of the wall found in the collapsed sections and higher portions of the wall found in the intact northern end.

The two pits (Pit 1 and Pit 2) are situated just south/southeast of the north end of the wall ... The pits are spaced approximately 1.0 m apart in the vicinity of a large boulder. Pit 1, the

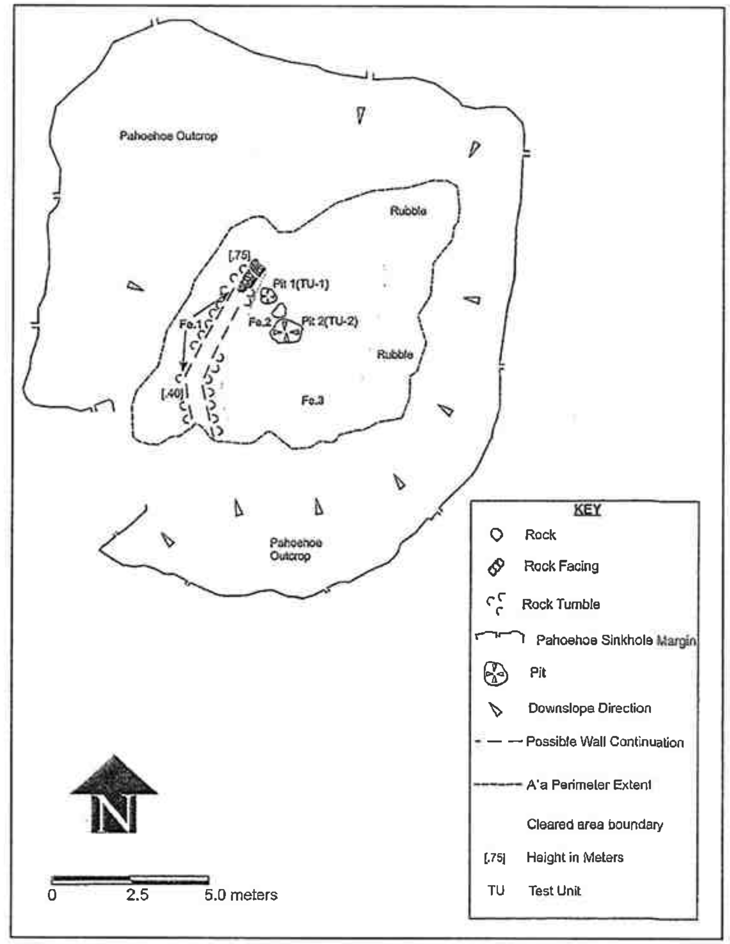


Figure 112. Plan map of SIHP 26738 (from Nakamura et al. 2009:18

northernmost and smallest of the two pits, measures 0.72 m (E/W) by 0.70 (N/S), and has a maximum depth of 0.67 m. Pit 2, the southernmost and larger of the two pits, measures 1.24 m (E/W) by 0.90 m (N/S), and has a maximum depth of 0.75 m. Pits 1 and 2 of Feature 2 were excavated during the survey ...

Feature 3 is a cleared area located just east of the wall; Feature 2 pits are located in the cleared area... *'a'ā* rubble bounds the east portion of the cleared area. This area has a fairly level surface consisting of 5.0 to 20.0 cm-diameter *'a'ā* cobbles, with a few larger cobbles and boulders intermittently present. The cleared area measures approximately 7.0 m (N/S) by 4.5 m (E/W).

The Feature 1 wall segment at Site 26738 is in poor condition and shows extensive collapsing; it has been disturbed by unknown forces, possibly earthquakes. The excavated pits (Feature 2) and the cleared area (Feature 3) are in good condition. No surface cultural material was observed at this site...

...Two test excavations, designated as Test Units 1 and 2 (TU-1, TU-2), were conducted in Feature 2 of Site 26738 ... The purpose of these excavations was to collect additional data to clarify the function of Feature 2 (the two pits) and the site complex as a whole. Feature 2 consists of two pits (Pits 1 and 2) excavated in the *'a'ā* lava present in the *kīpuka* in which this site is located ... TU-1 was excavated in Pit 1; TU-2 was excavated in Pit 2. The excavations within these two pits began at their bases (interior surfaces), and were accomplished by removing the *'a'ā* rock in arbitrary 20 cm levels ... The test units were not backfilled...

...Test Unit 1 (TU-1)

Test Unit 1 measures approximately 0.70 by 0.70 m (excavated area is approximately 0.49 square meters) and was excavated within Pit 1 of Feature 2. The excavations conducted within Pit I began at the base of Pit 1's interior and followed the pit's interior facing. No soil layers were encountered in TU-1 excavations. The rock matrix removed from TU-1 was nevertheless designated as Layer I, and consisted of a tightly compacted matrix of brown (7.5YR 5/2 to 7.5YR 4/5, dry), angular to subangular small to large *'a'ā* cobbles (with some small boulders), pebbles, and gravel, and a sparse quantity of coarse to find basaltic sand. Two excavation levels, each approximately 20.0 cm in thickness, were removed before excavations were terminated at approximately 98.0 cmbs, or about 45.0 to 65.0 cm below the base of Pit I ... Large *'a'ā* boulders or bedrock were not encountered. TU-1 excavations were terminated due to unsafe conditions.

Sparse faunal and floral materials were encountered in Layer I, Level 1 (Layer I/1) in TU-1 excavations. Faunal remains recovered include a very small amount (less than 0.2 g) of weathered marine shell fragments, including crab shell (at approximately 50.0 cmbs) and mollusk remains (at approximately 68.0 cmbs). A single *kukui* nut fragment was also recovered from Layer I /1 (at approximately 70.0 cmbs).

In addition, two manuports, identified as beach rock, were recovered from Layer I/2 (at approximately 95.0 cmbs). No artifacts were encountered during TU-1 excavations.

Test Unit 2 (TU-2)

Test Unit 2 measures approximately 0.90 by 0.90 m (excavated area is approximately 0.81 square meters), and was excavated within Pit 2 of Feature 2. Excavations within Pit 2 began at

the base of Pit 2's interior and followed the pit's interior facing. Although Pit 2 measures approximately 1.24 by 0.90 m, only the west portion of Pit 2 was excavated due to precarious boulders and cobbles situated along the north and south sides of the pit's edge.

As in TU-1, no soil layers were encountered in TU-2 excavations. The same Layer I rock matrix observed in TU-1 was observed in (and excavated from) TU-2 – a tightly compacted matrix of brown (7.5YR 5/2 to 7.5YR 4/5, dry), angular to subangular small to large *'a'ā* cobbles (with some small boulders), pebbles, and gravel, and coarse to find basaltic sand. Two excavation levels, each approximately 20.0 cm in thickness, were removed before excavations were terminated at approximately 110.0 cmbs, or about 35.0 to 70.0 cm below the base of Pit 2 (see Figure 10). Large *'a'ā* boulders or bedrock were not encountered. Excavations in TU-2 were terminated due to unsafe conditions.

No floral or faunal remains were recovered from TU-2. However, two manuports were encountered. The larger manuport is a rounded, fairly smooth basalt cobble encountered at approximately 70.0 cmbs, or about 5.0 cm into Layer I11, near the northwest corner of TU-2. The smaller manuport is a beach rock fragment with calcite crystals recovered from Layer I12 (approximately 95.0 cmbs) in the central north portion of TU-2. No artifacts were observed...

...Site 26738 is a small complex of four features in an *'a'ā kīpuka* that includes a wall segment (Feature 1), two pits excavated into the *'a'ā* flow (Feature 2), and a cleared area (Feature 3). A portion of the *'a'ā* matrix below the base of the two pits (Feature 2) was excavated and traditional Hawaiian faunal and floral materials, as well as basalt and beach rock manuports, were recovered. This site is interpreted as a probable pre-Contact traditional Hawaiian site.

8.1.27 SIHP 50-10-27-26868 (from Escott and Keris 2009:19)

Site 26868 is located on the slabby *pāhoehoe* surface of the project area (Figure 113) ... The site consists of three (Feature 1,2, and 3) small *pāhoehoe* excavations situated along the southwestern edge of the study area ... The site measures approximately 15.0 m long (NW/SE) by 9.0 m wide, and is 0.15 m maximum depth below the ground surface. The three features are small areas of slabby *pāhoehoe* that are naturally cracked and loose on the ground surface. They appear as small subangular slabby cobbles and small boulders resting upside down on the ground surface.

The only obvious human modification is that they were flipped over and left on the ground next to where they were lying. It does not appear that any material was taken away from the area. These represent an exploratory human action and no quarrying or tool manufacture is associated with these features.

Feature I is a 3.2 m long (E/W) by 2.5 m wide area of disturbed slabby *pāhoehoe* located along the southeast edge of the study area ... Feature 2 is a 1.5 m long (E/W) by 104m wide area of disturbed slabby *pāhoehoe* located 1.3m southeast of Feature I ... Feature 3 is a 5.3 m long (N/S) by 2.3 m wide area of disturbed slabby *pāhoehoe* located 2.9 m southeast of Feature 2.

Figure 113. Overview photo of SIHP 26868 from Escott and Keris 2009:20; view to the north

8.1.28 SIHP 50-10-27-28568 (from Clark et al. 2011:18-21)

The investigations at Site 28568 documented a small overhang shelter created by a cavity along the leading edge of an elevated, irregular, *'a'ā* flow (Figure 114). The edge of the *'a'ā* flow averages approximately 2.0 m in height, and is positioned on the south side of Borrow Pit 1 … and partly covers an earlier *pāhoehoe* flow that forms a lower, relatively level surface in front of the shelter. Site 28568 consists of three features: Feature 1 is the interior portion of the overhang shelter. Feature 2 is a stacked wall of *'a'ā* and *pāhoehoe* boulders and cobbles that encloses the shelter opening. Feature 3 consists of four smooth, rounded basalt boulders situated just outside the entrance. These boulders resemble boulders used in stepping stone trails.

On the *pāhoehoe* flow, situated immediately outside of the overhang shelter, was a low density scatter of marine shell and gravel-sized coral fragments. The marine shell fragments that were observed, but not collected, and included *pipipi* (*Nerita picea*), cowry (*Cypraea spp.*), and *'opihi* (*Cellana spp.*).

The survey also noted the presence of coral pieces (pebble and cobble size) placed on the *'a'ā* flow approximately 15.0 m west of the cave shelter (Site 28568). Approximately six pieces were noted. A broken, smooth basalt boulder was also noted on the edge of the *'a'ā* flow approximately 6.0 m west of Site 28568. This boulder, although broken, is similar to those observed in Feature 3. In addition, an aluminum pot, possibly historical in age, was found at the edge of the *'a'ā* flow approximately 4.0 m west of Site 28568.

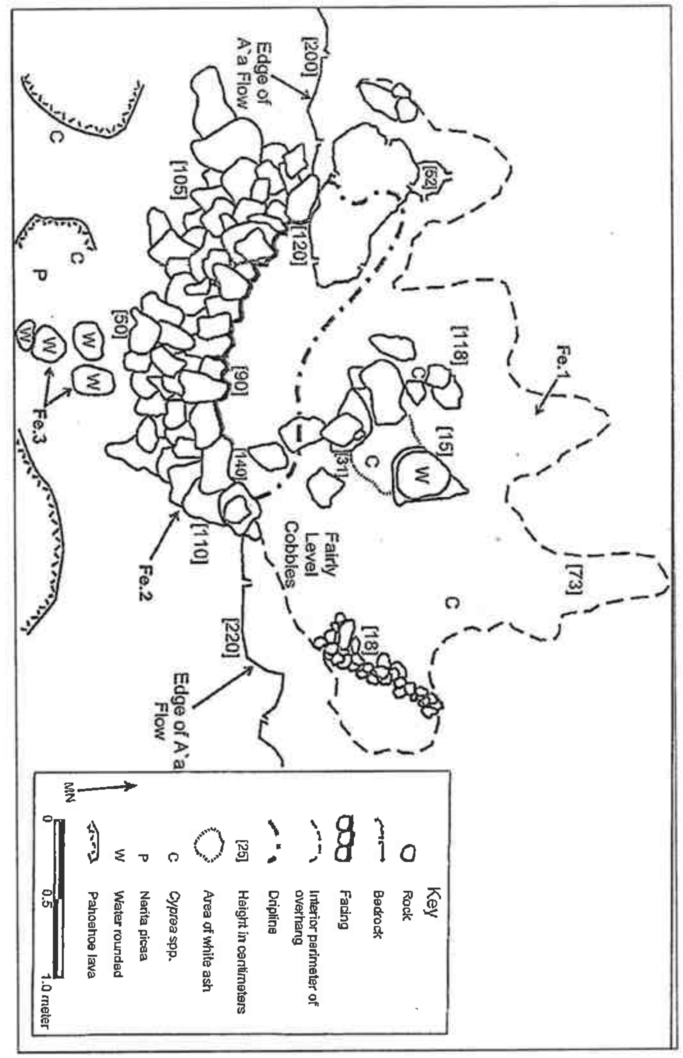


Figure 114. Plan map of SIHP 28568 (from Clark et al. 2011:22)

Feature 1

Feature 1 consisted of the interior area of the overhang, likely used as a temporary shelter. The overhang opening measured approximately 2.60 m (east/west) and opens to the south. The recessed interior area expands from the opening reaching a maximum width of approximately 4.0 m across the interior floor (east/west) ... The shelter's interior reaches a maximum height of 1.56 m along the drip line, near the center of the shelter opening. The ceiling of the shelter descends rapidly to an irregular floor at the back of the overhang. *'A'ā* bedrock is present in the shelter's interior.

From front to back, the interior floor of the shelter reaches a maximum depth of 3.0 m, measured from the interior face of the enclosing wall (Feature 2) to the deepest recess in the northeast part of the interior. The western interior section had been partitioned off with a low, roughly stacked alignment of *'a'ā* cobbles measuring about 18.0 cm in height. A narrow, inaccessible passage in the *'a'ā* bedrock separates the eastern-most section of the interior from the primary interior area. A rough alignment of tabular *'a'ā* slabs divide the central area of the shelter floor.

Immediately to the east of this alignment, in the central area of the shelter's interior, a water worn basalt boulder has been placed on a small *pāhoehoe* slab forming what may have been a low "seat," 15.0 cm in height ... The floor surrounding the basalt boulder seat consists of well-sorted *'a'ā* pebbles and small cobbles ... On the floor adjacent to the boulder (south) is a surface scatter of what appears to be white ash.

The remainder of the interior shelter floor is level and consists of small *'a'ā* gravels, pebbles, and cobbles. Faunal and floral remains identified on the shelter floor included marine shell (*pipipi* [*Nerita picea*]) and cowry [*Cypraea spp.*], and *kukui* nut (*Aleurites molluccana*), respectively.

Feature 2

Feature 2 was a wall of stacked *'a'ā* and *pāhoehoe* boulders and cobbles, which forms an enclosure over the opening of the overhang ... The interior face of the wall is nearly perpendicular and consists of six to eight courses of small *'a'ā* boulders, reaching a maximum height of about 1.40 m and averaging 0.90 m in height along the central interior face. The exterior of the wall is not vertically faced; instead, it slopes down to the base of the wall, which is approximately 0.60 m in thickness.

Feature 3

Feature 3 consisted of four boulder stepping stones situated adjacent to the Feature 2 wall, outside the overhang shelter ... The boulders range from 20.0 to 30.0 cm in diameter and from 8.0 to 10.0 cm in thickness. They were positioned in such a way that they facilitate access (by standing on the boulders) over the wall (Feat. 2) and into the overhang shelter (Feature 1). Boulders of this size and type are sometimes used in the construction of pre-Contact stepping stone trails (Type A trail - Apple 1965); however, no evidence of a trail of this type was observed in the APE for the VOR project area (including Borrow Pits 1 and 2).

8.1.29 SIHP 50-10-27-28569 (from Clark et al. 2011:21-46, 51)

The pedestrian survey of Site 28569 documented a complex of 17 features situated approximately 50.0 m east of Site 28568 (Figure 115). Site 28569 was found at the interface of a dark gray *'a'ā* flow outcrop and the adjacent brown *pāhoehoe* flow ... The site covered a roughly oval area measuring approximately 30.0 m (north/south) by 15.0 m (east/west). An irregular face of large *'a'ā* boulders and *pāhoehoe* slabs, which have been pushed up along the leading edge of an *'a'ā* flow, measured approximately 2.0 m in height and loosely delineated the eastern and northern boundaries of the site.

Pāhoehoe flows dominated the central and eastern areas of the site and formed a shallow basin of undulating *pāhoehoe* lava (ropy surfaces are intermittently present) below and adjacent to the (west and south) edge of the *'a'ā* flow. Documented features included one alignment (Feature 15), four cupboards (Features. 3, 6, 8, and 17), one enclosure (Feature 1), one midden scatter (Feature 16), three quarried areas (Features 2, 5, and 7), six rock-filled areas (Features 9, 10, 11, 12, 13, and 14), and one stepping stone path (Feature 4) ...

The four cupboard features (Features 3, 6, 8, and 17) are all located along the edge of the *'a'ā* flow. Several features originally thought to be cupboards (Features 2, 5, and 6) ultimately designated as quarried areas due to the absence of modifications and/or evidence of use. It is suspected that the four cupboard features likely were originally areas being quarried and later modified and/or used as cupboards.

In the northern section of the site, in the vicinity of Feature 1 and south and southeast of this feature, many of the *pāhoehoe* surfaces are broken into small to large cobbles ... The eastern side of the site also contains much broken *pāhoehoe*. *Pāhoehoe* surfaces in the central and south portions of the site remain intact.

Selected surface cultural materials at Site 28569 were recorded and collected. Materials collected include one basalt cobble hammerstone, one possible hammerstone, and faunal remains (marine shell).

Feature 1

Feature 1 is a roughly U-shaped enclosure built against the edge of the *'a'ā* flow at the northern end of Site 28569 ...It measures 4.0 m (east/west) by 2.5 m (north/south) from front to back. The north side of the enclosed area was formed by *'a'ā* boulders and *pāhoehoe* slabs that have been pushed up along the leading edge of the *'a'ā* flow, which is 2.0 m in height and loosely defines the eastern and northern boundaries of this site. The "walls" on the east and west sides enclose the interior area, and are comprised primarily of in situ *pāhoehoe* slabs, with some stacking and piling of small *pāhoehoe* boulders, and small to medium cobbles ... The east wall of the enclosure reached a maximum height of 0.70 m; the west wall is approximately 0.80 m in height. The south side of the feature is open ...

The interior floor area of the enclosure is roughly leveled, and it consists primarily of small, tabular *pāhoehoe* cobbles and boulders, with some small cobbles and pebbles. Two holes are present in the floor, one on the west side and a larger one in the center. Both were about 25.0 cm in depth. No artifacts or faunal remains were present in the enclosure. Feature 5, a quarried area is present under the east wall of this enclosure.

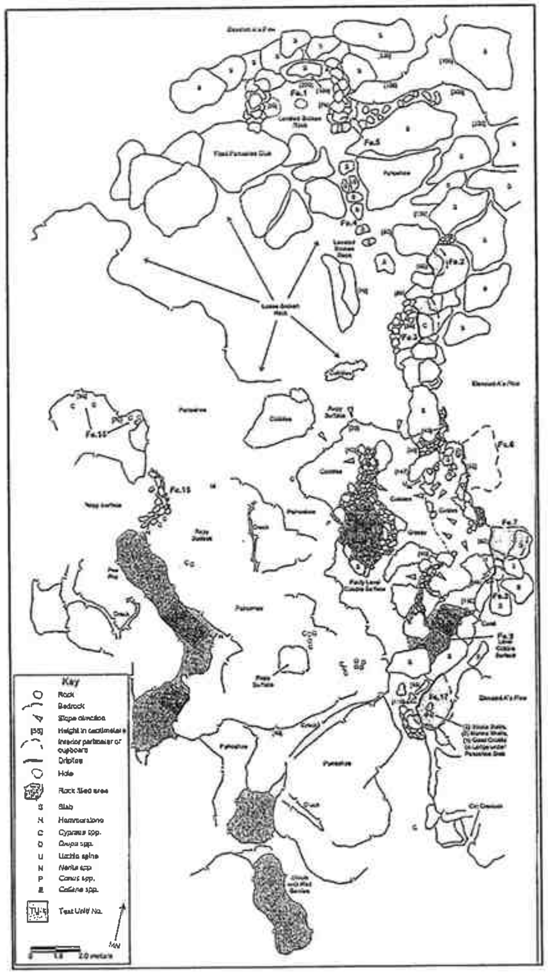


Figure 115. Plan map of SIHP 28569 (from Clark et al. 2011:24)

Feature 2

Feature 2 is a quarried area situated beneath large boulder slabs along the leading edge of the *'a'ā* flow in the northeast portion of Site 28569, approximately 7.0 m southeast of Feature 1 .... The quarried area measures approximately 1.5 by 0.60 m and is located under large *'a'ā /pāhoehoe* slabs from which rock materials appear to have been removed. The height under the slabs ranges from 0.20 to 0.30 m. The surface of the quarried area is composed of small *pāhoehoe* cobbles ... No cultural materials were present adjacent to, or within, the feature. No scoria lava was noted in this feature.

Feature 3

Feature 3 is a cupboard situated in a recessed edge of the *'a'ā* flow approximately 1.0 m south of Feature 2 ... The cupboard space is formed by large *'a'ā* slabs .... Some rocks may have been removed from under the slab forming the interior ceiling of the feature, which is approximately 0.50 m in height. The feature's interior measured 2.0 m in width and approximately 0.80 m in depth. The interior floor was comprised of well-sorted, small *pāhoehoe* cobbles and pebbles. A small *'opihi* shell (*Cellana spp.*) and a dorsal fragment of a large cowry shell (*Cypreae spp.*) were found within the interior area of the cupboard.

Feature 4

Feature 4 is a possible stepping stone path that connects Feature 1 (enclosure) and Feature 3 (cupboard) in the northeast portion of Site 28569 ... The path is approximately 4.5 m in length, 0.40 m in width, and is composed of eight tabular *pāhoehoe* slabs. Figure 13 provides a photograph of Feature 4 with a view to the north. Flat, tabular *pāhoehoe* slabs are common in this part of the site, and when this area was first examined, the presence of a stepping stone path was questionable. However, further examination indicated that the placement of these slabs appears to be intentional.

Feature 5

Feature 5 is a quarried area situated under a *pāhoehoe* slab that formed part of the east wall of the Feature 1 enclosure ...The quarried space appeared to have been formed by removing rock from under the slab. The interior surface of the quarried area consists of unaltered rocks. The feature measures approximately 0.80 by 0.50 m in size and 0.70 m in depth. ... No cultural materials were observed within this feature. No scoria lava was noted in this feature.

Feature 6

Feature 6 is a cupboard constructed along the overhanging edge of the *'a'ā* flow in the southeast portion of Site 28569, approximately 5.0 m southeast of Feature 3 ... The cupboard was probably formed by removing rocks from under several large overhanging boulder slabs. The interior cupboard area is 2.40 m in width, 1.40 m in depth, and approximately 0.45 m in height. Small to medium *pāhoehoe* cobbles had been stacked along the northern interior wall. The floor of the feature consisted primarily of exposed bedrock. Four tabular *pāhoehoe* slabs (approximately were present at the cupboard opening... No cultural materials were observed within this feature.

Feature 7

Feature 7 is a quarried area situated along the overhanging edge of the *'a'ā* flow, approximately 3.0 m south of Feature 6 in the southeast portion of Site 28569 ... This feature appears to have been formed by removing rocks from under a large boulder at the edge of the *'a'ā* flow. The interior space was approximately 1.45 m in width and 1.20 m in depth, and it ranges from 0.25 to 0.35 m in height. The interior floor of the quarried area is uneven and consisted of small to large *'a'ā* cobbles. ... No scoria lava was noted in this feature.

Feature 8

Feature 8 is a small cupboard located on the edge of the *'a'ā* flow immediately (0 .50 m) south of Feature 7 in the southeastern quadrant of Site 28569 … This cupboard's interior space also appears to have been formed by removing rocks from under a large *pāhoehoe* boulder. The interior of the feature measured 0.70 m in length, 0.60 m in width , and 1.0 m in height. The floor of the feature consisted of *'a'ā* bedrock and small cobbles. Fragments of marine shell (*Cypraea spp.*, *Cellana spp.*, and *Conus spp.*) were observed in the interior of the cupboard…

Feature 9

Feature 9 is a rock-filled area located adjacent to the edge of the *'a'ā* flow approximately 2.0 meters southwest of Feature 8, in the southeastern quadrant of Site 28569 … The pavement area measures 2.0 m north/south by 1.50 m east/west. The feature is bordered on the east by the edge of the *'a'ā* flow, which was 0.80 m in height; on the south by a large *pāhoehoe* slab; on the west by large *'a'ā* boulders; and on the north by a *pāhoehoe* outcrop. The surface of the rock fill is leveled and consists of well-sorted, small *pāhoehoe* cobbles and pebbles. A number of weathered pipipi shells (*Nerita picea*) and one piece of weathered coral were recorded on the surface of the feature. Figure 18 provides an overview of the feature area viewed to the north. A test excavation was conducted in this feature …

Feature 10

Feature 10 is a roughly oval, enclosed rock-filled area situated in the central portion of Site 28569, 3.0 m southwest of Feature 6 ... This leveled cobble-filled are measured 2.0 meters north/south and 1.5 m east/west. The interior of the rock-filled feature is bordered by intermittent *pāhoehoe* outcrops, and is connected on the north side by low, loosely piled, wall segments of small *pāhoehoe* boulders and cobbles. The bordering *pāhoehoe* outcrop and pilled rock walls reach a height of 0.40 m on the east side of the feature and 0.35 m on the west. The leveled interior area is composed of angular *pāhoehoe* cobbles and several tabular *pāhoehoe* slabs …

Feature 11

Feature 11 is a low, rock-filled area situated between *pāhoehoe* outcrops in the southern portion of Site 28569 … The rock-filled area is irregular in shape and measures 3.5 m north/south and 1.5 m east/west. The surface is roughly level, and consists of large to small angular *pāhoehoe* cobbles and large pebbles, with some small boulders. …

Feature 12

Feature 12 is a rock-filled area located 1.0 m north of Feature 11 in the southern portion of Site 28569 … This rock-filled area is surrounded by slightly elevated *pāhoehoe* outcrops. The

feature is roughly rectangular in shape and measures 2.0 m north/south by 1.5 m east/west. The surface is roughly level, and consists of large to small angular *pāhoehoe* cobbles. …

Feature 13

Feature 13 is a low rock-filled area situated between slightly elevated *pāhoehoe* outcrops in the central western portion of Site 28569, approximately 3.0 m northwest of Feature 12 ... It is also immediately south of Feature 14 (rock-filled area). This feature measures 3.0 m north/south and 1.5 m east/west. The surface of this feature consists of large to small angular *pāhoehoe* cobbles and pebbles. … A test excavation was conducted in this feature …

Feature 14

Feature 14 is a rock-filled area located immediately north of Feature 13 in the central western portion of Site 28569 … The feature measures 5.5 m northwest/southeast by 1.0 m from east/west, and was surrounded by slightly elevated *pāhoehoe* outcrops. The surface is roughly level, and consists of small to medium angular *pāhoehoe* cobbles and pebbles. A possible basalt hammerstone was recorded and collected near the southeastern edge of the feature … A test excavation was conducted in this feature …

Feature 15

Feature 15 is an alignment situated on a *pāhoehoe* outcrop in the central western portion of Site 28569, immediately north of Feature 14 … This feature is roughly C-shaped and measures approximately 2.0 m north/south in length. It encloses an area approximately 1.60 by 0.90 m in size. The interior surface of the feature and adjacent areas consists of a relatively level, ropy *pāhoehoe* outcrop. The alignment itself consists of a single course of small angular *pāhoehoe* boulders and large to medium cobbles. There was minimal stacking of one or two stones on the north end of the alignment. Small quantities of marine shell fragments (*Cypraea spp.*) were recorded to the east of the alignment, and a basalt hammerstone was recorded at the south end of the alignment.

Feature 16

Feature 16 is a midden scatter located in a shallow depression immediately adjacent to the north end of the Feature 15 alignment … The scatter is confined to a shallow pocket in the *pāhoehoe* flow, which contains a deposit of angular *pāhoehoe* cobbles, pebbles, and gravels, with small quantities of silty sediments. The feature area measures 4.0 m in length west/east and 2.0 m in width. The midden scatter exhibits a concentration of weathered marine shell fragments and several small fragments of coral. The marine shell includes fragments of *Cypraea spp.*, *Nerita picea*, *Thais spp.*, and *Drupa spp.* …

Feature 17

Feature 17 is a large cupboard situated in a recess along the edge of the *'a'ā* flow in the southeastern portion of Site 28569, approximately 1.5 m south of Feature 9 … In terms of modifications, Feature 17 represents the most elaborate of the cupboard features recorded in Site 28569. This cupboard was constructed in an overhang created by a large *pāhoehoe* boulder, which had been pushed up along the leading edge of the *'a'ā* flow. The abrupt edge of the *'a'ā* flow was nearly vertical and approximately 2.0 m in height at this locale.

The cupboard space has been formed by the removal of rocks from under the large, thick *pāhoehoe* slab that forms the roof. The interior area is 2.0 m in width and 1.5 m in depth from front to back, and ranged from 0.45 to 0.50 m in height. The interior floor is primarily exposed bedrock with scattered angular cobbles and pebbles, and one area of stacked cobbles.

The cupboard opening has been enclosed on the north side by two large *pāhoehoe* slabs, which have been placed on edge … The south end is enclosed by a well constructed wall segment, approximately 0.45 m in height, which is composed of a basal course of piled small angular *pāhoehoe* boulders, and capped with a course tabular *pāhoehoe* slabs. …

Several thin (3.0 cm) *pāhoehoe* slabs were found on top of the large *pāhoehoe* boulder which forms the roof of the Feature 17 cupboard. Under one of these thin slabs a cache of cultural items were found , including two marine shells *(Drupa morum)*, two roughly tabular pieces of scoria basalt … and a rounded, smooth coral cobble. Flake scars were visible on the several of the edges on the two tabular pieces of scoria. The two marine shells were collected. A large weathered *Cypraea spp.* shell was collected from the surface approximately 4.0 m south of Feature 17 …

Results of Excavations at Site 28569

Three test units were excavated in three features at Site 28569 … Test Units 1 and 2 (TU 1 and TU2) were excavated in two rock-filled areas, Features 13 and 14, and TU3 was excavated in Feature 9, a paved area. The purpose of these test units was to obtain information regarding the likely function of these features, and to determine the presence or absence of cultural materials and features, including human burials. Marine shell fragments were found in excavations in the paved area (TU3 in Feature 9). No human burials were found in the test excavations at Site 28569. The excavated matrices in TU1-TU3 consisted primarily of rock. Neither soil deposits nor sediments were encountered in any of the excavation units at Site 28569.

8.1.30 SIHP 50-10-27-28814 (Monahan et al. 2011:227)

SIHP# 50-10-27-28814 is a lava tube that is located approximately 105 m northwest of the intersection of Ka'iminani Drive and the Queen Ka'ahumanu Highway (Figure 116 and Figure 117). The lava tube has formed beneath an undulating pāhoehoe flow. The overall extent of the lava tube measures 15.0 m N/S by 13.0 m E/W. The opening of the lava tube, located near the northern extent, measures 1.5 m wide with a ceiling height of 0.5. The lava tube consists of two main chambers connected by a linear passageway along with several small, tapering offshoots that become impassable. Modification to the lava tube consists of two placed pāhoehoe boulders that are located near the northern interior wall, adjacent to the tube opening and within the light zone (Figure 118). A thin layer of sediment and organic debris was observed beneath the tube opening within the light zone, which presently supports the growth of grasses and ferns. The remainder of the interior of the lava tube consisted of bare pāhoehoe bedrock. No artifacts or midden were observed in the area.

The function of SIHP# 50-10-27-28814 is indeterminate. Minimal soil deposition beneath the tube opening was observed, but no artifacts or midden was identified. The presence of two placed boulders near the tube opening may suggest evidence of water catchment activity.

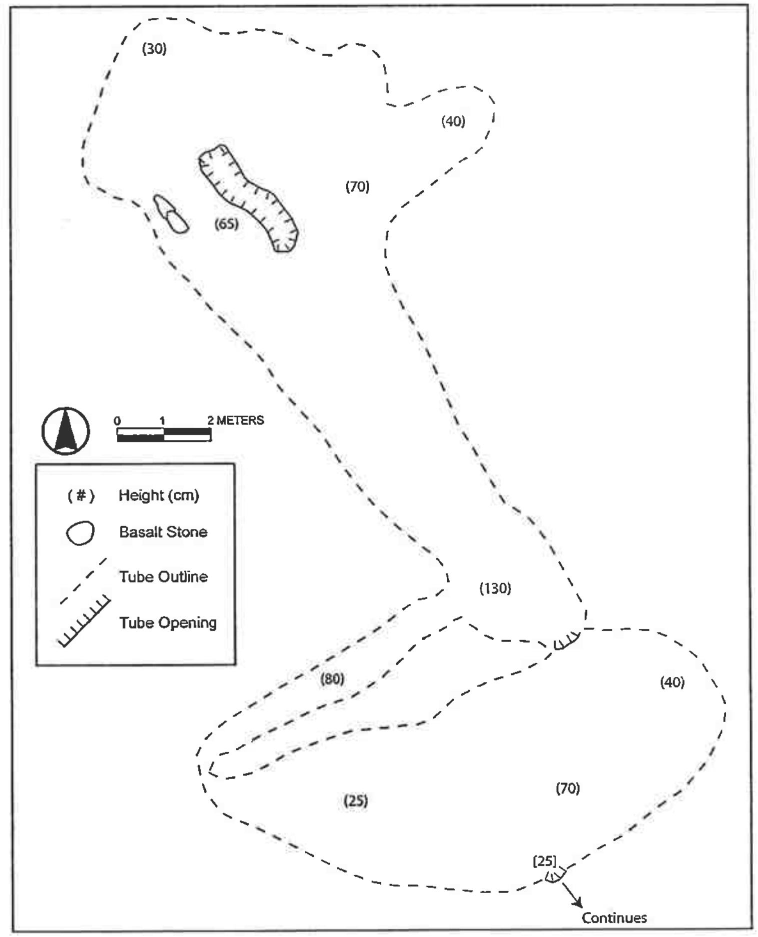


Figure 116. Plan view map of SIHP 28814 from Monahan et al. 2011:228

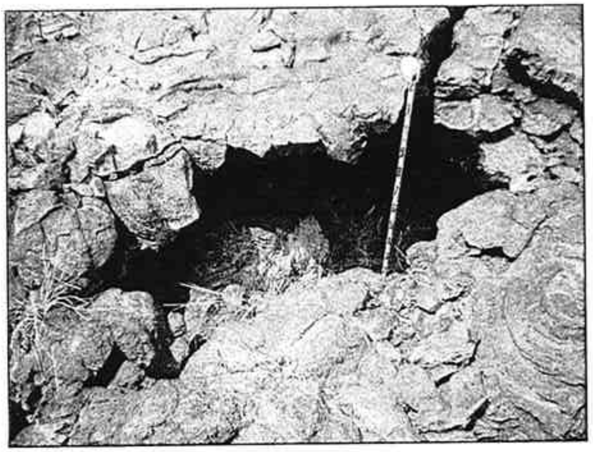


Figure 117. Photograph of SIHP 28814 from Monahan et al. 2011:229, view to south

Figure 118. Photograph of the two placed boulders within SIHP 28814 from Monahan et al. 2011:229, view to south

8.1.31 SIHP 50-10-27-28815 (from Monahan et al. 2011:230)

SIHP# 50-10-27-28815 is a *pāhoehoe* excavation that is located approximately 185 m northeast of the intersection of Ka'iminani Drive and the Queen Ka'ahumanu Highway (Figure 119). The pāhoehoe excavation consists of an area where an overlying, uplifted sheet of *pāhoehoe* has been quarried and removed, exposing a lower *pāhoehoe* surface. Quarry marks and scalloping were observed along the edges of the excavation. Some of the excavated material (large pāhoehoe cobbles) has been placed along the northeastern side of the excavation. The interior surface of the excavation consists of scattered pāhoehoe cobbles on solid *pāhoehoe* bedrock. The excavated area lacks soil deposition. The *pāhoehoe* excavation measures 1.1 m N/S by 1.4 m E/W with a maximum depth of 0.5 m below the adjacent ground surface. No artifacts or midden were observed in the area.

SIHP# 50-10-27-28815 is interpreted as a possible raw material quarrying locality. The *pāhoehoe* excavation lacks sediment accumulation that would indicate potential agricultural use.

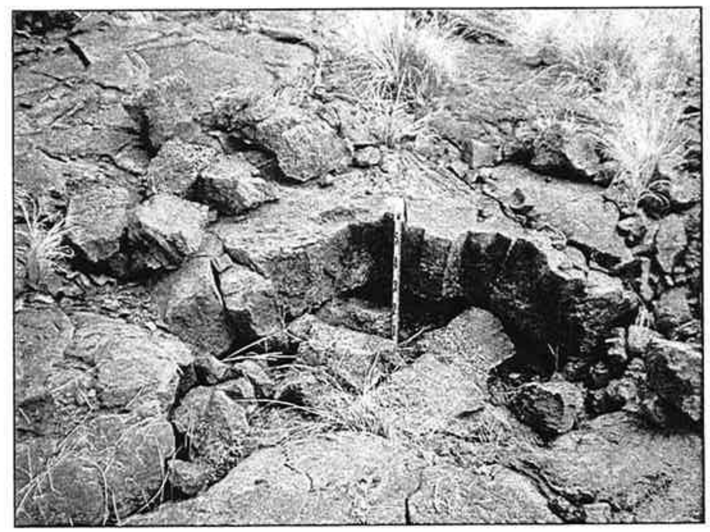


Figure 119. Photograph of SIHP 28815 from Monahan et al. 2011:231, view to north

8.2 Sites for Which Only Temporary Numbers Appear to Exist

8.2.1 From Ching and Rosendahl (1968:11-15)

8.2.1.1 Kalaoa T1

Approximately 450 feet *mauka* of the [former proposed] highway centerline, this cave site is located at the *mauka* end of a long lava tube that extends *makai* for perhaps 600 feet or more. Though the tube is exposed through a number of other breaks, this NE end is the only location found with associated cultural debris.

The cave site is accessible from the SW end of a depression approximately 20 feet in diameter. The central habitation area is roughly 25 feet by 35 feet, with a smaller NE Chamber perhaps 10 feet square. The average height is 3-4 feet. The floor is *pāhoehoe*, with scattered rubble, and a thin scattered layer of dark soil. Floor debris consisted of shell (*'opihi*, cowrie), kukui nut shell, fish bone (especially vertebrae), and *hala* nut, all scattered throughout the rubble of the habitation area.

Surface finds of the cleared area in the main chamber area included a bone (human?) fishhook blank and quadrangular polished micro-adze. The vicinity of an apparent hearth yielded a fire plow stick.

The small NE chamber was apparently walled off at one time, and there are also suggestions of possibly a second wall behind the existing wall. Much cultural debris was found in this chamber. Surface finds included Wana spine and coral files, two shark teeth, the barb half of a two piece bone fishhook, the knob end of a bone hook shank, two (matching) shank fragments of a two piece bone hook, and an unfinished one piece bone hook.

A square stone in the center of this small chamber, around which the various artifacts were found scattered, was perhaps a seat, or a working surface or "bench".

8.2.1.2 Haleohiu T1

This site has a number of low walled (*'a'ā*) circular features located between two small hills of *'a'ā*. The features have openings in their walls, facing a trail which runs through the site. The site itself is situated in what appears to be a deliberate cut (N -S) through a mound of *'a'ā*. The floor of the cut has been leveled, and the general result is that of a site shielded both *mauka* and *makai*.

In addition to the circular features, there appear to be some rectangular platforms, and a possible feature on the *makai* hillock. The site itself is very interesting as we know of nothing quite comparable. Surface finds included a pearl shell fishhook blank and a coral rubbing stone.

8.2.1.3 Haleohiu T2

[No site description included—Possibly considered part of Haleohiu T1?]

8.2.1.4 Kau T1

This site is an area of roughly two acres on the prehistoric *pāhoehoe* flow. The area is grown over with *pili* grass, among which are found numerous small *pāhoehoe* walled features. The average size is a diameter of 6 feet, and the shape variation includes semicircular, U-shaped, and circular shaped features. A few small mound features are also present.

The site is similar to site H-27-4-(316,650 - 332,790) –T1 [Haleohiu T1]. The low walls of the features average about a foot, and are constructed of brown *pāhoehoe* pieces (distinct from the black *pāhoehoe* of the nearby 1801 flow). The construction technique seems to be that of simply piling the material since the walls are not made of set stone. Shell material was observed scattered among the features of the site. The roughly rectangular rock mounds may represent monument burials. Then too, the walls may have tumbled in the great earthquake of 1868.

This site is quite interesting, and demands closer investigation than the cursory (primarily aerial) inspection given it so far.

[Possibly later recorded as Rosendahl (1973) Site 701/Complex D "*Makai* Cluster"?]

8.2.1.5 Kau T2

[No site description included—Possibly considered part of Kau T1?]

8.2.2 Carpenter et al. (1998:30-69)

8.2.2.1 T1 Trail

This site consists of a paved foot trail through rough *'a'ā* lava that extends from the northern end of Mahai'ula Bay to the southern boundary of Makalawena, where it becomes indistinguishable upon entering the sand dunes. A jeep road was constructed along the same alignment, obliterating portions of the earlier foot trail. The trail wound its way through the *'a'ā* field, and was paved with waterworn boulders, 1-3 stones wide. It appears to have been a solidly paved trail as opposed to a stepping stone trail, and was not curbed. Due to the winding nature of the trail, in some places it is nearly intact running parallel to the road, and in others the trail paving stones are still situated within the roadbed. In many places, however, the waterworn trail stones are used in the curbing of the later road.

The jeep road was apparently built circa 1950 by a Makalawena resident, Porto Almodober (Springer 1986). It is approximately 2.5 m wide, roughly curbed on the sides, and runs in nearly a straight alignment for approximately 650 meters. The bed of the road is roughly paved with crushed *'a'ā*.

8.2.2.2 T3 Trail

A little beyond Site T2 heading toward Makalawena, a trail branches off to the northwest (bearing approximately 330°), heading to the coast north of Kawili Point. This foot trail is narrow and winding and is intermittently paved with steppingstones of waterworn boulders. It is also occasionally roughly curbed, and its route is marked with large pieces of white coral. The total length of the feature is approximately 240 meters, and it leads to Sites T10, 11, and 12, situated at the back of a basalt and coral cobble beach.

8.2.2.3 T10 Ahu/platform

This feature is located just back of the cobble beach which is accessed by trail T3, within the *'a'ā* flow. It is immediately adjacent to the south side of the trail, approximately 70 meters from the shoreline. The feature consists of a large ahu or small platform, constructed of stacked *'a'ā*. It measures approximately 2.5 m by 2.5 m square, and up to 1 m in height, and is built atop a rough outcrop next to the trail. A great deal of coral, both waterworn and branch varieties, is placed atop and around the feature, which has collapsed a great deal and appears very rough. The presence of the coral, possibly placed as offerings, suggest that this feature may have served as a ko'a. Site T10 is part of a small complex and is associated with Sites T11 and T12. The beach *makai* of this complex is one of the areas which Reineke (n.d.) documented in 1930 as Site 96, noting deteriorated house platforms. There is no longer any evidence of these features, which were likely wiped out by the 1946 tsunami and/or winter storms.

8.2.2.4 T11 Stepped platform

This feature is located on the opposite side of foot trail T3 and slightly *makai* of Site T10, approximately 16 meters north of that feature. This terraced platform is situated on a small natural lava rise. A level surface has been created atop this rise, backed by piled *'a'ā* boulders and measuring approximately 6 m (N-S) by 4 m (E-W). This area is paved with *'ili'ili* stones and coral. The northwest corner of the feature is at a lower level than the upper platform, separated by a 30 cm high retaining wall. Near the southeast corner of the upper platform is a large boulder with a natural *puka* in it, which may have served as a cupboard. A great deal of shell midden is scattered throughout the feature.

8.2.2.5 T12 C-shaped shelter

Located just a few meters *makai* of Site T10, this is a rough walled C-shape containing a small amount of scattered marine shell. The feature is constructed of roughly stacked *'a'ā*, and is approximately 2 m long and 1 m high.

Just *makai* of the complex composed of Sites T10-T12 is a rather broad coral and basalt cobble beach. This area was indicated by Reinecke in 1930 as the location of Site 96, described only as "platforms in the sand". There is no evidence of Site 96 today. In fact, there is almost no sand there - most of the area is covered with the aforementioned coral and basalt cobbles. This area is undoubtedly very susceptible to high surf and tsunami inundation, either of which could easily have wiped out any surface features here. However, at the rear of this beach is a large level area measuring approximately 50 by 30 meters, containing a great deal of coarse coralline sand as well as cobbles, and overgrown with *pohuehue* (beach morning glory, *Ipomoea pes-caprae*). If there were platforms and other associated features in this location, it is possible that evidence of them lies buried here in the form of subsurface cultural deposits or features.

8.2.2.6 T13 Pool

This feature consists of a small brackish water pool excavated from the *'a'ā* on the north side of Mahai'ula Bay. It is located approximately 185 meters southeast of Kawili Point. A short stepping-stone trail of waterworn boulders leads to the feature from the main paved trail leading to Kawili Point. The trail is about 25 meters long, running roughly north-south. It descends to a

low point in the *'a'ā* flow where the pool is situated. The pool is roughly walled and circular, approximately 1.5 m in diameter by 1 m deep (to the surface of the water). The pool is shallow, perhaps 50 cm in depth. This pool is located very near the popular surfing break on the north side of Mahai'ula Bay, which according to Clark (1985), "many surfers consider... to be one of the best right slides on the Kona Coast (p. 116)", and is undoubtedly utilized by surfers as a rinsing-off place. However, it is not known whether the pool was constructed for that purpose in modern times, or if it represents an older feature being adapted for modern use.

8.2.2.7 T14 Complex

This is a very small complex of four adjacent features located 30 meters southeast of Site T13, situated on a lava shelf right at the northern edge of Mahai'ula Bay, with a 4 meter drop to a cobble beach. The four features consist of:

A: Small V-shaped walled shelter of stacked *'a'ā* boulders, with interior dimensions of approximately 4 m (N-S) by 2.5 m (E-W) and open to the bay (south) side. The rear wall is approximately 1 m in height and the side walls are lower, circa 50 cm high. The interior of the feature is fairly level and paved with *'a'ā* cobbles and a little waterworn coral.

B: *Ahu* of stacked *'a'ā*, situated between features A and C, measuring 1.6 m in diameter by 1.3 m high. This feature utilizes a portion of the eastern wall of Feature A for its base.

C: Cleared, paved area measuring roughly 7 m (E-W) by 3 m (N-S). This area is roughly rectangular, paved with *'a'ā* cobbles, and is on the east side of features A and B.

D: Rock-lined pit, off the northwest corner of Feature C. This pit is approximately square, with rounded corners, and lined with roughly stacked *'a'ā* boulders and cobbles. The feature measures 1.6 m in diameter by 1.6 m deep. It is obscured by several decayed coconut fronds.

8.2.2.8 T15 Enclosure

This feature consists of an elongate rectangular enclosure, measuring approximately 12.8 m (N-S) by 3.8 m (E-W), reminiscent of a canoe shed, but extremely rough in its construction. The feature is also walled on its *makai* side, which would not be expected for a canoe shed. The walls are of piled *'a'ā* cobbles and boulders, sometimes simply single-stacked, and bedrock is utilized in the wall construction. The walls average 70 cm high, with some breaks and collapse. A break in the north wall of the feature near the northeast corner allows access to the coastal trail leading to Kawili Point (Site 56). The interior of the feature is relatively level and is paved with *'a'ā* cobbles as well as a small quantity of *'ili'ili* stones. The enclosure is situated about 3 meters above a cobble beach on a natural lava shelf, and is oriented with its long axis perpendicular to the shore. This axis is oriented 235°. The feature is located approximately 30 meters southeast of complex T14.

8.2.2.9 T56 Trail

This is a very substantial paved trail leading from the northern end of Mahai'ula Beach nearly to Kawili Point, where it has been obliterated by high surf and/or tsunami. It originates just north of the northwest corner of the large enclosure marked by the coconut grove at the extreme north end of Mahai'ula Beach. The enclosure is one of the features of Site T70 (see below). It appears that construction of the enclosure destroyed the southern extent of the trail, suggesting that the enclosure is a more recent feature. The trail averages about a meter in width, although it is up to 1.5 meters wide in some sections. It travels more or less straight, bearing northwest toward the point, but occasionally winding where it traverses the coast. The trail passes through the entire length of Site T70, where a number of smaller trails connect to it, then continues an additional 195 meters toward Kawili Point. It finally becomes indistinguishable at the back of a cobble and coral beach approximately 30 meters southeast of the anchialine pool (Site T68) at the point. The overall length of the existing trail is 315 meters. The trail is the most impressive in the project area despite the fact that it is in rather poor condition. It is intermittently curbed and paved. In some areas it is paved with solid waterworn boulders, in others with flat *pāhoehoe* slabs, and still other areas utilize a crushed *'a'ā* pebble and *'ili'ili* paving. In some stretches a combination of paving materials is situated between two massive upright bedrock boulders in such a way that it can only be approached from *makai*. When approaching from this direction, the two bedrock boulders give the impression of a deep trench, which one must walk into to reach the pool. This "trench" is about a meter wide and three meters long. The sides of the boulders are approximately three meters high. A sloping *'a'ā* paved ramp with two waterworn stepping stones leads down to the pool, which is roughly walled, and measures circa 1 m in diameter by 50 cm deep. Its water is very cool and slightly brackish.

8.2.2.10 T68 Anchialine Pool

This is the largest anchialine pool in the project area. It is located at Kawili Point, separated from the ocean by a basalt and coral cobble beach perhaps 20 meters wide. This pool is natural, and contains brilliantly colored orange-red algae. There are a number of possible man-made pits along the inland edge of the pool, and its size suggests that it could have been used as a small fishpond prehistorically, although it is not recorded as one in any of the previous literature. The pool measures approximately 27 m (E-W) by 57 m (N-S), although the size of it fluctuates with the tide. A number of reef fish were observed in the pool. The surrounding area contains many additional small pools.

8.2.2.11 T70 Kawili Point Complex

This is a large, multi-use site located on the north side of Mahai'ula Bay. It is situated within the rough *'a'ā* flow that formed Kawili Point and which extends from the northern edge of Mahai'ula Bay into the southern portion of Makalawena. This site covers 160 meters along the coast (SE-NW) and approximately 70 meters inland from the coast. Many features in this complex are situated right at the edge of the bay, and portions of the site may extend further inland. This is the most complex and extensive site located during the park survey. It consists of circa 60+ features ranging from foot trails, enclosures, and complex habitation platforms to probable burials. This site was mapped in detail during the survey, and a large foldout map is included with this report...

For the purpose of recording, the site was broken down into a series of smaller complexes (A through P). Unless otherwise noted, all of the features are constructed of angular-subangular *'a'ā* stones. A brief description of each follows:

Complex A: This complex consists of a large stone-walled enclosure and associated features, situated at the northern edge of the sand beach at Mahai'ula (Figure 120). These features are constructed of cobbles and small boulders. They include the following:

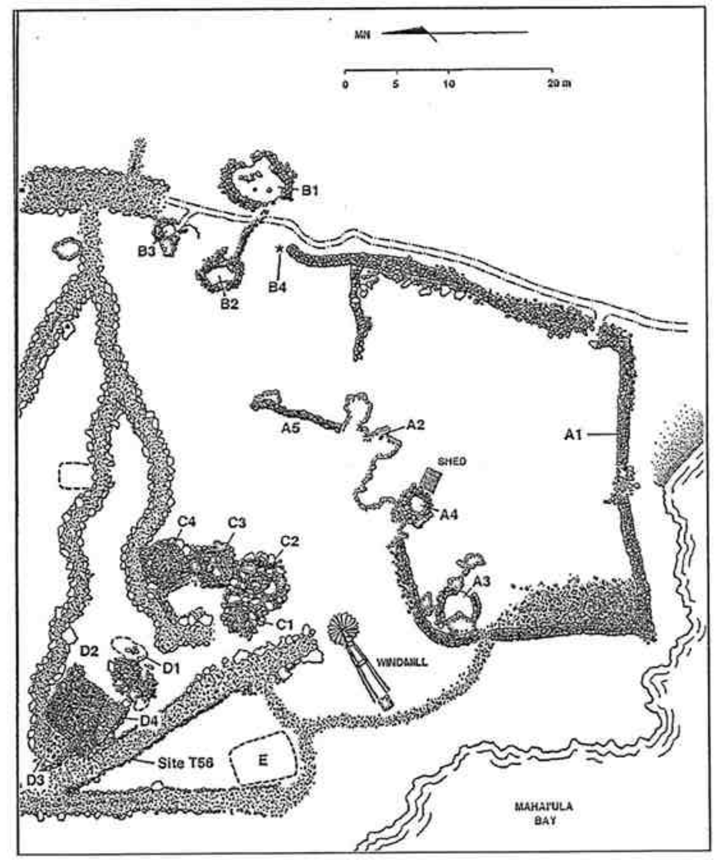


Figure 120. Map showing Complexes A-D and Feature E within Site T70 (from Carpenter et al. 1998:47)

A1: The large enclosure measures approximately 25 m (N-S) by 35 m (E-W), with core-filled walls approximately 90-100 cm in width and 80-100 cm in height. The central portion of the north wall of the feature is formed by a natural lava shelf that drops to the interior. There are two breaks in the wall, one in the east wall near the southeast corner, and a second in the west wall near the northwest corner. These breaks may be recent, as they presently are part of the trail leading to the point. The interior of the enclosure houses a grove of mature coconut trees, and is covered with sand, except for a small area adjacent to the west wall which is paved with *'a'ā* cobbles.

A2: Atop the aforementioned shelf on the north edge of the enclosure is a single petroglyph, a linear human form. This is the only petroglyph recorded in the project area which may be prehistoric in age.

A3: A small brackish water pond outlined by a stacked-stone wall is located in the northwest interior corner of A1. This pond measures approximately 3 meters in diameter and the walls surrounding it are 90 cm high to the interior. The western side of the pond is formed by a large bedrock boulder.

A4: This is a well feature located within Al against the north wall. This feature is excavated to a depth of 140 cm below the ground surface, and is roughly 1.5 m in diameter. The interior is of roughly stacked small boulders and cobbles. Adjacent to the well is a small shed that apparently housed a water pump. Several water pipes set into concrete originate from this water source.

A5: This is a poorly constructed wall extending northward from the outcrop which forms the northern side of A1. The intact portion of the wall extends 9 meters, but it appears to have originally been longer. This feature is roughly stacked atop undulating bedrock outcrops, and measures 90 cm in height and 70 cm in width.

Complex B: This consists of a cluster of four small walled brackish-water pools to the north of Complex A (see Figure 120). They are clustered around the trail from the Magoon house which leads to Makalawena.

B1: This is the largest of the ponds, and is situated on the east (*mauka*) side of the trail. This pond measures 4-5 m in diameter and is ringed by roughly stacked and piled boulders and cobbles, up to a meter in height. The water is accessed on the west side, where there is a break in the stonework. Several stones are in the interior of the pond. At the time of the survey, several adult *āholehole* (Hawaiian flagtail, *Kuhlia sandvicensis*) were visible in the pond. This pond is connected to B2 via a concrete-paved waterworn boulder trail.

B2: This pond is located across the main trail from B1, on the *makai* side of the trail. It measures 2-3 m in diameter and is surrounded by a roughly stacked cobble/small boulder wall up to 170 cm in height. The pond is accessed on the east side via a break in the wall. Two waterworn boulders placed near the entrance of the pond serve as a step down into the pond.

B3: This small pond is located about 5 meters north of B2. It is very small (1.5 m in diameter), and the west side of the feature is made up of natural bedrock boulders. The north and east sides are formed by a roughly stacked stone wall, up to 150 cm in height. The pond is accessed from the southeast via a break in the wall.

B4: A fourth small pond is located approximately 4 meters south of pond B2, near the end of the wall which extends off the northeast corner of Feature A1. This very small pond was completely obscured by vegetation at the time of the survey and therefore no detailed description of it is available.

Complex C: This is a cluster of several adjacent small, roughly constructed enclosures built within a natural *'a'ā* outcrop (see Figure 120).

C1: This is a small C-shape measuring 2 m by 2 m, incorporating some natural bedrock boulders. The feature is open to the northwest, and the maximum wall height is 70 cm. It is roughly paved with *'a'ā* pebbles and cobbles.

C2: Located 2 meters southeast of C1, this feature is a small rectangular enclosure measuring approximately 3m (N-S) by 2 m (E-W). Many natural bedrock boulders are incorporated into its walls, which are up to 70 cm high. The feature is well-defined only in the interior. The exterior of the feature simply blends in with the natural, rocky landscape. The level interior of the feature contains a couple of protruding bedrock boulders as well as a paving of *'a'ā* pebbles and cobbles. It has no entrance.

C3: This square enclosure is 1 meter north of C2, and shares a portion of its southern wall with the northern wall of that feature. It measures approximately 2.5 m (N-S) by 2.2 m (E-W). Unlike feature C2, this enclosure does have partially defined exterior walls. The walls measure up to about a meter high and a meter wide. The interior is similar to C2, with the addition of a minimal amount of waterworn coral pebbles. This feature also contains no entrance.

C4: Situated 1.5 meters north of C3, this is a rectangular enclosure measuring roughly 3.5 m (N-S) by 2.5 m (E-W). This feature, with walls circa 60 cm in height and up to a meter in width, is similar to C2 and C3, with no coral utilized in its paving. A small cupboard is integrated into the interior northwest corner of the feature as well. Immediately north of C4 is one of the many winding, cleared foot trails traversing the area and connecting the various complexes. As with C2 and C3, Feature C4 has no entrance.

Adjacent to Feature C4, on the west side, there are the remains of an additional feature too deteriorated to accurately evaluate.

Complex D: This group of features is located 10-15 meters northwest of Complex C, separated by a foot trail (see Figure 120). Complex D is immediately adjacent to the well defined, curbed and paved trail (Site T56), on its *mauka* side.

D1: This feature consists of an irregularly shaped, modified natural depression in the *'a'ā*, with natural lava bubble rockshelters on two sides. The depression is roughly L-shaped, measuring 3 m along the long axis (E-W) by 2.5 m along the short axis (N-S). The depression is about a meter deep, and its interior has been modified with stacked stone cobbles, so that the feature is partially walled. Two natural lava bubble shelters originate from the north and south extremes of the depression. The southern shelter is approximately 3 m deep, and the northern is approximately 1.5 m deep. The floor of the walled depression as well as the two natural shelters are roughly paved with *'a'ā* pebbles and cobbles, and all contain scattered marine shell.

D2: This feature is located about 2 meters northwest of D1, and consists of a substantially-walled V-shaped shelter. The interior of the feature, which is open to the southwest (facing the bay) measures 2.5 m by 2.5 m, and may have contained a slightly raised interior platform in the northeast half of the structure, against the rear wall. The relatively wide but partially collapsed core-filled walls measure as much as 90 cm high and 2 m wide. The interior of the feature is roughly paved with cobbles and pebbles. Both the interior paving and the walls utilize some waterworn coral in their construction. A very low, piled wall (ca. 20 cm high) defines the seaward (open) side. Additionally, in the back (northeast) wall of the feature, a small *puka* (hole) has been created in the center of the top of the wall, open to the top. This *puka* contained a rusted cooking pot. Immediately adjacent to the north side of D2 is a cleared foot trail through the *'a'ā* which heads east and intersects with the jeep road/trail to Makalawena (Site Tl).

D3: This is a deteriorated feature situated immediately adjacent to D2, on the northwest side of that feature. It appears to have formerly been a walled shelter, but presently consists of simply a cleared/paved area measuring roughly 2 m by 2 m. It is notable for a greater proportion of waterworn coral used in the paving than is typical of other features in the complex.

D4: On the *makai* (southwest) side of feature D2 is a small cleared and paved area, irregular but roughly oval in shape. Its limits are defined by a low border of piled cobbles. It measures roughly 4 m (NW-SE) by 2 m (SW-NE). The paving is of *'a'ā* pebbles, and it contains scattered marine shell on the surface.

Feature E: This is a single feature located Approximately 16 meters northwest of the northwest corner of the large enclosure Al (see Figure 120). Situated atop a natural rise in the *'a'ā* are the deteriorated remains of what appears to have been a platform, measuring roughly 6 m (N-S) by 4 m (E-W). Modern foot trails fork around its southern side. It is likely that foot traffic headed to Kawili Point has caused the damage to this feature.

Complex F: This complex is located approximately 30 meters northwest of Complex D, along the same trail (Site T56), also on its *mauka* side (Figure 121). It consists of two features, with a cleared foot trail separating the two. This trail, which contains intermittent stepping stones, is aligned north-south, connecting the trail to Kawili Point (T56) and the trail/jeep road to Makalawena (Site Tl).

Fl: This consists of an L-shaped shelter wall of stacked and piled cobbles surrounding a cleared and paved area. The wall is rather deteriorated, and has been broken along its long axis, apparently due to recent foot traffic. The long axis of the wall measures approximately 9 m long and parallels the coast, running northwest/southeast. From the southeast end of that wall, the short axis of the L-shape extends *makai* (southwest) at a 90-degree angle for 3 meters. The walls are roughly 60 cm high and 60 cm wide, but exhibit a great deal of collapse. An area paved with *'a'ā* pebbles, *'ili'ili* and coral, measuring 6 m by 3 m, is sheltered by the wall.

F2: Located just north of Fl on the opposite side of the aforementioned foot trail, this feature consists of a platform of two levels, the upper of which is walled. The overall size of the feature is approximately 7.5 m (N-S) by 7 m (E-W). The feature steps down toward the ocean, and directly faces a boulder beach 15 meters *makai.* The lower platform is built up 40 cm above the surrounding ground surface with a facing of boulders. The surface area of this portion is approximately 4.5 m (E-W) by 2 m (N-S). The upper platform is defined by a 20 cm high single-stone facing on the *makai* side and a roughly stacked sheltering wall 40 cm high on the *mauka* (east) and north sides. The area of this upper division measures approximately 3.5 m (NS) by 3

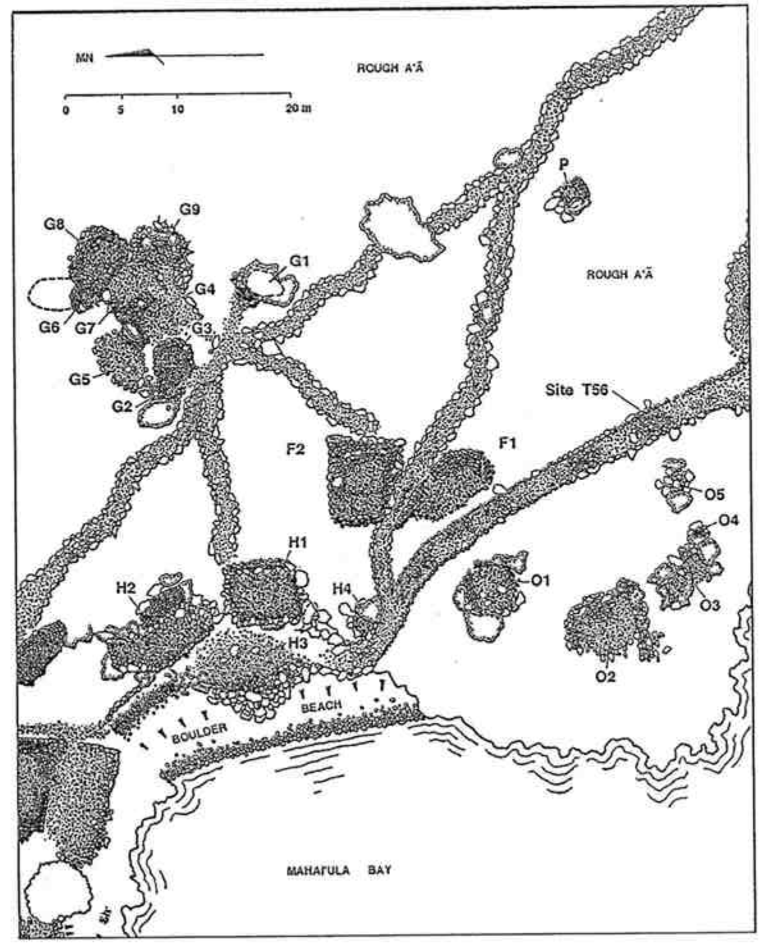


Figure 121. Map showing Complexes F-H, O and Feature P within Site T70 (from Carpenter et al. 1998:52)

m (E-W). The *mauka* end of the overall feature extends beyond the sheltering wall, where it consists of a level filled and unpaved surface. The platform facing on the north side of the feature is as much as 140 cm high. Both divisions of the platform surface are paved with *'a'ā* pebbles, *'ili'ili* and coral.

A foot trail extends from the *mauka* (east) side of F2 northeast to complex G, approximately 15 meters away.

Complex G: Four separate foot trails converge at this group of features, which is composed of several small shelters and a great deal of scattered surface midden indicative of habitation (see Figure 121).

Gl: This is the southernmost feature in the complex, situated in a natural depression. At the bottom of this depression is a small modified entrance to a rockshelter which is located beneath a very large bedrock boulder. The entrance is 100 cm deep and measures roughly 1 m (NW-SE) by 1.3 m (NE-SW). The subterranean portion of the shelter extends off the southeast side of the entrance and is roughly 2 m deep by 3 m wide by 1 m high. Within the shelter is a shallow soil deposit and shell midden. Additionally, a basalt flake, volcanic glass flake, and a single human molar tooth were noted on the surface within this feature.

G2: Situated 10 meters northwest of feature G1, this is a small, paved oval shelter /enclosure situated within a natural depression. The feature is entered from the south side via a narrow entrance. All but the eastern side of the feature consists of only slightly modified natural bedrock. The eastern side is a stacked cobble/small boulder wall which is shared with G3, serving as the western wall of that feature. The interior of G2 measures approximately 2 m (N-S) by 1.5 m (E-W), with a wall height of about a meter. It is paved with *'a'ā* pebbles, cobbles and a few 'ili'ili, and contains scattered marine shell.

G3: Immediately adjacent to G2 on its east side, this is a roughly paved, square enclosure. It has an entrance in the southwest corner, and interior measurements of 2 m by 2 m. The interior paving is of *'a'ā* boulders and cobbles. The walls of the feature measure roughly 80 cm in height and width.

G4: This feature is on the northeast side of G3, and consists of a cleared/paved area sheltered by an L-shaped wall. The cleared area measures 2.5 m square, and is paved with *'a'ā* pebbles. The L-shaped wall is roughly 3 m on each side and is on the northwest and northeast sides of the paved area. Nicely stacked of cobbles and small boulders, this wall is approximately 1 m high and 70 cm wide. Incorporated into the exterior of the northwest leg is a small cupboard containing shell midden.

G5: Feature G5 is a cleared and paved oval area defined by a border of boulders and cobbles, but no walls. It is located on the northwest side of features G3 and G4. It measures 5 m (NE-SW) by 3 m (NW-SE), and is paved with *'a'ā* pebbles.

G6: This is a small C-shaped shelter located 3 m northeast of G5. It is approximately 1.5 m wide by 1.5 m deep and is open to the southwest (*makai*). It utilizes the west wall of feature G8 as its eastern side. The interior of the shelter is paved with *'a'ā* pebbles.

G7: This feature is really just a cleared and paved area between features G4 and G8. The walls of those features essentially define the area, although there is a very rough, piled wall

defining the northwest side of this clearing as well. The paving measures approximately 3 m square, and is paved with *'a'ā* pebbles. Marine shell is scattered on the surface.

G8: On the north side of G7 and the east side of G6 is a well-defined walled enclosure. The feature is entered via a break in the wall at the southwest corner. This rectangular enclosure measures roughly 4 m (E-W) by 2.5 m (N-S), and is paved with *'a'ā* pebbles. The walls, of stacked cobbles and small boulders, measure up to 120 cm in height and about a meter wide. The interior contains scattered midden as well as a little waterworn coral.

G9: This feature is immediately adjacent to the southeast side of G7. It consists of another small, modified depression, defined largely by natural bedrock. It is entered via a narrow trail on its west side, descending slightly onto a circular shelter measuring approximately 2.5 m in diameter. Its interior modified walls are up to 110 cm in height. A small cupboard appears to have been situated in eastern side of the feature, but has been obscured by collapse. The interior of the shelter contains the densest midden deposit observed at the site within a shallow soil layer, including marine shell and visible fish bone. A few *'ili'ili* are scattered within the shelter as well.

Complex H: This complex consists of a grouping of three large platforms immediately adjacent to the ocean, at the back of a boulder beach (see Figure 121). The most *makai* of the three (H3) has been severely eroded by wave action. The trail to Kawili Point (Site T56) presently traverses this feature, although it appears that it formerly passed *makai* of this complex. Complex H is located about 10 meters northwest of Complex F.

H1: This feature is a rectangular platform measuring approximately 65 m (N-S) by 5 m (E-W). It has a stacked boulder facing on the *makai* (west) side built up to a height of 70 cm. The other three sides of the feature are defined by aligned boulders which simply meet up with the natural land surface. The *makai* and north sides of the platform are filled with cobbles and small boulders in order to create a level surface. The majority of the platform surface is paved with *'a'ā* pebbles, *"ili'ili*, and waterworn coral. From the northeast corner of this platform, a cleared foot trail containing a few stepping stones heads south, ending at Complex G.

H2: Situated just two meters north of HI, this is a long, narrow, roughly rectangular platform backed by a high sheltering wall. Oriented at roughly a 45-degree angle to H1, the feature is approximately 10 m long (NW-SE) by 4 m wide (NE-SW). The *makai* (southwest) side of the feature consists of a rough boulder facing 50 cm in height, and the northwest side is stacked to a height of as much as 130 cm. The other two sides are poorly defined and consist largely of natural bedrock. The surface of the platform is made up of natural flat bedrock outcrops, boulder and cobble fill, and a paving of *'a'ā* pebbles, *'ili'ili*, and coral. Near the northern corner of the feature is a small pit (ca. 60 cm diameter by 50 cm deep). Along the *mauka* (northeast) edge of the platform is a high stacked wall approximately 4.5 m long by 150 cm high and 150 cm wide. This wall segment shelters the southeastern half of the platform.

H3: Situated *makai* of H1 and H2, directly overhanging a boulder beach at the edge of Mahai'ula Bay, is another large platform. This feature is poorly defined on its *makai* sides (southwest and northwest), having been impacted by erosion caused by the forces of the ocean. The surface of the feature presently measures roughly 7 m (NW-SE) by 5 m (NE-SW). The *makai* edges are marked by rough boulder and cobble fill, while *mauka* of this fill the surface consists of natural level bedrock and abundant *'ili'ili* and coral pebble paving. Due to the proximity of the ocean, it is possible that these materials were deposited during times of high surf. The rear of this feature is defined by the front facings of H1 and H2. The *makai* edge of the platform sits about 2 meters above the boulder beach, and is a combination of natural bedrock and boulder fill. This portion of the platform is very irregular, the former seaward limit of the feature cannot be determined.

H4: Immediately adjacent to the southwest corner of feature H1, this is a modified natural shelter that is only large enough to have functioned as a cupboard. With its opening facing *makai* (west), its interior measures approximately 2 m long by 80 cm wide by 120 cm high. The floor of the cupboard is of natural stone with a few scattered pebbles present.

H5: This is a small rockshelter located 4 meters south of H4, directly adjacent to the *mauka* side of the coastal trail (Site T56). A small modified natural puka in the bedrock provides entry to a small underground shelter. The entry measures approximately 2 m (NE-SW) by 1.2 m (NW-SE) by and is roughly 1 m deep. The subterranean portion of the shelter is off of the southeast side of the *puka* and is approximately 1.5 m deep by 2 m wide and 1 m high. There is marine shell scattered both within and around the exterior of this shelter. The interior is filled/paved with *'a'ā* pebbles and cobbles.

Complex I: This is not really a complex, but rather three unusual features in close proximity to each other whose relationship is unclear (Figure 122).

I1: This is an irregular wall segment. It is unusual for its massive size, measuring up to 130 cm high on the *makai* side and up to 120 cm high on the *mauka* side. It is oriented roughly southeast-northwest, and narrows toward the northwest end, where it is collapsed. The southeast end meets natural bedrock, and near that end it is as much as 3 m wide. At the northwest end it is between 1 and 1.5 m wide. The wall is not particularly well constructed - it is roughly and irregularly stacked, utilizing mostly cobble-sized stones and a few small boulders. The wall is core-filled with cobbles, a few boulders and occasional waterworn coral. Also of note are two concentration of urchin along the base of the wall on the *makai* side. This wall is about 5 meters south of Feature M, a large enclosure (see below). A foot trail, with occasional paved sections and stepping stones, parallels the *mauka* side of feature I1, heading southeast to Complex G.

I2: This feature, located about 7 meters north of I1, consists of a roughly piled short cobble wall segment incorporating two pits and a cupboard. The wall segment is oriented roughly north-south, utilizes natural bedrock boulders in its construction, and is approximately 7 m long, 60 cm high, and 1.2 m wide. The eastern side of the wall is collapsed. At the southern end of the wall, a small cupboard has been constructed, opening to the south. It is roughly 1 m deep by 50 cm wide. Just beyond the opposite (north) end of the wall are two small pits, 60 cm deep by 50 cm in diameter and 70 cm deep by 80 cm in diameter.

At the approximate midpoint between the northern end of I1 and the southern end of I2, a stepping-stone foot trail originates and bears north, leading to Complex J and continuing on to Complex K. The total length of this trail is approximately 40 meters.

I3: Approximately three meters north of I2 is Feature I3, a deteriorated C-shaped shelter. This feature measures approximately 3 m by 3 m, open to the southeast. The southwest side utilizes natural bedrock in its wall construction and has an interior height of 90 cm. The back (northwest) wall has collapsed. The northeast side of the feature is best preserved, with a roughly

stacked cobble/boulder wall measuring 70 cm high on the interior, 100 cm high on the exterior, and 70 cm in thickness. The interior of the shelter contains boulder and cobble collapse from the rear wall, but is paved with *'a'ā* pebbles, and also contains a few waterworn basalt and coral cobbles, rare materials for this site.

Complex J: This complex, located on the opposite side of the foot trail from I3, consists of several very rough features located atop and between two extremely large bedrock boulders approximately 4 meters apart (Figure 122).

J1: This feature is an oval, piled-stone enclosure with an interior dividing wall built atop a boulder that protrudes two meters above the surrounding landscape and is approximately 5-6 meters in diameter. The enclosure, roughly constructed of cobbles piled no more than 30 cm high, occupies the southwest half of the boulder. The enclosure is approximately 4 m (NW-SE) by 2 m (NE-SW). A small wall segment divides the interior across its long axis, and a few stones are strewn about the interior of the enclosure. There is a scatter of *pipipi* shells atop the boulder, both within and outside of the enclosure.

J2: Between the boulder housing J1 and an even larger boulder to the north (J3) are a few very marginal features. J2 is a very rough C-shape with single-stacked/piled walls measuring approximately 3 m (N-S) by 1.5 m (E-W). The feature is open to the south (facing the large boulder). The walls of J2 are approximately 50 cm high by 80 cm wide. Its interior is roughly paved with *'a'ā* pebbles, and a couple of waterworn coral cobbles are present. Immediately adjacent to the feature, on its north side, is a roughly constructed pit, 40 cm in diameter by 50 cm deep. A second, more well defined pit is just northwest of J2, built at the base of the large boulder J3. This pit measures 50 cm (N-S) by 80 cm (E-W) by 90 cm deep.

J3: This feature is actually a large natural boulder, extending about 2.5 meters above the surrounding landscape. The top of the boulder measures almost ten meters across at its largest point, is fairly level, and has a very rough, weathered appearance with many pieces of stone broken away. This may be natural or due to some sort of human activity. There is marine shell (*pipipi*, cowrie, *'opihi*) scattered across the top of the boulder as well.

J4: This is a poorly defined feature built up against the east side of boulder J3. It is simply a raised area of *'a'ā* pebbles and cobbles, neatly leveled of at the top, which measures approximately 4 m along the edge of the boulder (N-S) by 2 m wide (E-W). Its size and shape (roughly oval or rectangular) suggest that it may be a burial.

Complex K: The stepping-stone trail which leads from wall segments I past Complex J turns slightly to the west, and approximately 20 meters beyond Complex J terminates at another set of unusual features, Complex K (see Figure 122).

K1: The main feature of this complex is an irregularly shaped platform built entirely surrounding a large natural circular bedrock boulder. The boulder protrudes 1.4 meters above the surface of the surrounding platform, thus rendering the platform essentially unusable for habitation. The boulder measures approximately 2.5-3 m in diameter, and has two stones stacked atop it. Completely surrounding the boulder is a nearly circular platform, faced to a height of up to 90 cm with cobbles and small boulders. The platform would be a complete circle, save for the north side, which is a straight-walled segment that essentially dissects the circle. The south and east sides of the platform are defined by a border of boulders which meet the natural ground

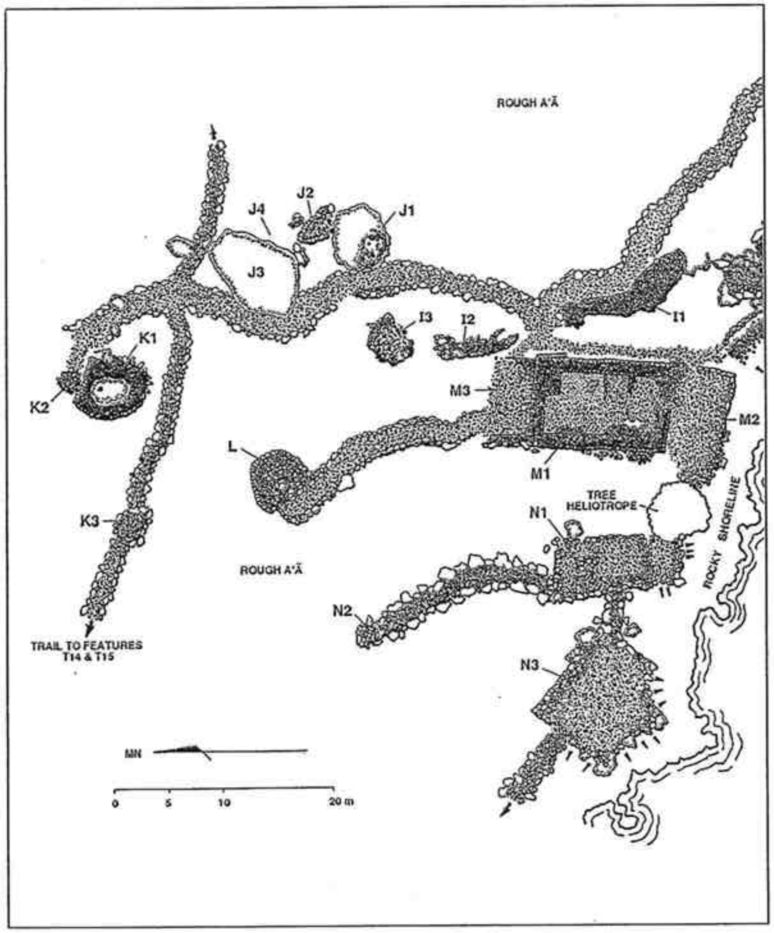


Figure 122. Map showing Complexes I-K, Feature L, and Complexes M-N within Site T70 (from Carpenter et al. 1998:58)

surface. The net effect of this construction is the creation of a narrow "ledge" surrounding the boulder, 100-180 cm wide, which is meticulously leveled and paved with *'a'ā* pebbles. The unusual shape of this feature and the care taken to construct it suggest a ceremonial function. It is possible that it houses a burial or multiple burials. A single stone utilized in the wall facing on the northwest side of this feature has mortar attached to it. Although this stone was apparently brought from another area, and not mortared in place, it nonetheless suggests a historic age for this feature.

K2: This is a walled pit feature adjacent to feature Kl on its north side, and appears to be related to feature Kl. Situated at the base of the straight wall section of Kl, the shape of the pit is nearly a mirror-image of that larger feature, with the pit having a straight wall on the south side, with the rest being circular in shape. The pit measures approximately 100 cm in diameter by 60 cm deep. The sides of the pit are nicely faced with small boulders and cobbles, and the base is paved in a similar style to the surface of Kl. In addition, the area surrounding the pit is similarly leveled and paved.

K3: This feature is located about 10 meters west of Kl, accessed via a narrow cleared foot trail through the *'a'ā*. This feature actually lies directly within that trail alignment, one must walk across the feature in order to continue westward along the trail. The feature consists of an oval outline of boulders surrounding a level filled area paved with *'a'ā* pebbles. It measures approximately 3 m (E-W) by 2 m (NS). Its size and shape suggest it as a possible burial, although it would certainly be an unusual placement of such a feature (in the center of a trail alignment).

Feature L: Feature L is an isolated C-shaped shelter of very substantial construction, accessed via a well constructed trail leading from the *makai* end of Feature M (see below, and Figure 122). This C-shape, open to the west, has walls of stacked cobbles and small boulders measuring up to 130 cm high (both interior and exterior) and nearly 200 cm wide. Its overall size is approximately 5 m by 5 m, with interior dimensions of approximately 3 m (E-W) by 2 m (N-S). The interior is roughly leveled and the floor is of *'a'ā*, basalt and coral cobbles. A few large boulders are roughly piled at the rear wall inside the shelter. At its center is a small walled pit, 50 cm in diameter by 70 cm deep. In the top of the north wall near the open end is a small niche, circa 40 cm deep. The trail that leads to the site from Complex M is approximately 20 meters long. It is roughly curbed, up to 1.5 m wide and paved with *'a'ā* pebbles, *'ili'ili*, and waterworn coral, as well as a few waterworn basalt cobbles. The northern end is paved with *'a'ā* pebbles and cobbles only. This trail is among the nicest of all the foot trails which interconnect throughout Site T70.

Complex M: This complex includes the largest and most complex feature in Site T70. It is located just a few meters from the rocky shoreline of Mahai'ula Bay, above the northern end of the boulder beach fronting Complex H, and just 5 meters west of the unusual wall feature Il (see Figure 122). Feature Ml is a large rectangular enclosure with interior features, with a connected platform *makai* (M2) and a walled, paved area *mauka* (M3) of the main structure. In addition, it contains evidence of rebuilding episodes, and historic modification.

Ml: The main enclosure is oriented north-south with an entrance at the south (*makai*) end. It measures approximately 13 m (N-S) by 8 m (E-W) overall, with interior measurements of approximately 11 m by 5.5 m. Much of the structure is very well-preserved, with double-faced walls of boulders and cobbles and core-fill of cobbles and pebbles. The walls are as much as 150 cm in height. The east, north and west walls are 120-150 cm wide. The north (back) wall formerly had a 90 cm wide doorway in its center which has been filled in using a rougher construction style. The east wall is in an excellent state of preservation, while the north and west walls exhibit some collapse, especially the interior of the west wall. Due to collapse, earlier facings are visible within the walls at the southwest and northwest corners, indicating that the walls have been widened over time. The seaward (south) wall is narrower than the others and has been mortared with a white limestone material, probably a later modification in response to wave damage. There is a meter-wide entrance slightly east of center in that wall. West of that entrance, the mortared wall is 70 cm wide and well-preserved. East of the entrance, the south wall is damaged, and is little more than a linear pile of rubble extending to the southeast corner of the enclosure. The interior of the enclosure is level and paved with *'ili'ili* and waterworn coral, in higher concentration than is typical of structures at this site, as well as a smaller quantity of *'a'ā* pebbles. There is some marine shell scattered in the southeast corner, and a small *'ilima* bush near the southwest corner. In addition, three interior features are situated against the east wall of the enclosure. A short piled rock wall, 40 cm high, extends out 1.5 meters perpendicular to the east wall approximately 3 meters north of the southeast interior corner. Approximately 2.5 meters north of this wall segment is an imbedded alignment of waterworn boulders, also perpendicular to the wall. This alignment of 6 stones is 2.5 m long. Finally, nestled in the northeast corner of the enclosure is a small rectangular platform, measuring approximately 2.5 m (E-W) by 1.2 m (N-S) by 1 m high. It is roughly stacked of *'a'ā* boulders, and the top is covered with waterworn basalt and coral cobbles as well as large pieces of marine shell. A single upright boulder has been placed at its center. This feature appears to be a recent "altar." Between this feature and the imbedded alignment, the ground is covered with a crushed white powdery substance which may be limestone mortar residue as was used to reinforce the seaward wall of this structure.

M2: As mentioned above, connected platforms extend both *mauka* and *makai* of the enclosure. The larger of the two is the seaward (south) platform, which is rectangular and measures 5 m (N-S) by 10 m (E-W). This three-sided platform is faced with boulders on the east, south and west sides, to a maximum height of circa 80 cm, with its north side being formed by the front wall of the enclosure. The eastern wall of the platform is aligned with the east wall of Ml, however the platform extends 2 meters beyond the west side of the enclosure. The coastal trail (Site T56) traverses this platform just in front of the enclosure.

M3: This walled and paved area extends *mauka* of enclosure M1. Its eastern and western sides are defined by low walls that extend directly off of the respective walls of the enclosure. These walls are approximately a meter wide and 20-40 cm high. The walls become less distinct as they extend *mauka* (north), and essentially become indistinguishable from the natural landscape 4 meters north of the back wall of Ml. Between these two low walls is a flat area paved with *'a'ā* pebbles, *'ili'ili*, and waterworn coral and containing scattered midden. The northern edge of the paved area is poorly defined, and the southern side is marked by the back wall of Ml. The area of the paving is approximately 6 m (E-W) by 4 m (N-S).

The trail to Feature L originates from the northwest corner of feature M3. Complex M is undoubtedly a habitation complex. The relative isolation and orientation (opening facing away from M) of feature L, combined with the structural components of that feature, suggest that it

may have served as a *lua* (toilet) for the residents of Complex M. A similar feature is associated with Complex N (N3, see below).

Complex N: This Complex consists of a platform of two levels, a paved foot trail leading to a sheltered pit feature, and a second platform (see Figure 122). It is located about 10 meters west of Complex M along the coastal trail (Site T56), which is very indistinct in this area of the site. Complex N is situated just a few meters from the rough, rocky shoreline of the bay.

N1: The main platform of this feature is rectangular, measuring approximately 9 m (N-S) by 5 m (E-W). It is built up on all four sides with a stacked boulder facing, to a maximum height of 70 cm on the west and north, but just 1-2 stones high (10-20 cm) on the east and south. The south (*makai*) side steps down 20 cm to a lower level, with a surface area of 5 m (E-W) by 3 m (N-S). The seaward wall of this lower platform has been eroded by high surf, but it still contains a rough facing with cobble fill behind it. The level surface of the platform is paved similarly to the other features in the site, with *'a'ā* pebbles, *'ili'ili*, and waterworn coral. In addition, there is a concentration of *'opihi* shells at the rear of the platform. The southeastern corner of this feature is obscured by a tree heliotrope. The larger, upper platform is unusual for a couple of reasons. First, it has a rough paving of boulders two stones wide along its front (south) and west edges, which may delineate a trail across its surface, making a right angle turn at the southwest corner of the platform, and exiting to the north at its northwest corner, continuing on to feature N2. On the east side of this "trail" near the northern end of the platform, is an alignment of small boulders. Parallel to this alignment about 1.5 meters east is a natural bedrock shelf. Between the alignment and the shelf is a pit, approximately 2 m by 1.5 m. This pit has been roughly filled in with large boulders. It is unclear if this "pit" was formerly leveled and paved like the rest of the platform, or if it served another purpose. The feature appears too shallow and the boulders too haphazardly placed to have been a burial. The rest of the platform is paved in the typical fashion of the features in this site.

N2: Similar to the trail leading to Feature L from Complex M, a nicely constructed foot trail leads *mauka* (north) 18 meters from the northwest corner of N1 to a walled pit feature, N2. The trail is nicely cleared and paved with a larger quantity of *'ili'ili* stones than other features of the site, as well as *'a'ā* pebbles, waterworn coral, and a few boulders. At the terminus of the trail is a walled pit, 80 cm (N-S) by 130 cm (EW) by 120 cm deep. It is afforded natural shelter by large upright slabs of lava. As with Feature L, the isolation and situation of this feature suggests it served as a *lua*.

N3: Just four meters west of Feature N1 is the westernmost feature of Site T70, a large square platform. N3 and N1 are connected by a roughly curbed and cobble paved section of the coastal trail (Site T56). The trail leads from the center of the west side of N1 to enter platform N3 at its northeast corner. This platform is oriented at a 45-degree angle to N1 and at a right angle to the rocky coastline, which is just a few meters to the southwest. It measures approximately 10 m (NW-SE) by 10 m maximum (NE-SW). However the seaward (southwest) side of the feature has suffered much damage from high surf, and the southern corner of the platform is missing. The rear (northeast) and southeast sides are the platform are the most well-defined, consisting of stacked boulder facings up to 80 cm high, incorporating natural bedrock boulders. Additionally, the feature appears to have had a low wall at the rear of the structure (circa 1 m wide), which is partially preserved at the northern corner. The northwest side of the platform is roughly defined by a border of small boulders and natural bedrock. The *makai*, damaged side of the platform is a combination of boulder fill and natural bedrock outcrops, up to 120 cm in height. The surface of the platform has a rougher paving than other features at the site, perhaps due to its close proximity to the ocean and the susceptibility to wave damage. The feature has a rough paving of *'a'ā* cobbles and pebbles, plus a small amount of *'ili'ili* and coral. Portions of the surface are marked by rough bedrock. Along the northwest side of the platform surface is a concentration of corroded, flaky pieces of iron. The coastal trail to Kawili point (Site T56) continues northwestward from the northwest side of the platform. At this point it nicely paved with waterworn boulders and roughly curbed.

<u>Complex O:</u> These features are the only ones situated *makai* of the coastal trail (T56), on a small point of land southwest of Complex F (refer to Figure 121). This area is very rough, irregular *'a'ā*, and this group of features utilizes many natural boulders in its construction.

Ol: This feature is situated directly across the trail from Fl, and consists of a roughly rectangular enclosure measuring approximately 4 m (E-W) by 3 m (N-S). Its walls are very roughly stacked of cobbles and a few small boulders on the interior, 30-70 cm high. The exterior is generally formed by natural outcroppings. There is a narrow entrance to the enclosure at its northeast corner. The interior is paved with *'a'ā* pebbles, *'ili'ili*, and coral, and also contains a few large boulders.

O2: This feature is located about 6 meters south of Ol. It is a rather deteriorated U-shaped shelter, with an additional wall segment attached. The feature measures approximately 5.5 m (N-S) by 4 m (E-W), and is open to the ocean (west). Its walls are of roughly stacked cobbles and boulders which modify natural large bedrock boulders. The walls range in height from 20-120 cm. The exterior walls are poorly defined or consist of natural bedrock features. The interior is paved with *'a'ā* pebbles, *'ili'ili*, and coral, and also contains some piled boulders, possibly from wall collapse, especially against the back wall. A small cupboard is built into the northeast corner of the shelter. The opening is 40 cm in diameter and the cupboard is 80 cm deep (horizontally).

From the western end of the south wall of the feature, a remnant of a nicely constructed double-faced/core-filled wall extends *makai* for another 3 meters or so. On the northern side this wall is just one stone (10 cm) high, but due to the fact that it was built over a natural ledge, the southern side of the wall is several stones (70 cm) in height. The wall is a little over a meter wide and appears to have formerly extended further *makai*. Due to its different style of construction, this wall segment may be a remnant of an older, more substantial feature.

O3: Located about 3 meters southeast of 02, this feature is a largely natural formation of bedrock boulders which has been cleared and modified to create a small V-shaped shelter with a natural interior division. The feature is approximately 4 m (NW-SE) by 2.5 m (NE-SW), and open to the ocean side (southwest). The natural and artificial interior walls range from 60-180 cm in height. The interior is divided into two activity areas. The northwest half is formed by a raised natural level bedrock shelf which is paved with *'a'ā* pebbles, *'ili'ili* and coral. This shelf is at a higher level than the adjacent southeastern half of the feature, which consists of a depression filled with *'a'ā* pebbles and cobbles, but not presently leveled or paved.

O4: A small pit is just outside of the eastern corner of Feature O3. This roughly triangular pit is approximately one meter on a side and 70 cm deep.

O5: About seven meters south of O3 is an isolated walled pit. This feature is roughly circular, 80 cm in diameter by 60 cm deep.

<u>Feature P:</u> This feature is a small isolated C-shaped shelter, located alongside a cleared stepping-stone foot trail through the lava that leads from Complex F southeast to meet up with the jeep road/trail (Site Tl) to Makalawena (refer to Figure 121). Feature P is about 25 meters east of Complex F and 4 meters south of the trail, measures approximately 2 m (NE-SW) by 1 m (NW-SE) (interior dimensions), and is open to the northeast. The back wall of the feature is composed of a large naturally upright boulder that provides a small overhanging shelter. The side walls are of stacked boulders and cobbles, and the interior is roughly paved with *'a'ā* pebbles and cobbles.

8.2.3 Dye and Prasad (2000:17-18)

8.2.3.1 Sites 1-9

Sites 1-9 can be described as circular or near-circular plan alignments of angular *pāhoehoe* 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 *pāhoehoe* 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 *pāhoehoe* that is level or gently sloping. No cultural materials were found associated with any of these sites.

Site 1 is a circular alignment of angular *pāhoehoe* cobbles and boulders with an outside diameter of 1.9 m ... No cultural materials are associated with the site.

Site 7 is a circular alignment of angular *pāhoehoe* cobbles and boulders with an outside diameter of 1.7 m ... Several of the *pāhoehoe* 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 *pāhoehoe* and *'a'ā* cobbles and boulders with an outside diameter of 1.5 m ... The site is located at the edge of a massive *'a'ā* lava flow, from which several cobbles and small boulders were taken as construction materials. No cultural materials are associated with the site.

8.2.3.2 Site 10

Site 10 is a C-shape structure of *pāhoehoe* cobbles and boulders up to two courses high that augments a natural depression in the *pāhoehoe*, 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...

Appendix B Select SHPD Correspondence

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

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

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

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

October 28, 1992

Mr. Barry Meyers
Project Manager
Keahole Associates, Inc.
420 Waikamilo Road, Suite 411B
Honolulu, Hawaii 96817

LOG NO: 6654
DOC NO: 0344x

Dear Mr. Meyers:

SUBJECT: **Grubbing of the Shoreline Access Road, Keahole Airport**
Kalaoa, North Kona, Island of Hawaii TMK: 7-3-43: 3

Thank you for bringing to our attention the presence of possible historic sites in the proposed shoreline access road corridor along the northern perimeters of Keahole Airport. Our Hilo staff archaeologist, Marc Smith, conducted a field check of the corridor this morning and confirmed that the presence of archaeological sites in the area.

Our records initially showed that the northern edges of Keahole Airport had been covered by the 1801 Lava Flow, and hence, the presence of any significant archaeological sites in that area was unlikely. It was with this assumption that we determined a "no effect" on historic sites by the access road project when we first reviewed it for various permitting processes. However, it is now apparent that the 1801 Lava Flow left a kipuka of the older substrate containing remnants of what appears to be prehistoric agricultural features, a couple of the features may actually be human burials. These agricultural sites are significant for their information content and need to undergo further data recovery before they can be destroyed.

Mr. Smith, in consultation with your field engineer, is of the opinion that the shoreline access road corridor can be moved to be contained entirely with the 1801 Lava Flow and thereby avoid destroying the archaeological sites. If such an action is feasible, we would strongly recommend that it be taken, and hence, avoid "adversely affecting" the archaeological sites. If it is not feasible, then we suggest that our office be notified so that we can have Mr. Smith be present in the field to lead your engineers through a new

Mr. Barry Meyers
Page 2

corridor that will be mutually agreeable and will not "adversely affect" at this stage the significant historic sites.

Your cooperation in this matter will be greatly appreciated. If you should require further assistance, please contact Kanalei Shun at 587-0007.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

KS:sty

c: Mr. Owen Miyamoto, D.O.T., Airport Division
Mr. Norman Hayashi, Planning Department, County of Hawaii

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

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

DEPUTIES

JOHN P. KEPPELER, II
DONA L. HANAIKE

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

January 13, 1993

LOG NO: 7200
DOC NO: 9301KS06

Mr. Barry Meyers
Project Manager
Keahole Associates, Inc.
420 Waikamilo Road, Suite 411B
Honolulu, Hawaii 96817

Dear Mr. Meyers:

SUBJECT: **Chapter 6E (HRS) and National Historic Preservation Act Compliance--Mamalahoa Trail, Keahole Airport**
Kalaoa, North Kona, Island of Hawaii TMK 3-7-3-43:1, 2, 3

We have reviewed Barrera's letter report ("Archaeological Documentation of Mamalahoa Trail, Keahole Airport") to Chester Koga, dated December 23, 1992, concerning the recording and documentation of Mamalahoa Trail located within the proposed Keahole Airport expansion area. We have also consulted with Mr. Barrera personally to discuss the level of documentation and its adequacy.

We believe that field documentation of the trail in the area of the South Ramp expansion has been adequately executed. Thus, construction can proceed in this area. This area is located on the southeast corner of the airport. Hence, grubbing and destruction of the portion of Mamalahoa Trail in this section of Keahole Airport is permissible. However, archaeological data recovery work will not be completely fulfilled until an acceptable report of the fieldwork is submitted to our office.

The portion of Mamalahoa Trail located between the taxiway and the runway is the project area covered by federal funds, to our understanding. At least two previously unrecorded historic sites, both apparently associated with the trail, have been identified by Mr. Barrera -- one site with a rock mound which may be a human burial. To be in compliance with the federal historic preservation laws, testing of this mound must occur to verify if it is a burial or not and a complete inventory survey report of the two new sites must be submitted to our office with their

Mr. Barry Meyers
January 13, 1993
Page 2

significance evaluations. This needs to be done before any construction in the area. Also, because the Trail is significant for multiple criteria of the National Register of Historic Places, and our agencies are in agreement on this point, technically a Memorandum of Agreement (MOA) (to handle the effect to this site is needed. The U.S. Advisory Council on Historic Preservation has to have an opportunity to comment on this MOA. Hence, before any grubbing is permitted in this area, the following actions must be undertaken.

1. The possible burial mound must be tested right away to determine if it contains human remains. Our office should be notified of the findings as soon as possible. If this is a burial, then FAA/DOT and our office will have to decide on appropriate treatment. We will have to consult with our Hawaii Island Burial Council also.

2. The two newly recorded sites must be properly mapped, located, and described in detail. The significance of the two sites must also be evaluated. The results of this action must be submitted to our office in report format for review and approval.

3. Once the first two steps are completed, our office will prepare a MOA for the Trail mitigation and for the mitigation of the two new sites, if they prove to be significant.

Our office will not be able to agree to any destruction of the trail or new sites in this portion of the airport between the runway and the taxiway until these actions have been completed.

If you should require further assistance, please contact Kanalei Shun at 587-0007.

Sincerely,

Ross Cordy

for DON HIBBARD, Administrator
State Historic Preservation Division

KS:jen

cc: Owen Miyamoto, D.O.T., Airport Division
Virginia Goldstein, Planning Department, County of Hawaii
Rudy Akioshi, DLTA
Na Ala Hele

JAN 13 1993

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

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

DEPUTY
GILBERT COLOMA-AGARAN

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

August 15, 1995

Mr. Larry Chun
Edward K. Noda and Associates, Inc.
615 Piikoi Street, Suite 1000
Honolulu, Hawaii 96814

LOG NO: 14895
DOC NO: 9505ms08

Dear Mr. Chun:

SUBJECT: **Site inspection of 50 acre parcel for proposed land exchange from DOT - Airport Division to DLNR - Land Division Keahole Airport, Haleohiu, North Kona, Hawaii Island TMK: 7-3-43:3 (portion)**

At your request, Historic Preservation Division staff archeologist Marc Smith visited the subject parcel on May 4, 1995.

The boundaries of the parcel have not been marked in the field, however, it appears that most of the area has been covered by the 1801 lava flow. No structures were observed on the recent flow, and it is unlikely that any significant sites would exist.

However, the southeast corner of the subject area along Queen Ka'ahumanu Highway, appears to be an older *kipuka*. Vegetation in the *kipuka* consists of fountain grass, lantana, and small *kiawe*. Within the kipuka are numerous stacked stone features. These include small mounds, C-shapes, and modified outcrops. They appear to be Hawaiian agricultural features, and may be significant for their information content. We feel that the exchange can proceed with "no effect" on significant historic sites, as the exchange does not involve any land altering activities. However, prior to any future land altering activities we would recommend an inventory level archaeological survey be completed to record these features. The findings of the inventory survey must be submitted to our office in report format for our review and comment. If significant historic sites are present in the property, then as a part of any permit action, a mitigation plan detailing a

Cultural Surveys Hawai'i Job Code: KALAOA 14 Appendix B: Select SHPD Correspondence

Page 2

data recovery program and/or preservation commitment would also be submitted to our office for review and concurrence.

If you should have any further questions, please contact Patrick McCoy at 587-0007 (Honolulu), or Marc Smith at 933-4346 (Hilo).

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

MS:amk

APPENDIX D

Air Quality Study for the Proposed Kona International Airport at Keāhole Improvements State Project No. AH2011-05

B.D. Neal & Associates

July 2012

AIR QUALITY STUDY

FOR THE PROPOSED

KONA INTERNATIONAL AIRPORT AT KEAHOLE IMPROVEMENTS

STATE PROJECT NO. AH2011-05

KEAHOLE, NORTH KONA, HAWAII

Prepared for:

Wilson Okamoto Corporation

July 2012

B.D. NEAL & ASSOCIATES

Applied Meteorology • Air Quality • Computer Science

P.O. BOX 1808 • KAILUA-KONA, HAWAII 96745 • TELPHONE (808) 329-1627 • FAX (808) 325-6739
EMAIL: bdneal@bdneal.com

CONTENTS

FIGURES

TABLES

TABLES (cont.)

Table

1.0 SUMMARY

The State of Hawaii Department of Transportation Airports Division is proposing improvements to Kona International Airport at Keahole (KOA), which is located in the North Kona District on the island of Hawaii. The proposed improvements include the expansion of the existing general aviation facilities, a new medical transitional facility, a new aircraft rescue fire-fighting station and regional training facility and other terminal modifications. The proposed improvements are expected to be constructed in phases and be fully completed by 2022. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are comparable to the national standards, although in some cases the Hawaii standards are more stringent than the national standards, such as for carbon monoxide. For some other parameters, such as for particulate matter and sulfur dioxide, the national standards are more restrictive.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its coastal situation and by nearby mountains. Winds are predominantly light and variable, although kona storms generate occasional strong winds from the south or southwest during winter. Temperatures in the project area are generally very consistent and moderate with average daily temperatures ranging from about 65°F to 85°F. The extreme minimum temperature recorded at the nearby Old Kona Airport is 47°F, while the extreme maximum temperature is 93°F. Average annual rainfall in the area amounts to about 25 inches with each month typically contributing about 2 inches.

Except for chronic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion, the present air quality of the project area is believed to be relatively good. The limited air quality data that are available for the area from the Department of Health indicate that fine particulate concentrations, which are due to the vog, exceed the national air quality standards.

If the proposed project is given the necessary approvals to proceed, it may be inevitable that some short- and/or long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phases. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption

of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during periods of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, a computerized air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at roadway intersections in the project vicinity and to predict future levels with the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are within both the state and the national ambient air quality standards. In the year 2022 without the proposed improvements, carbon monoxide concentrations were predicted to remain about the same or decrease slightly in the project area, and concentrations should remain within state and federal standards. With the proposed improvements in the year 2022, carbon monoxide concentrations would remain about the same or increase slightly compared to without the improvements, and concentrations would remain well within standards. Implementing mitigation measures for traffic-related air quality impacts is probably unnecessary and unwarranted.

With or without the proposed improvements, aircraft operations are expected to increase by 2022, and the associated air pollution emissions will increase proportionally. However, the proposed improvements are not expected to affect the number or type of aircraft operations. Thus, the proposed improvements should not result in an increase in air pollution emissions from aircraft operations at the airport.

2.0 INTRODUCTION

The State of Hawaii Department of Transportation Airports Division (HDOT-A) is proposing various improvements to the existing KOA. KOA is situated on an approximately 3,470-acre site located west of Queen Kaahumanu Highway at Keahole on the island of Hawaii. The proposed improvements at the airport include:

- Expansion of the existing general aviation facilities
- Construction of a new helicopter general aviation facility
- Construction of a new seawater air conditioning system

- Relocation of the Astronaut Ellison S. Onizuka Space Center
- Expansion of the existing terminal to encompass the former Space Center site
- Construction of a high pressure hydrogen fuel storage and fueling station
- Construction of an ARFF Regional Training Facility
- Construction of a 45,000 square foot medical transitional facility
- Construction of a temporary State of Hawaii Department of Agriculture (DOA) inspection facility
- Interior renovations to the existing Aircraft Rescue Fire Fighting Facility (ARFF) for a new commuter terminal.

The proposed improvements are expected to be completed by 2022.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short- and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as planned. Measures to mitigate project impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit.

The national AAQS are reviewed periodically, and multiple revisions have occurred over the past 30 years. In general, the national AAQS have become more stringent with the passage of time and as more information and evidence become available concerning the detrimental effects of air pollution. Changes to the Hawaii AAQS over the past several years have tended to follow revisions to the national AAQS, making several of the Hawaii AAQS the same as the national AAQS.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the 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 most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

The site of the proposed project is located near the midpoint of the western coast of the island of Hawaii. The topography of Hawaii Island is dominated by the great volcanic masses of Mauna Loa (13,653 feet), Mauna Kea (13,796 feet), and of Hualalai, the Kohala Mountains and Kilauea. The island consists entirely of the slopes of these mountains and of the broad saddles between them. Mauna Loa and Kilauea, located on the southern half of the island, are still active volcanoes.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Nearly the entire western coast of the island of Hawaii, however, is sheltered from the trade winds by high mountains, except when unusually strong trade winds sweep through the saddle between the Kohala Mountains and Mauna Kea and reach some areas to the lee. Due to wind shadow effects caused by the terrain, winds in the project area are predominantly light and variable. Local winds such as land/sea breezes and/or

upslope/downslope winds dominate the wind pattern for the area. During the daytime, winds typically move onshore because of seabreeze and/or upslope effects. At night, winds generally are land breezes and/or drainage winds that move downslope and out to sea. During winter, occasional strong winds from the south or southwest occur in association with the passage of winter storm systems.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's leeward location results in a larger temperature profile compared to windward locations at the same elevation. At the Old Kona Airport, located a few miles south of the project site, average daily minimum and maximum temperatures are 67°F and 83°F, respectively [1]. The extreme minimum temperature on record at this location is 47°F, and the extreme maximum is 93°F. Temperatures at the project site are similar.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 is the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Kona area, stability classes 5 or 6 typically occur during the nighttime or early morning hours when temperature inversions form due to radiational cooling or to drainage flow from the mountainous interior of the island. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air

rushes in over warmer land. Mixing heights in Hawaii typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the project area is wetter than might be expected for a leeward location. This is due to the persistent onshore and upslope movement of marine air caused by both eddie and seabreeze or mountain slope effects. Some of the rainfall occurs during summer afternoons and evenings as a result of this onshore and upslope movement of moisture-laden marine air, and some occurs in conjunction with winter storms. At the Old Kona Airport, average annual rainfall amounts to about 25 inches with each month registering about 2 inches [1]. Rainfall at the project site is probably about the same.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Table 2 presents an air pollutant emission summary for the island of Hawaii for calendar year 1993. This has become somewhat dated but is the latest information available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the manmade particulate emissions on Hawaii originate from area sources, such as the mineral products industry and agriculture. Manmade sulfur oxides are emitted almost exclusively by point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions emanate predominantly from area sources (mostly motor vehicle traffic), although industrial point sources contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Hawaii, emissions of particulate and nitrogen oxides may have increased during the past several years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons probably have declined.

It should be noted that Hawaii Island is unique from the other islands in the state in terms of the natural volcanic air pollution emissions that occur. Volcanic emissions periodically plague the project area. This is especially so since the latest eruption phase of the Kilauea Volcano began in 1983. Air pollution emissions from the Hawaiian volcanoes consist primarily of sulfur dioxide. After entering the atmosphere, these sulfur dioxide emissions are carried away by the wind and either washed out as acid rain or gradually transformed into particulate sulfates or acid aerosols. Although emissions from Kilauea are vented on the other side of a mountain barrier more than 50 miles east of the project site, the prevailing wind patterns eventually carry some of the emissions into the Kona area. These emissions can be seen in the form of the volcanic haze (vog) which persistently hangs over the area.

The project area has relatively few major sources of air pollution. KOA itself is likely one of the more significant sources. Aircraft operations (landing, takeoff, taxiing and approach), fuel storage and fueling operations, ground support equipment, motor vehicle traffic and other activities result in emissions of carbon monoxide, nitrogen oxides, sulfur oxides, hydrocarbons, particulate matter and other air pollutants.

A major industrial source of air pollution in the project vicinity is Hawaii Electric Light Company's Keahole Power Plant, which is located immediately east of KOA. Air pollution emissions from Keahole Power Plant consist mostly of sulfur dioxide and oxides of nitrogen.

The project site is situated along Queen Kaahumanu Highway on the makai side. This highway is a regional arterial roadway that often carries substantial volumes of traffic. Winds may sometimes carry emissions from motor vehicles traversing these roadways toward the project site.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state. Unfortunately, very limited data are available for Hawaii Island, and even less data are available for the Kona area specifically. During the most recent 5-year period for which data have been reported (2006-2010), the Department of Health operated an air quality monitoring site in the Kealakekua area for measuring sulfur dioxide. Particulate (PM 2.5) was also monitored at this site, but monitoring for this parameter was only initiated during 2008. As indicated in Table 3, measurements of sulfur dioxide concentrations at this location during the 2006-2010 monitoring period were consistently low with annual average concentrations of 0.004 to 0.009 ppm, which represents about 30 percent of the state and national standard. The highest annual second-highest 3-hour and 24-hour concentrations (which are most relevant to the standards) for these five years were 0.112 and 0.042 ppm, respectively; these are about 22 to 30 percent of the applicable standards. No exceedances of the state/national 3-hour and 24-hour AAQS for sulfur dioxide were recorded. It should be noted that a new national 1-hour sulfur dioxide standard was implemented during 2010, but data pertaining to this new standard have not yet been reported.

The annual average particulate (PM 2.5) concentrations for the years 2008 through 2010 ranged from 16 to 21 $\mu g/m^3$. These values exceed the national annual standard which is set at 15 $\mu g/m^3$. The 98^{th} percentile 24-hour concentration (which is most relevant to the national 24-hour standard) was reported at 37 $\mu g/m^3$ for 2008 and 2009 and at 35 $\mu g/m^3$ for 2010. These values are equal to or slightly above the national standard of 35 $\mu g/m^3$. The higher concentrations of fine particulate are primarily due to volcanic emissions.

At this time, there are no reported measurements of lead, ozone, nitrogen dioxide or carbon monoxide in the project vicinity.

These are primarily motor vehicle related air pollutants. Lead, ozone and nitrogen dioxide typically are regional scale problems. Concentrations of lead and nitrogen dioxide generally have not been found to exceed AAQS elsewhere in the state. Ozone concentrations measured at Sand Island on Oahu are somewhat elevated but are within state and national standards. Carbon monoxide air pollution typically is a microscale problem caused by congested motor vehicular traffic. In traffic congested areas such as urban Honolulu, carbon monoxide concentrations have been found to occasionally exceed the state AAQS. Present concentrations of carbon monoxide in the project area are estimated later in this study based on computer modeling of motor vehicle emissions.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site, from a temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from demolition activities and from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of the elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the project site would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown

away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the annual standard for nitrogen dioxide is not likely to be violated by short-term construction equipment emissions. Also, the new short-term (1-hour) standard for nitrogen dioxide is based on a three-year average; thus it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel engines are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area will temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the President signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, and these began to take effect during the next decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 20 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term ambient air quality impact of motor vehicle traffic using the proposed new roadway facilities, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways within the project area. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single project.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2011 with present conditions, (2) year 2022 without the project, and (3) year 2022 with the project. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, the three key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Keahole Airport Road at Queen Kaahumanu Highway

- Keahole Airport Road at Halalu Street
- Keahole Airport Road at Pao'o Street.

The traffic impact report for the project [4] describes the existing and projected future traffic conditions and laneage configurations of the study intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

The EPA computer model MOBILE6.2 [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6.2 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on

national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 34.2% light-duty gasoline-powered automobiles, 52.9% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.6% heavy-duty diesel-powered trucks and buses, and 0.5% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change somewhat with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and carbon monoxide emission estimates given by MOBILE6.2 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model had become outdated. Studies have shown that

CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings. All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted or design speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied

for all three scenarios. This acknowledges that pedestrian sidewalks already exist in these locations. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the morning cases, while atmospheric stability category 4 was assumed for the afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within urban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted concentrations for 2011. Although increased traffic is expected to occur within the project area within the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 5 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 2011 with existing traffic, year 2022 without the project and year 2022 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2011) case was 2.6 ppm. This was projected to occur during the morning peak traffic hour near the intersection of Keahole Airport Road at Queen Kaahumanu Highway. Concentrations at other locations and times studied were 2.1 ppm or lower. Predicted worst-case 1-hour concentrations at all locations studied for the 2011 scenario were well within both the national AAQS of 35 ppm and the state standard of 9 ppm.

In the year 2022 without the proposed project, the highest worst-case 1-hour concentration was predicted to continue to occur during the morning at the intersection of Keahole Airport Road and Queen Kaahumanu Highway. A value of 2.1 ppm was predicted to occur at this location and time. Peak-hour worst-case values at the other locations and times studied for the year 2022 without project scenario ranged between 0.9 and 1.8 ppm. Compared to the existing case, predicted concentrations for the year 2022 without the project remained mostly unchanged or decreased slightly at all locations, and worst-case concentrations remained well within the state and national standards.

Predicted 1-hour worst-case concentrations for the year 2022 with project scenario remained nearly unchanged or increased slightly at the study intersections. Similar to the 2022 without project case, the maximum concentration was predicted to occur during the morning at the intersection of Keahole Airport Road at Queen Kaahumanu Highway, increasing slightly compared to the without project scenario at a concentration of 2.2 ppm. Other concentrations ranged between 1.2 and 2.0 ppm. Worst-case concentrations at all locations studied remained well within the state and federal standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and

(2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [11] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 6. For the year 2011 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the three locations studied ranged from 0.6 to 1.3 ppm, with the highest concentration occurring at the intersection of Keahole Airport Road and Queen Kaahumanu Highway. The estimated worst-case concentrations for the existing case were well within both the state standard of 4.4 ppm and the national limit of 9 ppm.

For the year 2022 without project scenario, worst-case concentrations ranged between 0.6 and 1.0 ppm, with the highest concentration occurring at the intersection of Keahole Airport

Road and Queen Kaahumanu Highway. All predicted concentrations were within the standards.

For the year 2022 with project scenario, worst-case concentrations remained nearly unchanged compared to the without project case, indicating minimal project impact. All predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.2 Aircraft Operations

With or without the project, aircraft operations are expected to increase during the next 10 years, and consequently, emissions from aircraft operations will likely increase compared to existing levels. That being said, the proposed improvements at KOA primarily involve improvements that do not affect aircraft operations. Although the proposed improvements include the expansion of the existing general aviation facilities and the construction of a new helicopter general aviation facility, it is not expected that these improvements will result in either an increase in aircraft operations or a change in the types of aircraft using the airport facilities. Thus, it is not expected that the proposed improvements will result in increased air pollution emissions due to aircraft operations.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Existing air quality in the project area is impacted by emissions from Kilauea Volcano. Fine particulate measurements from the Department of Health monitoring station at Kealakekua indicate that the national standards for both the 24-hour and the annual averaging periods may be exceeded. While this phase of Kilauea's eruption has been occurring for more than 25 years and it is unknown when it will end, fine particulate concentrations will go down significantly when it does.

The major potential short-term air quality impact of the project will occur from the emission of fugitive dust during construction

phases. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program and to adjust the program if necessary.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After construction of the proposed improvements is completed, carbon monoxide concentrations in the project area due to increased motor vehicle traffic will likely remain about the same or increase very slightly. Worst-case concentrations should remain well within both the state and the national ambient air quality standards at least through the year 2022. Implementing any air quality mitigation measures for long-term traffic-related impacts is probably unnecessary and unwarranted.

While the proposed improvements may result in increased motor vehicle traffic on roadways at the airport, the improvements are not expected to cause an increase in the number of aircraft operations or a change in the types of aircraft using the airport. Thus, while the number of aircraft operations is expected to increase during the next 10 years due to an increase in passenger volume and air pollution emissions from aircraft operations can be expected to increase compared to existing levels, with or without the project, the proposed improvements should not result in increased air pollution emissions from aircraft operations.

REFERENCES

1. "Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", U.S. Department of Commerce, Weather Bureau, Washington, D.C., 1965.

2. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

3. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

4. Wilson Okamoto Corporation, Traffic Impact Report, Kona International Airport, March 2012.

5. User's Guide to MOBILE6.0, Mobile Source Emission Factor Model, U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Assessment and Standards Division, Ann Arbor, Michigan, January 2002.

6. Guideline on Air Quality Models (Revised), Including Supplements A and B, EPA-450/2-78-027R, U.S. Environmental Protection Agency, Research Triangle Park, NC, July 1986.

7. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, U.S. Environmental Protection Agency, November 1992.

8. CALINE4 - A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways, FHWA/CA/TL-84/15, California State Department of Transportation, November 1984 with June 1989 Revisions.

9. "Persistence Factors for Mobile Source (Roadway) Carbon Monoxide Modeling", C. David Cooper, Journal of the Air & Waste Management Association, Volume 39, Number 5, May 1989.

10. Guideline for Modeling Carbon Monoxide from Roadway Intersections, U.S. Environmental Protection Agency, EPA-454/R-92-005, November 1992.

11. Annual Summaries, Hawaii Air Quality Data, 2006-2010, State of Hawaii Department of Health.

Figure 1 - Project Location

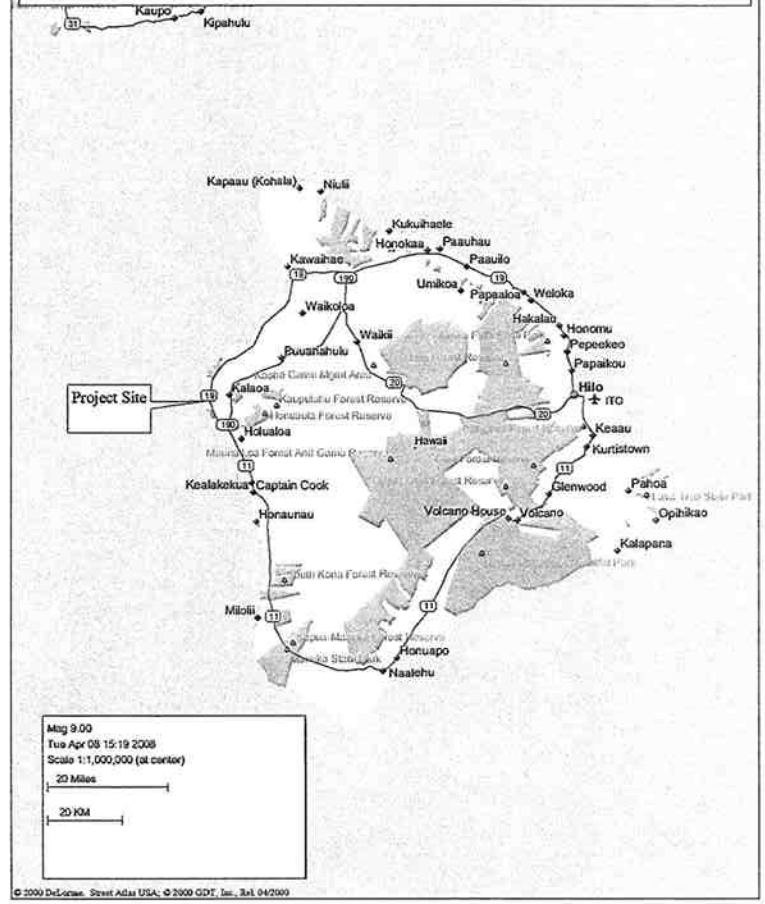


Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	μg/m³	Annual	-	-	50
		24 Hours	150[a]	150[a]	150[b]
Particulate Matter (<2.5 microns)	μg/m³	Annual	15[c]	15[c]	-
		24 Hours	35[d]	35[d]	-
Sulfur Dioxide	ppm	Annual	-	-	0.03
		24 Hours	-	-	0.14[b]
		3 Hours	-	0.5[b]	0.5[b]
		1 Hour	0.075[e]	-	-
Nitrogen Dioxide	ppm	Annual	0.053	0.053	0.04
		1 Hour	0.100[f]	-	-
Carbon Monoxide	ppm	8 Hours	9[b]	-	4.4[b]
		1 Hour	35[b]	-	9[b]
Ozone	ppm	8 Hours	0.075[g]	0.075[g]	0.08[g]
Lead	μg/m³	3 Months	0.15[h]	0.15[h]	-
		Quarter	1.5[i]	1.5[i]	1.5[i]
Hydrogen Sulfide	ppm	1 Hour	-	-	0.035[b]

[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the 24-hour concentrations averaged over three years.
[e] Three-year average of annual fourth-highest daily 1-hour maximum.
[f] 98th percentile value of the daily 1-hour maximum averaged over three years.
[g] Three-year average of annual fourth-highest daily 8-hour maximum.
[h] Rolling 3-month average.
[i] Quarterly average.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF HAWAII, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	30,311	9,157	39,468
Sulfur Oxides	9,345	nil	9,345
Nitrogen Oxides	4,054	8,858	12,912
Carbon Monoxide	3,357	23,934	27,291
Hydrocarbons	1,477	203	1,680

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST KOA

Parameter / Location	2006	2007	2008	2009	2010
Sulfur Dioxide / Kealakekua, Kona					
3-Hour Averaging Period:					
No. of Samples	2697	2756	2445	2560	2625
Highest Concentration (ppm)	0.046	0.034	0.124	0.130	0.150
2nd Highest Concentration (ppm)	0.035	0.025	0.112	0.111	0.095
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
No. of Samples	341	343	353	365	344
Highest Concentration (ppm)	0.012	0.011	0.054	0.045	0.039
2nd Highest Concentration (ppm)	0.011	0.011	0.038	0.042	0.034
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (ppm)	0.004	0.004	0.009	0.004	0.006
Particulate (PM-2.5) / Kealakekua, Kona					
24-Hour Averaging Period:					
No. of Samples	-	-	292	352	359
Highest Concentration (µg/m³)	-	-	44	61	63
98TH Percentile Concentration (µg/m³)	-	-	37	37	35
No. Occurrences Greater than 35 µg/m³	-	-	10	8	6
Annual Average Concentration (µg/m³)	-	-	21	16	18

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2006 - 2010"

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR KOA (parts per million)

Roadway Intersection	Year/Scenario					
	2011/Present		2022/Without Project		2022/With Project	
	AM	PM	AM	PM	AM	PM
Keahole Airport Rd at Queen Kaahumanu Hwy	2.6	2.1	2.1	1.8	2.2	2.0
Keahole Airport Rd at Halalu Street	1.2	1.3	1.2	1.2	1.3	1.2
Keahole Airport Rd at Pao'o Street	1.1	0.9	1.1	0.9	1.3	1.3

Hawaii State AAQS: 9
National AAQS: 35

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR KOA (parts per million)

Roadway Intersection	Year/Scenario		
	2011/Present	2022/Without Project	2022/With Project
Keahole Airport Rd at Queen Kaahumanu Hwy	1.3	1.0	1.1
Keahole Airport Rd at Halalu Street	0.6	0.6	0.6
Keahole Airport Rd at Pao'o Street	0.6	0.6	0.6

Hawaii State AAQS: 4.4
National AAQS: 9

APPENDIX E

Acoustic Study for the Master Plan Update
Kona International Airport at Keāhole

Y. Ebisu & Associates

August 2012

ACOUSTIC STUDY FOR THE MASTER PLAN UPDATE KONA INTERNATIONAL AIRPORT AT KEAHOLE KONA, HAWAII

Prepared for:

WILSON OKAMOTO CORPORATION

Prepared by:

Y. EBISU & ASSOCIATES
1126 12th Avenue, Room 305
Honolulu, Hawaii 96816

AUGUST 2012

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF TABLES

LIST OF TABLES (CONTINUED)

CHAPTER 1. INTRODUCTION AND SUMMARY

The existing and future traffic noise levels in the vicinity of Kona International Airport At Keahole (KOA) in Kona, Hawaii were evaluated for their potential impact on noise sensitive receptors in the project environs. The future traffic noise levels along the primary access roadways to the airport under the Do Nothing and Action Scenarios were calculated for 2011 and 2022. A list of the proposed airport improvements included in the Action Scenario are included in Reference 9.

Risks of future traffic noise impacts resulting from the proposed KOA improvements are considered to be low due to the relatively small increases in traffic noise associated with the Action Alternative. The largest increases in traffic noise attributable to the KOA improvements are anticipated to occur along Pao`o Street within the Airport property. The largest forecasted increases within the Airport property are approximately 3 DNL (Day-Night Average Sound Level) from CY 2011 to CY 2022. These changes in traffic noise levels will be very difficult to detect over the 11 year period of the proposed improvements, and risks of traffic noise impacts from the KOA improvements should be very low.

Traffic noise level increases along Queen Kaahumanu Highway are predicted to be 4 DNL due to non-project traffic and 0.3 DNL or less due to project traffic. Along Queen Kaahumanu Highway in the airport environs, risks of adverse traffic noise impacts are expected to be minimal due to the relatively small increases in traffic volumes associated with project traffic. Mitigation of existing or future traffic noise impacts along Queen Kaahumanu Highway are expected to occur during the planned widening of the highway and/or during improvements to the properties along the highway by the individual property owners.

By current federal criteria for identifying aircraft noise impacts, the KOA improvements should not result in adverse noise impacts within the KOA environs. New land use incompatibilities beyond the Airport boundaries should not occur as a result of increases in airport noise levels under the Do Nothing or Action Alternatives. The primary reason for this is that adequate buffer distances exist between the airport runways and the nearest noise sensitive properties beyond the Airport boundaries. Therefore, even with increasing aircraft operations at KOA, the resulting noise contours at the airport are not expected to result in new land use incompatibilities.

With the implementation of the proposed KOA improvements, the near term (2013) and long term (post 2022) airport 60 DNL noise contours will enclose planned noise sensitive facilities within the Airport boundaries. These planned facilities include the relocated Onizuka Museum, a new Aircraft Rescue Fire Fighting (ARFF) Training Facility, and a new Medical Transitional Facility. These facilities should be constructed with provisions for noise attenuation features because they will all be located within the 60 DNL noise contour.

Unavoidable, but temporary, noise impacts may occur during construction activities at KOA and at any outlying roadway improvement project sites. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. For this reason, the use of quiet equipment and construction curfew periods as required under the State Department of Health noise regulations are recommended to minimize construction noise impacts.

CHAPTER 2. PURPOSE

The objectives of this study were to describe the existing and future noise environment in the environs of Kona International Airport At Keahole (KOA) on the island of Hawaii. The future noise environment and potential noise impacts were examined for the Do Nothing and Action Scenarios of the KOA 2010 Master Plan using aircraft operations forecasts for the Years 2013 and beyond 2022 and using motor vehicle traffic forecasts for 2022. The selection of the airport operations forecast years of 2013 and beyond 2022 was dictated by the 14 CFR Part 150 Noise Compatibility Program Update for KOA, which developed airport noise contours for KOA for 2013 and 2030.

Both motor vehicle and aircraft noise level increases and impacts associated with the various improvement scenarios were to be determined within the project environs. A specific objective was to determine future road traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases. Assessments of possible impacts from noise resulting from fixed and rotary wing aircraft operations at KOA were included in the study objectives. In addition, assessments of potential impacts from short term construction noise at the project site were also included in the noise study objectives. Recommendations for minimizing these noise impacts were also to be provided as required.

CHAPTER 3. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (DNL). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. The maximum A-Weighted sound level occurring while an aircraft is flying past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value". The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level", or Lse, which is analogous to the energy of the time-varying sound levels associated with a single event.

The DNL contours represent the average noise during a typical day of the year. DNL exposure levels of 55 or less are typical of quiet rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways.

By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA. A more complete list of noise descriptors is provided in Appendix B to this report. In Appendix B, the Ldn descriptor symbol is used in place of the DNL descriptor symbol.

Table 3-1, derived from Reference 1, presents current federal noise standards and acceptability criteria for residential land uses. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in Figure 3-1. As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. Due to noise shielding effects from intervening structures, interior lots are usually exposed to 3 to 10 DNL lower noise levels than the front lots which are not shielded from the traffic noise.

For the purposes of determining noise acceptability for funding assistance from federal agencies, an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration (FAA), Department

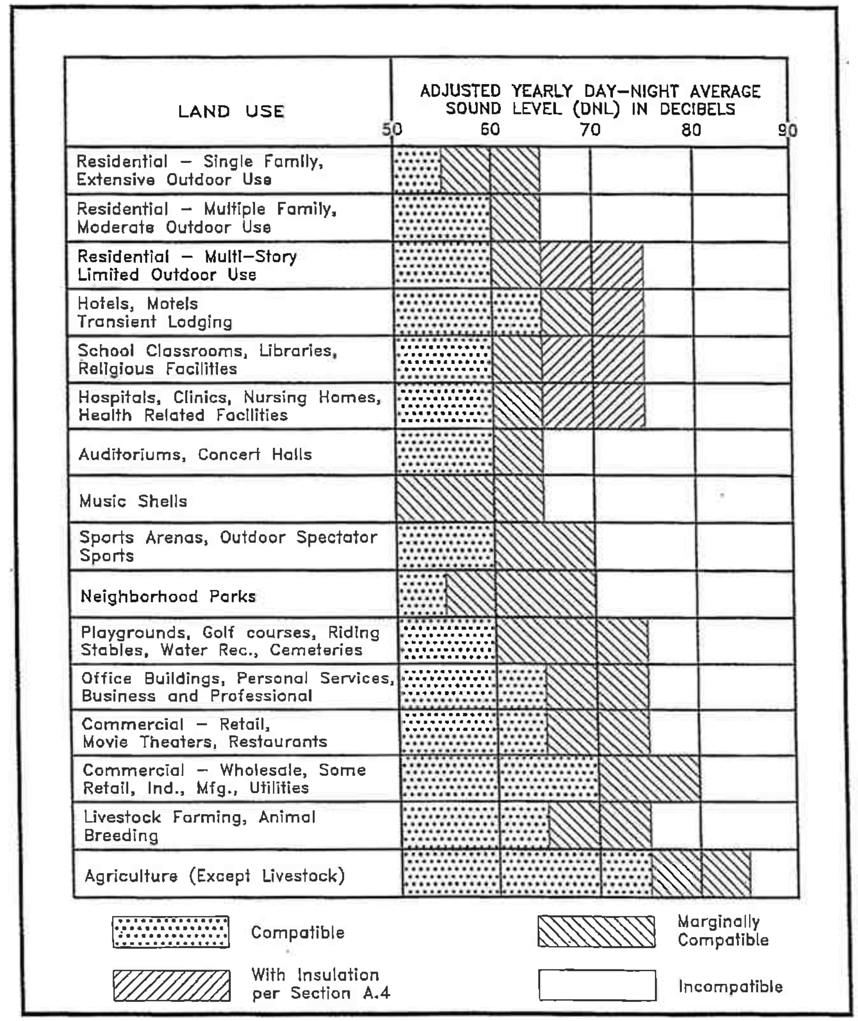
TABLE 3-1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY-NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9-1998/Part 5)

FIGURE 3-1

of Defense (DOD); Federal Housing Administration, Housing and Urban Development (FHA/HUD), and Veterans Administration (VA). This standard is applied nationally (see Reference 2), including Hawaii.

Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise (see Reference 3). For typical, naturally ventilated structures in Hawaii, an exterior noise level of 55 DNL results in an interior level of approximately 45 DNL, which is considered to be the "Unconditionally Acceptable" (or "Near-Zero Risk") level of interior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For aircraft noise, the State of Hawaii Department of Transportation, Airports Division (DOTA), has recommended that 60 DNL be used as the common level for determining land use compatibility in respect to noise sensitive uses near its airports. Table 3-2 summarizes the recommendations for compatible land uses at various levels of aircraft noise. For those noise sensitive land uses which are exposed to aircraft noise greater than 55 DNL, the division recommends that disclosure of the aircraft noise levels be provided prior to any real property transactions. Reference 4 requires that such disclosure be provided prior to real property transactions concerning properties located within Air Installation Compatibility Use Zones (AICUZ) or located within airport noise maps developed under Federal Aviation Regulation Part 150 - Airport Noise Compatibility Planning (14 CFR Part 150).

Traffic noise associated with public roadways and federally financed highways are evaluated in respect to the Federal Highways Administration (FHWA) and the Hawaii State DOT, Highways Division (DOT-HWYS) noise abatement criteria. For noise sensitive land uses, an hourly traffic noise level of 66 Leq(h) [Hourly Equivalent or Average Sound Level] is considered to be the level at and above which traffic noise is considered to be unacceptable see Table 3-3. The 66 Leq(h) DOT-HWYS criteria is approximately 1 Leq unit lower than the FHWA noise abatement criteria (see Reference 5), and is applied on all federally funded highway projects in the State of Hawaii.

Other noise sources, such as stationary machinery and construction equipment, are regulated by the State Department of Health (DOH) noise regulations (Reference 6). The DOH noise regulations for stationary machinery and construction noise sources (Reference 6) apply on the island of Hawaii, and throughout the State of Hawaii. These DOH community noise regulations limit stationary machinery noise levels to approximately 55 DNL and 60 DNL when operating near single family and multifamily residences, respectively. The DOH noise rules also regulate noise during construction activities.

TABLE 3–2

HAWAII STATE DEPARTMENT OF TRANSPORTATION RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBILITY WITH YEARLY DAY–NIGHT AVERAGE SOUND LEVELS (DNL).

TYPE OF LAND USE	**** Yearly Day-Night Average Sound Level ****					
	< 60	60-65	65-70	70-75	75-80	80-85
RESIDENTIAL						
Low density residential, resorts, and hotels (outdoor facil.)	Y(a)	N(b)	N	N	N	N
Low density apartment with moderate outdoor use	Y	N(b)	N	N	N	N
High density apartment with limited outdoor use	Y	N(b)	N(b)	N	N	N
Transient lodgings with limited outdoor use	Y	N(b)	N(b)	N	N	N
PUBLIC USE						
Schools, day-care centers, libraries, and churches	Y	N(c)	N(c)	N(c)	N	N
Hospitals, nursing homes, clinics, and health facilities	Y	Y(d)	Y(d)	Y(d)	N	N
Indoor auditoriums and concert halls	Y(c)	Y(c)	N	N	N	N
Government services and office buildings serving the general public	Y	Y	Y(d)	Y(d)	N	N
Transportation and Parking	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
COMMERCIAL AND GOVERNMENT USE						
Offices - government, business, and professional	Y	Y	Y(d)	Y(d)	N	N
Wholesale and retail - building materials, hardware and heavy equipment	Y	Y	Y(d)	Y(d)	Y(d)	Y(d)
Airport businesses - car rental, tours, lei stands, ticket offices, etc.	Y	Y	Y(d)	Y(d)	N	N
Retail, restaurants, shopping centers, financial institutions, etc.	Y	Y	Y(d)	Y(d)	N	N
Power plants, sewage treatment plants, and base yards	Y	Y	Y(d)	Y(d)	Y(d)	N
Studios without outdoor sets, broadcasting, production facilities, etc.	Y(c)	Y(c)	N	N	N	N
MANUFACTURING, PRODUCTION, AND STORAGE						
Manufacturing, general	Y	Y	Y(d)	Y(d)	Y(d)	N
Photographic and optical	Y	Y	Y(d)	Y(d)	N	N
Agriculture (except livestock) and forestry	Y	Y(e)	Y(e)	Y(e)	Y(e)	Y(e)
Livestock farming and breeding	Y	Y(e)	Y(e)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y(f)	Y(f)	N	N	N
Outdoor music shells, amphitheaters	Y(f)	N	N	N	N	N
Nature exhibits and zoos, neighborhood parks	Y	Y	Y	N	N	N
Amusements, beach parks, active playgrounds, etc.	Y	Y	Y	Y	N	N
Public golf courses, riding stables, cemeteries, gardens, etc.	Y	Y	N	N	N	N
Professional/resort sport facilities, locations of media events, etc.	Y(f)	N	N	N	N	N
Extensive natural wildlife and recreation areas	Y(f)	N	N	N	N	N

Numbers in parentheses refer to notes.

KEY TO TABLE 3–2:

Y(Yes) = Land Use and related structures compatible without restrictions.
N(No) = Land Use and related structures are not compatible and should be prohibited.

TABLE 3–2 (CONTINUED)

HAWAII STATE DEPARTMENT OF TRANSPORTATION RECOMMENDATIONS FOR LOCAL LAND USE COMPATIBILITY WITH YEARLY DAY–NIGHT AVERAGE SOUND LEVELS (DNL)

NOTES FOR TABLE 3–2:

(a) A noise level of 60 DNL does not eliminate all risks of adverse noise impacts from aircraft noise. However, the 60 DNL planning level has been selected by the State Airports Division as an appropriate compromise between the minimal risk level of 55 DNL and the significant risk level of 65 DNL.

(b) Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 DNL or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure plus air conditioning may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems.

(c) Because the DNL noise descriptor system represents a 24-hour average of individual aircraft noise events, each of which can be unique in respect to amplitude, duration, and tonal content, the NLR requirements should be evaluated for the specific land use, interior acoustical requirements, and properties of the aircraft noise events. NLR requirements should not be based solely upon the exterior DNL exposure level.

(d) Measures to achieve required NLR must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(e) Residential buildings require NLR. Residential buildings should not be located where noise is greater than 65 DNL.

(f) Impact of amplitude, duration, frequency, and tonal content of aircraft noise events should be evaluated.

TABLE 3–3

FHWA & HDOT–HWYS NOISE ABATEMENT CRITERIA [Hourly A–Weighted Sound Level––Decibels (dBA)]

ACTIVITY CATEGORY	LEQ (h)*	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Lands on which serenity and quiet are of extra–ordinary significance and serve an important public need and where the preservation of those qualities is essential if the areas are to continue to serve their intended purpose.
B	67 (Exterior)	Residential.
C	67 (Exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libra–ries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, and television studios.
E	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F. Includes undeve–loped lands permitted for this activity category.
F	None	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water re–sources, water treatment, electrical), and warehousing.
G	None	Undeveloped lands that are not permitted.

* The Hawaii State Department of Transportation, Highways Division, utilizes Noise Abatement Criteria levels which are 1 Leq unit less than the FHWA values shown.

CHAPTER 4. GENERAL STUDY METHODOLOGY

Noise Measurements. Existing traffic levels were measured at 6 locations in the project environs to provide a basis for calculating the traffic noise levels along the primary access roadways which service KOA: Queen Kaahumanu Highway and the Keahole Airport Road. Aircraft noise levels were measured at 7 noise monitoring sites in the airport area. The locations of the measurement sites are shown in Figure 4-1. Traffic noise measurements were obtained at sites A1, A2, E, D1, D2, and G. Aircraft noise measurements were obtained at Sites B, C, E, F, G, H, and I. The noise measurements were performed during April of 2012.

Road Traffic Noise Analysis. Traffic noise calculations for the existing conditions as well as noise predictions for the future conditions with and without the project were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (TNM), Version 2.5 (see Reference 7). Traffic data entered into the noise prediction model were: hourly traffic volumes, average vehicle speeds, estimates of traffic mix, and loose soil propagation loss factor. The results from the traffic study for the project (Reference 9) and Hawaii State Department of Transportation counts on Queen Kaahumanu Highway (Reference 10) were the primary sources of data inputs to the model. For existing and future traffic, it was assumed that the average noise levels, or Leq(h), during the PM peak hour were equal to the 24 hour DNL along each roadway segment. This assumptions was based on computations of both the hourly Leq and the 24-hour DNL of traffic noise on Queen Kaahumanu Highway (see Figure 4-2).

The traffic noise measurement results, and their comparisons with TNM computer model predictions of existing traffic noise levels are summarized in Table 4-1. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used.

Traffic noise calculations for both the existing (2011) and future (2022) conditions in the project environs were developed for ground level receptors without the benefit of shielding effects. Traffic assignments with and without the project improvements were obtained from the project's traffic study (Reference 9). The forecast increases in traffic noise levels over existing levels were calculated for both the Do Nothing and Action Alternative, and noise impact risks evaluated. The relative differences between the traffic noise levels resulting from the Do Nothing and Action Alternative were calculated, and an evaluation was made of possible traffic noise impacts resulting from the Action Alternative. The DOT-HWYS 66 Leq and 71 Leq traffic noise abatement criteria were used to evaluate these traffic noise impacts, and to recommend possible mitigation measures. The DOT-HWYS noise abatement criteria for significant increase in existing traffic noise levels by 15 dBA was not applied on this project since all increases in future traffic noise levels were less than 10 dBA.

Aircraft Noise Measurements and Analysis. Tables 4-2 through 4-8 present the aircraft noise measurements obtained at the locations B, C, E, F, G, H, and I where

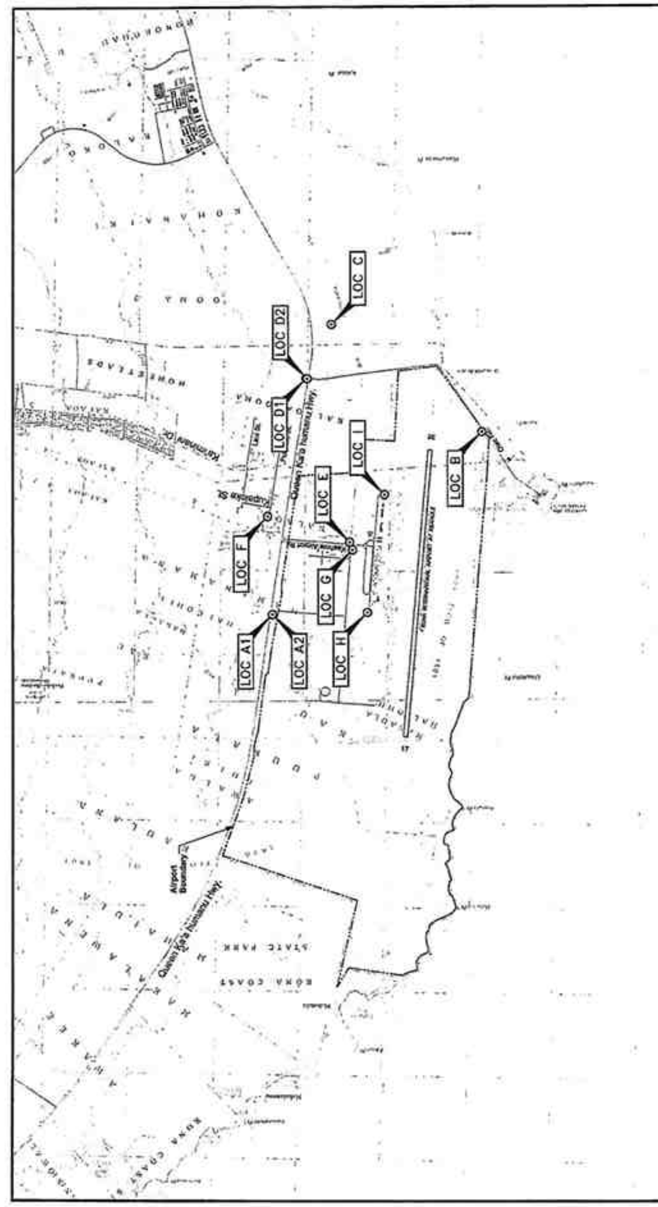


FIGURE 4-1

PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 4–2

HOURLY VARIATIONS OF TRAFFIC NOISE AT 100 FT SETBACK DISTANCE FROM THE CENTERLINE OF QUEEN KAAHUMANU HIGHWAY 0.25 MILES NORTH OF OTEC ACCESS ROAD (STA. 000T8M; FEBRUARY 6, 2012)

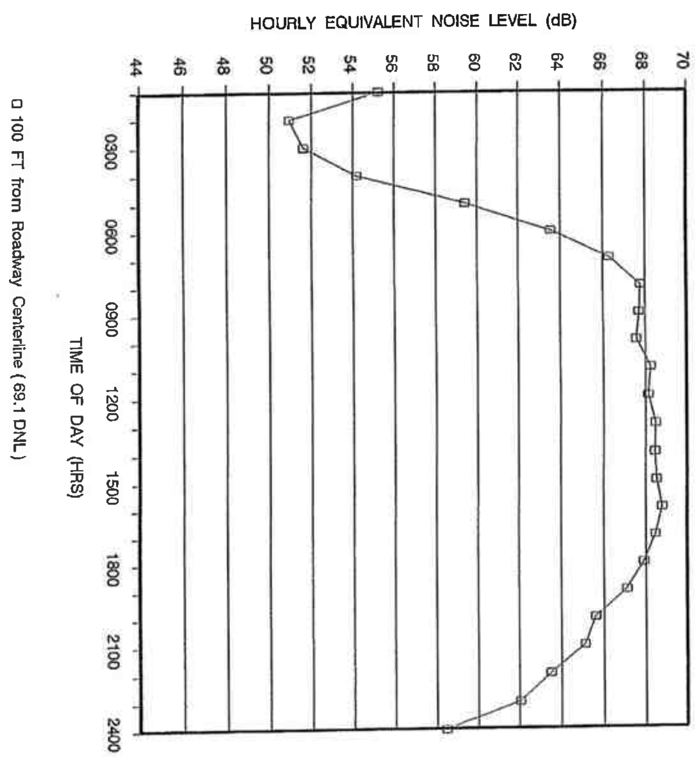


TABLE 4-1
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	Hourly Traffic Volume M.TRUCK	Hourly Traffic Volume H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
E 50 FT from centerline of Keahole Airport Rd. (4/07/12)	1002 TO 1102	32	397	66	6	62.6	62.7
D1 52 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	0645 TO 0745	55	1,370	47	44	74.3	74.1
D2 102 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	0645 TO 0745	55	1370	47	44	68.3	68.0
A1 50 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	0809 TO 0909	49	827	27	48	69.1	69.2
A2 100 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	0809 TO 0909	49	827	27	48	61.9	63.2
G 50 FT from centerline of Pao`o Rd. (4/09/12)	0935 TO 1035	35	38	55	0	58.6	58.3

TABLE 4-1 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	Hourly Traffic Volume M.TRUCK	Hourly Traffic Volume H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A1 50 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	1400 TO 1500	46	1,081	27	27	68.5	68.6
A2 100 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	1400 TO 1500	46	1081	27	27	61.1	62.5
D1 52 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	1517 TO 1617	55	1,662	36	24	74.0	74.2
D2 102 FT from centerline of Q. Kaahumanu Hwy. (4/09/12)	1517 TO 1617	55	1662	36	24	68.3	67.9

TABLE 4-2

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "B" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-767/B-757 (RWY 17) (TAKEOFF)	81.7; 84.3 (AVE.=83.0)	89.3; 92.3 (ENERGY AVE.=91.1)
B-717(200) (RWY 17) (TAKEOFF)	70.4; 69.7; 68.9; 69.2 (AVE.=69.6)	79.9; 79.5; 77.7; 79.6 (ENERGY AVE.=79.3)
B-717(200) (RWY 35) (LANDING)	62.8 (AVE.=62.8)	69.3 (ENERGY AVE.=69.3)
BUSJET (RWY 17) (TAKEOFF)	74.1; 81.1 (AVE.=77.6)	83.0; 88.7 (ENERGY AVE.=86.7)
SD-360 (RWY 17) (TAKEOFF)	70.6 (AVE.=70.6)	77.2 (ENERGY AVE.=77.2)
DASH-8 (RWY 17) (TAKEOFF)	65.9 (AVE.=65.9)	73.7 (ENERGY AVE.=73.7)
GA1 (RWY 17) (TAKEOFF)	66.7; 69.9; 66.8 (AVE.=67.8)	74.0; 75.1; 72.0 (ENERGY AVE.=73.9)

TABLE 4-3

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "C" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-767/B-757 (RWY 17) (TAKEOFF)	69.1 (AVE.=69.1)	74.4 (ENERGY AVE.=74.4)
B-767/B-757 (RWY 35) (LANDING)	61.8 (AVE.=61.8)	67.4 (ENERGY AVE.=67.4)
B-737(800) (RWY 17) (TAKEOFF)	71.7 (AVE.=71.7)	79.5 (ENERGY AVE.=79.5)
B-717(200) (RWY 17) (TAKEOFF)	67.9; 65.2; 68.1; 69.1 (AVE.=67.6)	73.3; 71.9; 75.3; 74.8 (ENERGY AVE.=74.0)
GA-1 (RWY 17) (TAKEOFF)	70.1 (AVE.=70.1)	74.3 (ENERGY AVE.=74.3)
R-44 (RWY 17) (TAKEOFF)	69.5 (AVE.=69.5)	76.9 (ENERGY AVE.=76.9)

TABLE 4-4

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "E" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-767/B-757 (RWY 17) (TAKEOFF)	72.7; 78.9 (AVE.=75.8)	77.5; 83.4 (ENERGY AVE.=81.4)
B-737(800) (RWY 17) (TAKEOFF)	73.9; 72.3 (AVE.=73.1)	79.8; 80.0 (ENERGY AVE.=79.9)
B-717(200) (RWY 17) (TAKEOFF)	65.2; 68.2; 71.0; 68.8 (AVE.=68.3)	72.7; 79.9; 76.4; 75.1 (ENERGY AVE.=76.8)
BUSJET (RWY 17) (TAKEOFF)	69.3 (AVE.=69.3)	79.2 (ENERGY AVE.=79.2)
CRJ200 (RWY 17) (TAKEOFF)	64.3 (AVE.=64.3)	70.6 (ENERGY AVE.=70.6)
GA-1 (RWY 17) (TAKEOFF)	62.5; 62.4; 64.7 (AVE.=63.2)	69.5; 72.4; 73.8 (ENERGY AVE.=72.2)
R-44 (HELO 1) (T/GO)	83.0; 73.2; 70.2 (AVE.=75.5)	88.1; 81.4; 76.9 (ENERGY AVE.=84.4)

TABLE 4-5

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "F" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-717(200) (RWY 17) (TAKEOFF)	58.7; 55.2; 57.5; 62.0; 62.1; 58.6 (AVE.=59.0)	69.1; 64.4; 65.1; 66.3; 70.6; 70.2 (ENERGY AVE.=68.3)
BUSJET (RWY 35) (TAKEOFF)	54.0 (AVE.=54.0)	64.2 (ENERGY AVE.=64.2)
CRJ200 (RWY 17) (TAKEOFF)	56.4 (AVE.=56.4)	62.9 (ENERGY AVE.=62.9)
GA-1 (RWY 17) (TAKEOFF)	70.7; 78.2; 73.5 (AVE.=74.1)	77.3; 82.5; 81.5 (ENERGY AVE.=80.9)
GA-2 (RWY 17) (TAKEOFF)	55.1 (AVE.=55.1)	64.1 (ENERGY AVE.=64.1)
DASH-8 (RWY 17) (TAKEOFF)	58.1 (AVE.=58.1)	66.8 (ENERGY AVE.=66.8)
B-206L (RWY 17) (LANDING)	66.6 (AVE.=66.6)	72.3 (ENERGY AVE.=72.3)

TABLE 4-6

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "G" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-717(200) (RWY 17) (TAKEOFF)	67.2 (AVE.=67.2)	77.3 (ENERGY AVE.=77.3)

TABLE 4-7

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "H" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-737(800) (RWY 17) (TAKEOFF)	74.5 (AVE.=74.5)	81.2 (ENERGY AVE.=81.2)
B-717(200) (RWY 17) (TAKEOFF)	72.4 (AVE.=72.4)	74.5 (ENERGY AVE.=74.5)

TABLE 4-8

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS AT LOCATION "I" (APRIL, 2012)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
B-767/B-757 (RWY 17) (TAKEOFF)	85.8; 85.8 (AVE.=85.8)	92.2; 90.0 (ENERGY AVE.=91.2)
B-737(800) (RWY 17) (TAKEOFF)	85.3 (AVE.=85.3)	90.8 (ENERGY AVE.=90.8)
B-717(200) (RWY 17) (TAKEOFF)	72.5; 76.1; 77.0; 76.8; 77.6 (AVE.=76.0)	78.0; 82.0; 82.3; 83.9; 84.5 (ENERGY AVE.=82.6)
BUSJET (RWY 17) (TAKEOFF)	81.1; 82.7 (AVE.=81.9)	85.9; 85.6 (ENERGY AVE.=85.8)
CRJ200 (RWY 17) (TAKEOFF)	74.9 (AVE.=74.9)	80.1 (ENERGY AVE.=80.1)
B-206L (HELO 1) (LANDING)	98.7 (AVE.=98.7)	107.8 (ENERGY AVE.=107.9)

shown in Figure 4-1. The aircraft noise analysis was performed in accordance with FAA requirements (FAA Order 1050.1E, Reference 11) using DOTA land use compatibility guidelines contained in Table 3-2. The regulations governing the preparation of airport Environmental Impact Statements (FAA Order 1050.1E, March 20, 2006) and Airport Noise Compatibility Programs (14 CFR, Chapter I, Subchapter I, Part 150, February 6, 1985) require that noise contours be prepared using an approved computer model such as the Integrated Noise Model (INM) (Reference 12) or an approved equivalent. The use of a model with wide public availability is intended to provide interested parties the opportunity to substantiate the results of the noise modeling.

The new airport facilities (expansion of fixed-wing general aviation aircraft facilities, new helicopter general aviation facility, and new Kona Auxiliary Training Runway (KATR), were included in the noise modeling efforts and contours developed during the 2010 14 CFR Part 150 Noise Compatibility Program Update. The 2013 noise contours did include the military aircraft operations on the KATR, but did not include the new helicopter general aviation facility. The Long Range noise contours did include the civil helicopter operations at the new helicopter facility, but also included the operations on a new parallel runway, which is not included in this Environmental Assessment. The increases in forecasted fixed-wing general aviation aircraft operations using the expanded general aviation facility were incorporated in both the 2013 and Long Range noise contours. Unfortunately, the Long Range noise contours included the use of a new parallel runway, which is not included within the proposed actions of the current environmental assessment. For this reason, the Long Range noise contours contained in the 2010 14 CFR Part 150 Noise Compatibility Program for KOA (Reference 8) were redeveloped for this study's post 2022 time frame, and assumed that all future operations beyond 2022 would remain on the existing Runway 17/35, the KATR, and the new helicopter runway.

The existing and future aircraft noise contours for KOA developed during the 2010 14 CFR Part 150 Noise Compatibility Program Update (see Reference 8) were used to describe potential aircraft noise impacts associated with existing and future KOA operations. The aircraft noise contours associated with the 2013 and Long Range (beyond 2022) forecast periods were developed in Reference 8. However, the Long Range noise contours developed in Reference 8 assumed that a new parallel runway (Runway 35L/17R) would be in operation during the Long Range forecast period. Therefore, for this current noise analysis, a new set of Long Range noise contours were developed for conditions without the new parallel runway. The Long Range aircraft operations assumed in Reference 8 were retained, but with all operations on the new parallel runway transferred to the existing Runway 35/17. Risks of adverse noise impacts associated with the forecast operations in the Long Range Scenario without the new parallel runway were then evaluated by examining the relationship of the future long range aircraft noise contours to the noise sensitive land uses in the airport environs. In addition, the relationships of the forecast 2013 and modified Long Range airport noise contours to existing (2008) contours were also examined. Possible aircraft noise mitigation measures, in addition to those contained in the 2010 14 CFR Part 150 Noise Compatibility Program for KOA (Reference 8), were also discussed.

The FAA criteria of 1.5 DNL increase in aircraft noise level at noise sensitive properties was used in defining noise impacts resulting from increases in aircraft noise exposure associated with the forecast operations. Although this criteria was originally intended for use within the 65 DNL noise contour (see Reference 11), the 1.5 DNL criteria was used in this study for all noise sensitive uses within the 60 DNL noise contour. In order to be consistent with the 14 CFR Part 150 study and the DOTA recommendations, the 60 DNL contour was used to identify noise levels which were considered to be incompatible with noise sensitive land uses (dwellings, schools, day care centers, other public use facilities, hotels, etc.). The relative degrees of noise impacts resulting from forecast aircraft operations were compared by examining the increase in noise levels at noise sensitive properties located within the 60 DNL contours.

CHAPTER 5. EXISTING NOISE ENVIRONMENT

Traffic Noise. The existing (2011) traffic noise levels along Queen Kaahumanu Highway in the immediate vicinity of the airport are in the "Moderate Exposure, Acceptable" and "Significant Exposure, Normally Unacceptable" categories at 107 FT setback distance from the roadway's centerline. Existing traffic noise levels equal or exceed 65 DNL and 66 Leq at 107 FT distance from centerline of Queen Kaahumanu Highway north and south of the Keahole Airport Road intersection. Calculations of existing traffic noise levels during the PM peak traffic hour are presented in Table 5-1. Appendix C presents the existing (Base Year or 2011) and future traffic volumes which were used to develop Table 5-1 and the future traffic noise level predictions. The hourly Leq (or Equivalent Sound Level) contributions along each roadway section in the project environs were calculated for comparison with forecast traffic noise levels with and without the project. The existing setback distances from the roadways' centerlines to their associated 66 and 71 Leq contours were also calculated as shown in Table 5-2. By current DOT-HWYS noise abatement criteria (see Table 3-3), an exterior traffic noise level less than 66 Leq is considered to be acceptable for residential and other noise sensitive uses, and an exterior level less than 71 Leq is considered to be acceptable for commercial and industrial uses. The critical noise level setback distances indicated in Table 5-2 do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections.

Noise sensitive properties located in the KOA environs and located closest to the roadways which service KOA consist of five single family residences on the agricultural lots near the Queen Kaahumanu Highway and Kaiminani Drive intersection. There are no other existing residences or noise sensitive receptors along Queen Kaahumanu Highway in the vicinity of the airport or along Keahole Airport Road, which are the primary access roadways to the airport.

Along Queen Kaahumanu Highway north and south of the Keahole Airport Road intersection, existing traffic noise levels exceed 66 Leq(h) at setback distances of 107 to 136 feet from the roadway's centerline. Existing traffic noise levels along Queen Kaahumanu Highway are highest at the lots which front the roadway. At the interior lots, traffic noise levels decrease due to their larger setback distances from the highway and the noise shielding effects of intervening structures between the highway and the interior lots. At these interior lots, local traffic or traffic along Kaiminani Drive may be the more dominant noise sources. Between road traffic or aircraft noise events, background noise levels drop to a range of 45 to 50 dBA, and can go below 45 dBA during calm periods. The steady background noise levels at these interior locations are controlled by distant traffic, birds, and foliage movement with the wind.

Aircraft Noise. Aircraft noise sources in the project environs are associated with fixed and rotary wing aircraft operations at KOA. Table 5-3 (extracted from Reference 8) contains a detailed breakdown of average day operations by aircraft at KOA during 2008. For the purposes of this study, aircraft operations in 2008 as contained in

TABLE 5-1

EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	********* VOLUMES (VPH) ********** AUTOS	M TRUCKS	H TRUCKS	50' or 75' Leq	100' Leq	200' Leq
Q. Kaahumanu Hwy. - N. of Keahole Airport Rd.	48	1,271	1,190	34	47	68.7	66.6	60.7
Q. Kaahumanu Hwy. - S. of Keahole Airport Rd.	55	1,630	1,548	49	33	71.0	68.8	62.5
Keahole Airport Rd. W. of Q. Kaahumanu Hwy.	35	581	566	9	6	61.8	56.3	50.5
Keahole Airport Rd. E. of Halalu St.	35	578	563	9	6	61.7	56.3	50.5
Keahole Airport Rd. Between Halalu and Pao`o	32	507	445	56	6	62.1	56.8	51.2
Keahole Airport Rd. W. of Pao`o St.	30	512	383	123	6	63.3	58.1	52.6
Halalu St. N. of Keahole Airport Rd.	30	211	146	65	0	59.8	54.6	48.9
Pao`o St. N. of Keahole Airport Rd.	30	69	28	41	0	57.2	52.0	46.4
Pao`o St. S. of Keahole Airport Rd.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:
Traffic noise levels calculated at 75 feet from centerline of Queen Kaahumanu Highway, and at 50 feet from centerlines of all other roadways.

TABLE 5-2

YEAR 2011 AND 2022 DISTANCES TO 66 AND 71 LEQ CONTOURS

STREET SECTION	66 LEQ SETBACK (FT) CY 2011	CY 2022	71 LEQ SETBACK (FT) CY 2011	CY 2022
Q. Kaahumanu Hwy. - N. of Keahole Airport Rd.	107	146	55	100
Q. Kaahumanu Hwy. - S. of Keahole Airport Rd.	136	172	75	120
Keahole Airport Rd. W. of Q. Kaahumanu Hwy.	29	36	16	19
Keahole Airport Rd. E. of Halalu St.	29	35	15	19
Keahole Airport Rd. Between Halalu and Pao`o	30	37	16	19
Keahole Airport Rd. W. of Pao`o St.	35	39	18	20
Halalu St. N. of Keahole Airport Rd.	22	25	< 12	13
Pao`o St. N. of Keahole Airport Rd.	15	26	< 12	13
Pao`o St. S. of Keahole Airport Rd.	N/A	< 12	N/A	< 12

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See Tables 5-1 and 6-1 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.

TABLE 3B
Daily Operational Fleet Mix
Kona International Airport at Keahole

		2008			2013			Long Range		
	INM Designator	Day Ops	Night Ops	Total	Day Ops	Night Ops	Total	Day Ops	Night Ops	Total
Air Carrier										
B747	747400	0.14	0.00	0.14	0.43	0.00	0.43	0.93	0.00	0.93
B777-200	777200	1.25	0.00	1.25	2.41	0.00	2.41	3.32	0.00	3.32
767-400	767400	0.00	0.00	0.00	0.88	0.88	1.75	3.29	0.95	4.24
767-300	767300	4.38	0.00	4.38	5.96	0.82	6.78	7.19	0.96	8.15
757-200	757PW	10.55	0.67	11.22	10.93	0.90	11.83	13.01	0.96	13.97
737-800	737800	0.76	0.00	0.76	0.00	0.00	0.00	5.67	0.00	5.67
B717	717200	28.39	2.14	30.53	30.80	2.69	33.49	23.47	2.07	25.53
B737-200	737N9	8.68	1.20	9.88	6.92	0.87	7.78	1.43	0.32	1.76
B737-200	737QN	6.46	0.89	7.36	0.00	0.00	0.00	0.00	0.00	0.00
B737-700	737700	2.50	0.00	2.50	11.55	0.77	12.32	19.87	1.19	21.06
CRJ700, CRJ900	GV	0.00	0.00	0.00	3.48	0.00	3.48	17.62	0.96	18.58
CRJ200, Challenger 604	CL601	13.94	1.75	15.68	7.75	0.96	8.71	3.69	0.96	4.65
DHC Dash 8 Q400	DHC830	6.90	0.00	6.90	15.68	0.00	15.68	13.93	0.00	13.93
CESSNA 208B	GASEPF	0.99	0.00	0.99	4.36	0.00	4.36	3.72	0.00	3.72
Subtotal		84.95	6.65	91.60	101.15	7.89	109.04	117.12	8.36	125.48
Air Cargo										
B747	74720B	1.06	0.00	1.06	1.37	0.00	1.37	2.33	0.68	3.01
B767-400	767400	0.75	0.00	0.75	0.41	0.41	0.82	2.33	0.68	3.01
B737-200	737N9C	0.63	1.65	2.28	1.88	4.97	6.85	1.88	4.97	6.85
B737-200	737QNC	1.27	3.36	4.63	0.00	0.00	0.00	0.00	0.00	0.00
Shorts 360	SD330	1.30	0.00	1.30	1.64	0.00	1.64	1.64	0.00	1.64
Beech 1900	1900D	1.94	0.00	1.94	2.19	0.00	2.19	2.19	0.00	2.19
Subtotal		6.95	5.01	11.96	7.50	5.38	12.88	10.38	6.34	16.71
Other Air Taxi										
B737-700	737700	0.13	0.01	0.13	0.27	0.01	0.27	0.53	0.02	0.55
Hawker 800	LEAR35	0.30	0.01	0.32	1.06	0.03	1.10	3.19	0.09	3.29
Very Light Jet	CNA55B	0.00	0.00	0.00	1.59	0.05	1.64	6.65	0.19	6.85
Shorts 360	SD330	1.15	0.04	1.20	2.65	0.08	2.74	3.99	0.12	4.11
King Air	DHC6	1.64	0.05	1.69	3.19	0.10	3.29	5.86	0.17	6.03
Cessna Caravan	GASEPF	14.80	0.51	15.30	13.80	0.44	14.25	17.57	0.51	18.08
MEP	BEC58P	15.11	0.52	15.63	10.62	0.34	10.96	11.98	0.35	12.33
SEP	GASEPV	3.72	0.12	3.85	5.31	0.17	5.48	7.99	0.23	8.22
Helicopter	B206L	0.01	0.00	0.01	3.98	0.13	4.11	7.99	0.23	8.22
Subtotal		36.87	1.25	38.13	42.47	1.37	43.84	65.76	1.92	67.67

EXISTING AND FUTURE AVERAGE DAILY AIRCRAFT OPERATIONS AT KONA INTERNATIONAL AIRPORT AT KEAHOLE

TABLE 5–3

TABLE 3B (Continued)
Daily Operational Fleet Mix
Kona International Airport at Keahole

		2008			2013			Long Range		
	INM Designator	Day Ops	Night Ops	Total	Day Ops	Night Ops	Total	Day Ops	Night Ops	Total
General Aviation – Itinerant										
B727-200	727EM2	0.08	0.00	0.09	0.05	0.00	0.05	0.00	0.00	0.00
B737-700	737700	0.05	0.00	0.06	0.27	0.01	0.27	0.53	0.02	0.55
B757	757300	0.02	0.00	0.02	0.16	0.01	0.16	0.40	0.01	0.41
Challenger 600	CL600	0.28	0.01	0.29	0.27	0.01	0.27	0.00	0.00	0.00
Challenger 601, 604	CL601	0.41	0.01	0.43	0.80	0.02	0.82	2.13	0.06	2.19
Cessna 750 Cit. X	CNA750	0.26	0.01	0.27	0.53	0.02	0.55	1.60	0.05	1.64
Embraer ERJ135	EMB145	0.10	0.00	0.10	0.27	0.01	0.27	0.67	0.02	0.68
Gulfstream II/III	GIIB	0.55	0.02	0.57	0.27	0.01	0.27	0.00	0.00	0.00
Gulfstream IV	GIV	1.72	0.05	1.77	2.93	0.08	3.01	6.65	0.19	6.85
Gulstream V, BD700	GV	0.96	0.03	0.99	2.13	0.06	2.19	5.32	0.16	5.48
G200, Westwind Astra	IA1125	0.25	0.01	0.26	0.53	0.02	0.55	1.60	0.05	1.64
Lear 35 & 36, Hawker 800	LEAR35	0.11	0.00	0.12	0.53	0.02	0.55	1.60	0.05	1.64
Falcon 50, 900, 2000	FAL50	0.94	0.03	0.97	1.38	0.04	1.42	3.19	0.09	3.29
King Air	DHC6	1.35	0.04	1.39	2.40	0.07	2.47	3.99	0.12	4.11
SEP	GASEPF	18.20	0.55	18.74	29.82	0.87	30.68	42.59	1.24	43.84
SEP	GASEPV	18.20	0.55	18.74	29.82	0.87	30.68	42.59	1.24	43.84
MEP	BEC58P	4.06	0.12	4.18	4.79	0.14	4.93	5.32	0.16	5.48
Helicopter	B206L	5.32	0.16	5.48	7.99	0.23	8.22	13.31	0.39	13.70
Subtotal		52.88	1.59	54.47	84.93	2.47	87.40	131.51	3.83	135.34
Military - Itinerant										
C-40	GV	0.33	0.01	0.34	0.38	0.01	0.39	0.38	0.01	0.39
P-3	P3A	3.56	0.11	3.67	0.00	0.00	0.00	0.00	0.00	0.00
P-8	737800	0.00	0.00	0.00	3.81	0.12	3.93	3.81	0.12	3.93
KC-135	KC-135	2.77	0.08	2.86	3.06	0.10	3.15	3.06	0.10	3.15
C-17	C17	1.55	0.05	1.60	3.38	0.10	3.48	3.38	0.10	3.48
Subtotal		8.22	0.25	8.47	10.63	0.33	10.96	10.63	0.33	10.96
General Aviation - Local										
SEP	GASEPF	31.56	0.95	32.51	58.50	1.78	60.27	93.11	2.78	95.89
SEP	GASEPV	31.56	0.95	32.51	58.50	1.78	60.27	93.11	2.78	95.89
MEP	BEC58P	11.28	0.34	11.62	15.95	0.48	16.44	21.28	0.64	21.92
Helicopter	R22	73.65	2.21	75.86	110.88	3.36	114.25	159.62	4.77	164.38
Subtotal		148.06	4.44	152.50	243.84	7.40	251.23	367.12	10.96	378.08

EXISTING AND FUTURE AVERAGE DAILY AIRCRAFT OPERATIONS AT KONA INTERNATIONAL AIRPORT AT KEAHOLE

TABLE 5–3 (CONT.)

TABLE 3B (Continued)
Daily Operational Fleet Mix
Kona International Airport at Keahole

	INM Designator	2008 Day Ops	2008 Night Ops	2008 Total	2013 Day Ops	2013 Night Ops	2013 Total	Long Range Day Ops	Long Range Night Ops	Long Range Total
Military – Local										
C-40	GV	1.46	0.04	1.51	2.42	0.07	2.50	2.42	0.07	2.50
P-3	P3A	9.64	0.29	9.93	0.00	0.00	0.00	0.00	0.00	0.00
P-8	737800	0.00	0.00	0.00	15.99	0.49	16.48	15.99	0.49	16.48
C-20	C-20	0.49	0.01	0.50	0.81	0.02	0.84	0.81	0.02	0.84
C-26	DHC6	0.31	0.01	0.32	0.51	0.02	0.53	0.51	0.02	0.53
C-5	C5A	0.18	0.01	0.19	0.30	0.01	0.31	0.30	0.01	0.31
C-135	C135B	0.72	0.02	0.75	1.20	0.04	1.24	1.20	0.04	1.24
KC-135	KC-135	4.85	0.15	5.00	8.05	0.25	8.30	8.05	0.25	8.30
F-15	F15A	0.18	0.01	0.19	0.00	0.00	0.00	0.00	0.00	0.00
F-22	F-18	0.00	0.00	0.00	0.30	0.01	0.31	0.30	0.01	0.31
H-65 Dolphin	SA365N	0.04	0.00	0.04	0.06	0.00	0.07	0.06	0.00	0.07
UH-60	S70	0.24	0.01	0.25	0.40	0.01	0.42	0.40	0.01	0.42
CH-47	CH47D	0.04	0.00	0.04	0.06	0.00	0.07	0.06	0.00	0.07
C-17	C17	8.01	0.24	8.24	38.98	1.21	40.18	38.98	1.21	40.18
Subtotal		26.18	0.78	26.96	69.10	2.14	71.23	69.10	2.14	71.23
Grand Total		364.12	19.96	384.08	659.62	26.96	586.58	771.61	33.87	805.48

* Existing operations are based on 12 months from Airport Traffic Control Tower (August 2007 through July 2008).
To account for the period when the ATCT is closed, 3 percent was added to general aviation and military operations.
2007 Kona International Airport at Keahole Master Plan
Note: INM Substitutions were made in accordance with FAA's approved substitution list and through correspondence documented in Appendix F.

EXISTING AND FUTURE AVERAGE DAILY AIRCRAFT OPERATIONS AT KONA INTERNATIONAL AIRPORT AT KEAHOLE

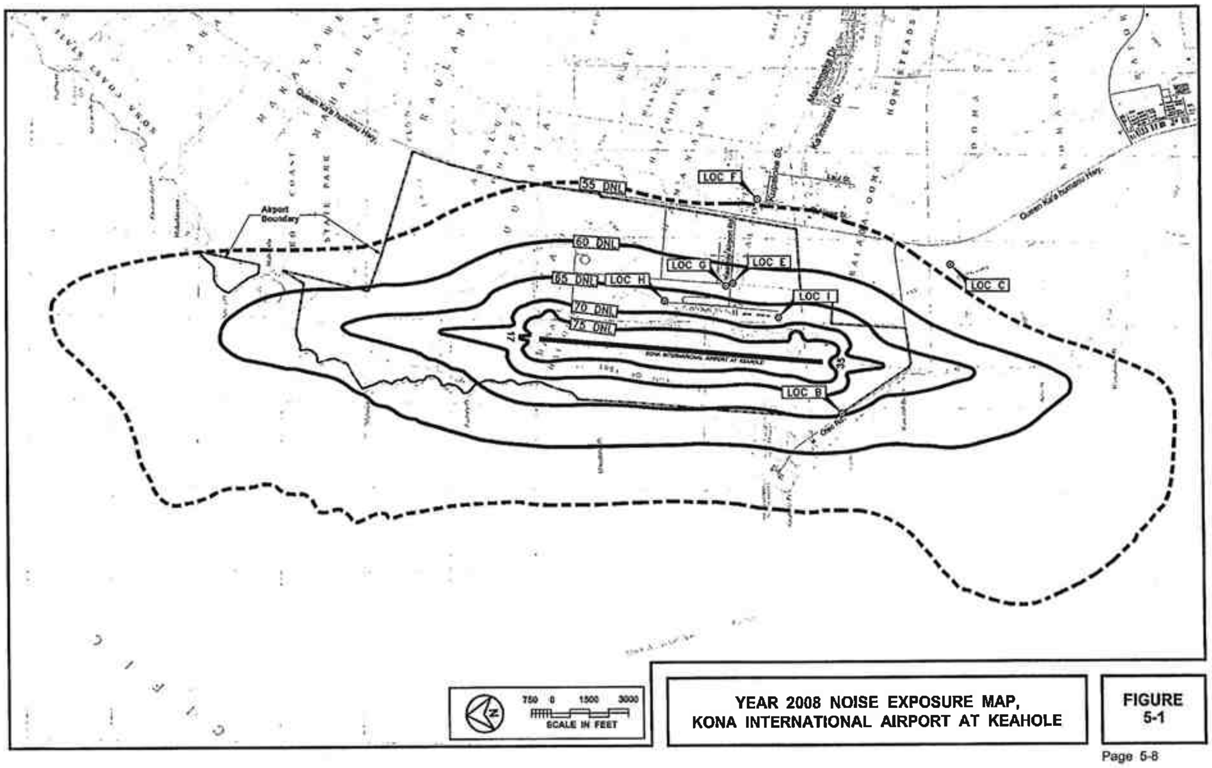
TABLE 5–3 (CONT.)

Reference 8 were assumed to be similar to those in 2011. Typically, aircraft noise contours change very little with annual changes in aircraft operations, unless large changes in nighttime jet aircraft operations occur, or unless there are changes to airport runways. The 2008 aircraft noise contours for KOA are shown in Figure 5-1, and were extracted from Reference 8. As indicated in the figure and noted in Reference 8, the only noise sensitive facility within the 60 DNL contour and outside the Airport property in Figure 5-1 is the West Hawaii Explorations Academy Public Charter School located on OTEC Road near the southwest corner of the airport property (near Location B), where existing aircraft noise levels are approximately 65 DNL. On the east side of Queen Kaahumanu Highway, approximately two existing residences are located within the 55 DNL contour. Airport controlled facilities (Onizuka Museum, Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility, and the Medical Transitional Facility) are also considered to be noise sensitive, and should include sound attenuation treatments.

The departure, approach, and training (or local) flight tracks used to depict existing (2008) conditions at KOA are shown in Figures 5-2, 5-3, and 5-4, respectively. The aircraft flight tracks depicted in Figures 5-2 through 5-4 during CY 2008, were reported in Reference 8 and reproduced from the INM data input file used by Reference 8. No significant changes in aircraft flight tracks have occurred between 2008 (the Base year of the 14 CFR Part 150 study) and 2011. No significant changes in aircraft operations or airport runways have occurred between 2008 and 2011.

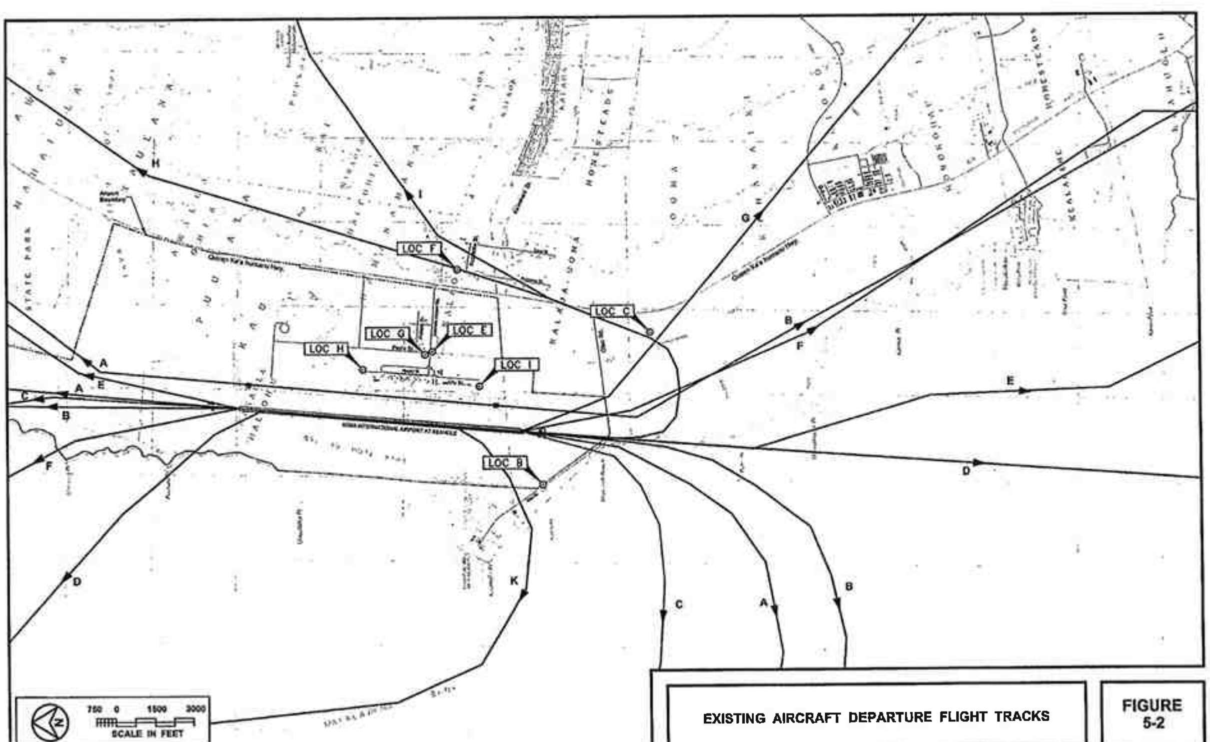
Tables 4-2 through 4-8 summarize the results of the more recent aircraft noise measurements at KOA. The locations of the noise measurement sites are shown in Figure 5-1. Maximum jet aircraft noise levels (Lmax) were typically between 51 to 86 dBA at the measurement sites shown in Figure 5-1. For the purposes of comparison, typical maximum noise levels of heavy trucks are in the order of 80 to 85 dB at 50 FT distance. At noise sensitive Location B, which is at the existing charter school and near the 65 DNL contour, typical maximum noise levels associated with overseas jet aircraft were between 80 and 85 dBA, and those associated with interisland jet aircraft were between 60 and 70 dBA. At Location F, which is within the existing agricultural subdivision east of Queen Kaahumanu Highway, existing maximum aircraft noise levels from jet aircraft departures are relatively low and less than 70 dBA. The louder aircraft noise events (70 to 80 dBA) occur when light fixed wing propellor and rotary wing aircraft fly in the vicinity of Location F.

Those noise sensitive land uses within the 60 DNL contour are considered to be exposed to incompatible levels of aircraft noise. The degree of adverse health and welfare impacts resulting from aircraft noise depends upon the sound attenuation properties of the structures containing the noise sensitive uses. For the purposes of this environmental assessment study, it was assumed that all noise sensitive properties can be considered to be adversely impacted by aircraft noise if they are located within the 60 DNL aircraft noise contour and if they are not specially treated to reduce interior noise levels to 45 DNL or less. Total closure and air conditioning is generally required for structures located within the 60 DNL contour in order to achieve the 45 DNL interior



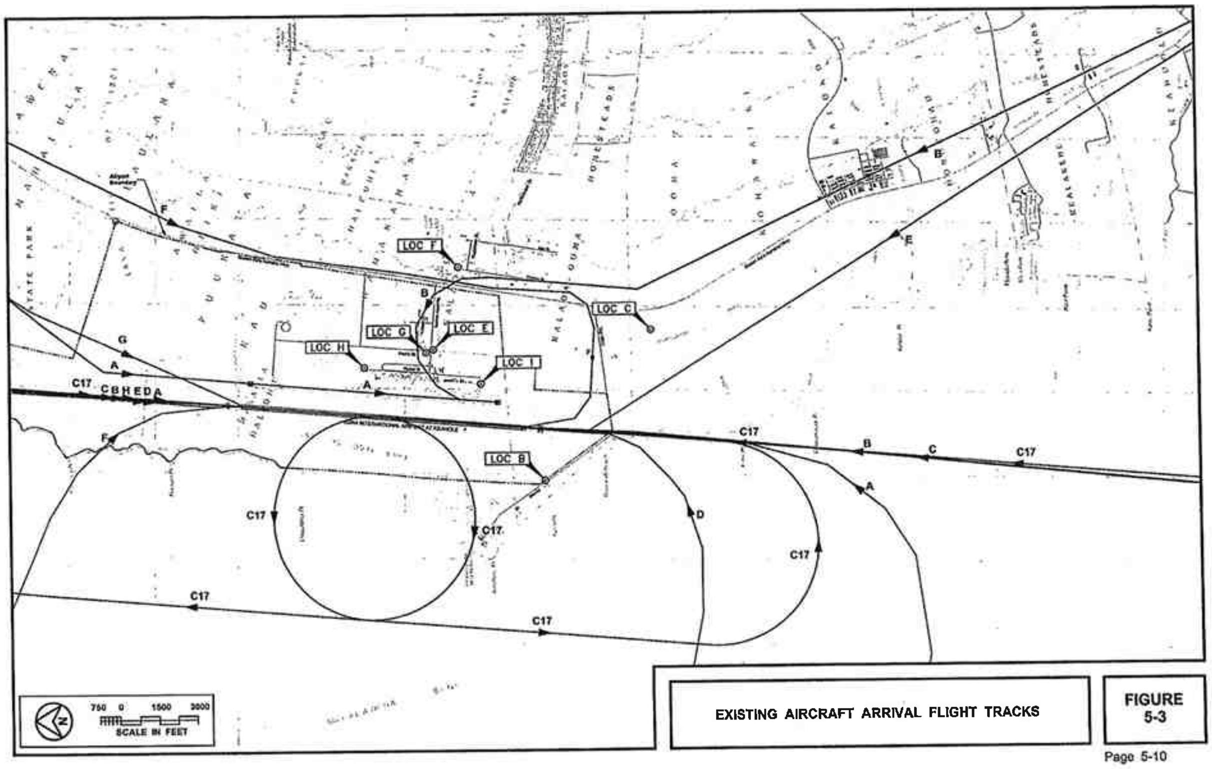
YEAR 2008 NOISE EXPOSURE MAP,
KONA INTERNATIONAL AIRPORT AT KEAHOLE

FIGURE 5-1



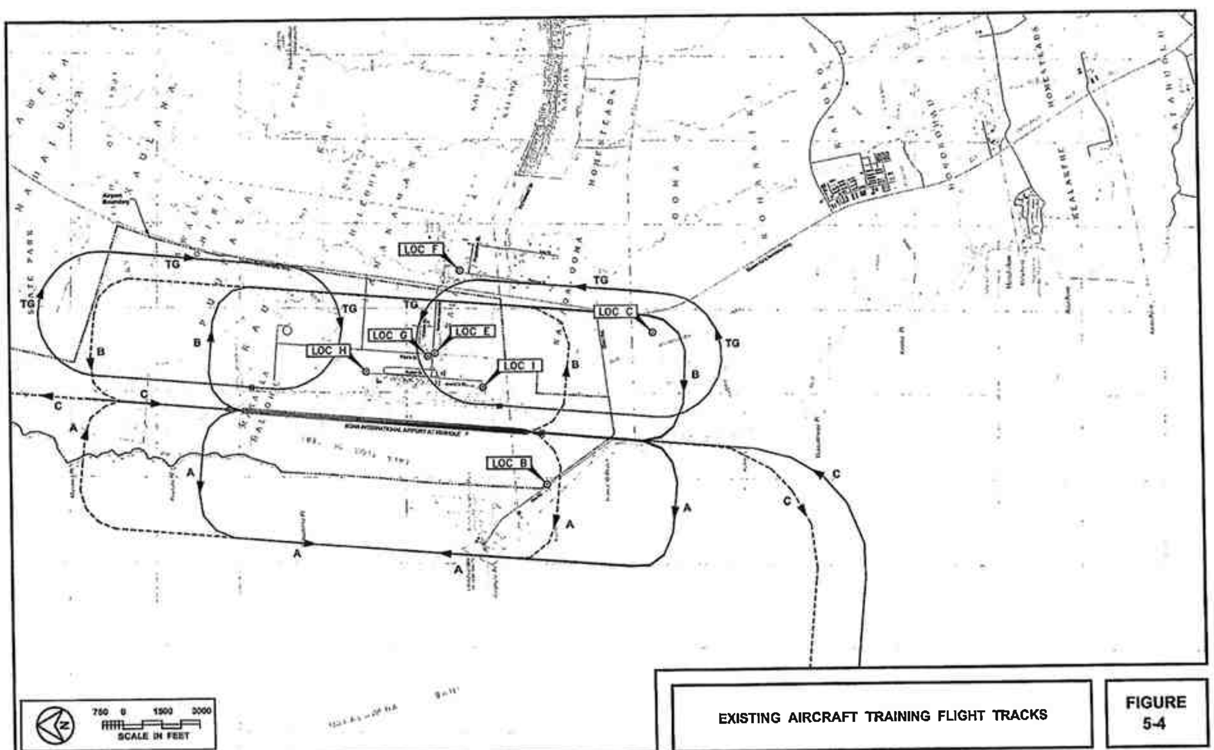
EXISTING AIRCRAFT DEPARTURE FLIGHT TRACKS

FIGURE 5-2



EXISTING AIRCRAFT ARRIVAL FLIGHT TRACKS

FIGURE 5-3



EXISTING AIRCRAFT TRAINING FLIGHT TRACKS

FIGURE 5-4

noise criteria.

As shown in Figure 5-1, the existing aircraft noise levels at KOA are generally compatible with the surrounding land uses. Noise sensitive land uses which were located within the 60 DNL contour during the Base Year included the West Hawaii Explorations Academy Pacific Charter School and facilities under airport control. The charter school was not included for sound attenuation treatment within the 2010 14 CFR Part 150 Noise Compatibility Program. Sound attenuation treatment will probably be incorporated into the new airport facilities as required by the user agencies.

CHAPTER 6. FUTURE NOISE ENVIRONMENT

Traffic Noise. Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 9 for 2022 for the Do Nothing and Action Scenarios. Included under the Action Scenario was the development of a new helicopter general aviation facility by 2022. No improvements to the roadways outside the Airport boundaries are included in the proposed KOA improvements.

The differences in future traffic noise levels between the Do Nothing and the Action Scenarios were calculated and evaluated. For the purposes of this traffic noise analysis, traffic volumes and noise levels associated with the Do Nothing Scenario were considered to be base levels, and the incremental increases in noise levels associated with the Action Scenarios were considered to be attributable to the proposed KOA improvements.

Calculations of forecast traffic noise levels along the roadway sections previously evaluated in Chapter 5 - Existing Noise Environment are shown in Table 6-1 for the PM peak hour of traffic. Appendix C lists the peak hour traffic volumes for the Do Nothing and Action Alternatives in 2022. The future traffic volumes in Table 6-1 represent future assignments under the Action Alternative in 2022. Table 5-2 depicts the future increases in setback distances to the 66 Leq and 71 Leq traffic noise contours in 2022 resulting from both project (KOA improvements) and non-project traffic.

Table 6-2 presents the project and non-project contributions to traffic noise level increases along the roadways servicing KOA in 2022. The largest increases in future traffic noise levels are expected to occur along Queen Kaahumanu Highway, and primarily as a result of non-project traffic. Traffic noise level increases along Queen Kaahumanu Highway due to project traffic are predicted to be range from 0.1 to 0.3 dB (Leq), which will be difficult to measure. Along Pao`o Road north of Keahole Airport Road, traffic noise increases are predicted to be approximately 4.1 dB (Leq), but future traffic noise levels are expected to remain relatively low. All future traffic noise level increases are predicted to be well below the DOT-HWYS criteria of 15 dB for significant increase in traffic noise levels.

Existing noise sensitive residences in the agricultural subdivision east of Queen Kaahumanu Highway should not be adversely affected by project related traffic noise level increases. Future traffic noise levels at the first row of residences which front Queen Kaahumanu Highway may begin to approach the DOT-HWYS noise abatement level of 66 Leq primarily as a result of non-project traffic. The planned widening of the highway will also contribute to higher traffic noise levels at these existing residences. It is anticipated that any required traffic noise mitigation measures at these existing residences would probably be incorporated into the future highway widening project in accordance with current DOT-HWYS' highway noise abatement policy (see Reference 5).

TABLE 6-1

FUTURE (CY 2022) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS ROADWAY SECTIONS (PM PEAK HOUR, WITH PROJECT)

LOCATION	SPEED (MPH)	TOTAL VPH	******** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' or 75' Leq	100' Leq	200' Leq
Q. Kaahumanu Hwy. - N. of Keahole Airport Rd.	48	1,579	1,478	43	58	74.4	71.0	61.9
Q. Kaahumanu Hwy. - S. of Keahole Airport Rd.	55	2,101	1,996	63	42	76.9	73.5	63.9
Keahole Airport Rd. W. of Q. Kaahumanu Hwy.	35	850	828	13	9	63.4	58.0	52.2
Keahole Airport Rd. E. of Halalu St.	35	847	826	13	8	63.3	57.9	52.1
Keahole Airport Rd. Between Halalu and Pao`o	32	760	668	84	8	63.8	58.5	52.8
Keahole Airport Rd. W. of Pao`o St.	30	625	467	150	8	64.2	59.0	53.5
Halalu St. N. of Keahole Airport Rd.	30	259	179	80	0	60.7	55.5	49.8
Pao`o St. N. of Keahole Airport Rd.	30	174	70	104	0	61.2	56.1	50.4
Pao`o St. S. of Keahole Airport Rd.	30	51	49	1	1	49.9	45.1	39.7

Notes:
1. Queen Kaahumanu Highway widened from 2 lane to 4 lane highway, with 84 feet wide median.
2. Traffic noise levels calculated at 75 feet from centerline of Queen Kaahumanu Highway, and at 50 feet from centerlines of all other roadways.

TABLE 6-2

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2022)

STREET SECTION	NOISE LEVEL (DNL) INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Q. Kaahumanu Hwy. - N. of Keahole Airport Rd.	4.3	0.1
Q. Kaahumanu Hwy. - S. of Keahole Airport Rd.	4.4	0.3
Keahole Airport Rd. W. of Q. Kaahumanu Hwy.	0.9	0.8
Keahole Airport Rd. E. of Halalu St.	0.9	0.7
Keahole Airport Rd. Between Halalu and Pao`o	0.8	0.9
Keahole Airport Rd. W. of Pao`o St.	0.9	0.0
Halalu St. N. of Keahole Airport Rd.	1.3	-0.4
Pao`o St. N. of Keahole Airport Rd.	0.9	3.2
Pao`o St. S. of Keahole Airport Rd.	N/A	Nil *

Note:
At 50 and 100 feet setback distances from Pao`o Street centerline, existing background noise levels are predicted to increase by 3 and 1 dB, respectively.

For the most part, future exceedances of the 66 Leq(h) DOT-HWYS criteria level are expected to be attributable to future non-project traffic and are not associated with the KOA improvements. Where existing or forecasted traffic noise levels exceed DOT-HWYS or FHWA noise abatement criteria, traffic noise mitigation measures (such as highway noise barriers) are normally constructed by individual property owners or are included within any roadway improvement project where existing and forecast traffic noise levels justify those mitigation measures. The inclusion of traffic noise mitigation measures within the proposed KOA improvements should not be required since improvements to the off-airport roadway (Queen Kaahumanu Highway) are not part of the proposed KOA improvements.

Aircraft Noise - Do Nothing or Action Scenarios: The average daily aircraft operations forecast for 2013 and beyond 2022 are shown in Table 5-3. Aircraft flight tracks under the Do Nothing Scenario were assumed to be identical to those shown in Figures 5-2 through 5-4, since they are associated with the existing runways. By 2013, it was assumed in Reference 8 that the proposed KATR for C-17 training operations would be completed. Therefore, the new flight tracks associated with operations on the KATR (see Figure 6-1) by C-17 aircraft are associated with the Action Scenario. The noise contours associated with the Action Scenario for 2013 were extracted from Reference 8 and are shown in Figure 6-2. The airport noise contours for 2013 under the No Action Scenario should be slightly smaller than those shown in Figure 6-2 due to much lower number of C-17 operations expected at KOA without the KATR. The 7 aircraft noise monitoring locations are also shown in Figures 6-1 and 6-2. Two additional noise sensitive receptor locations (Locations KI and P) were included in Figure 6-2 to depict the locations of future noise sensitive land uses which are anticipated in the KOA environs.

Table 6-3 summarizes the forecast changes in aircraft noise levels at the various aircraft noise monitoring and future noise sensitive receptor sites from the 2008 noise levels. By CY 2013, under the Action Scenario, aircraft noise levels at KOA are expected to increase by 0.4 to 1.4 DNL above CY 2008 levels. At the present location of the charter school (near Location B), increases in aircraft noise levels of 1.2 DNL are predicted to occur between CY 2008 and 2013. New incompatible land uses are not expected to result from the growth in the airport noise contours by CY 2013 under the Action Scenario. Where an increase in aircraft noise levels are expected to occur under the Action Scenario by 2013, the magnitude of the increase will be less than the FAA's 1.5 DNL criteria for significant increase. For this reason, it was concluded that additional aircraft noise mitigation measures for improving the land use compatibility situation at KOA would not be required in 2013 under the Action Scenario. It should be noted that the future site of the charter school is near Location C, which should be compatible with the 2013 noise levels under the Action Scenario.

Figure 6-3 depicts the forecasted Long Range noise contours for KOA which were extracted from Reference 8. Figure 6-3 includes the effects of the construction of a new helicopter general aviation facility northeast of the existing airport terminal

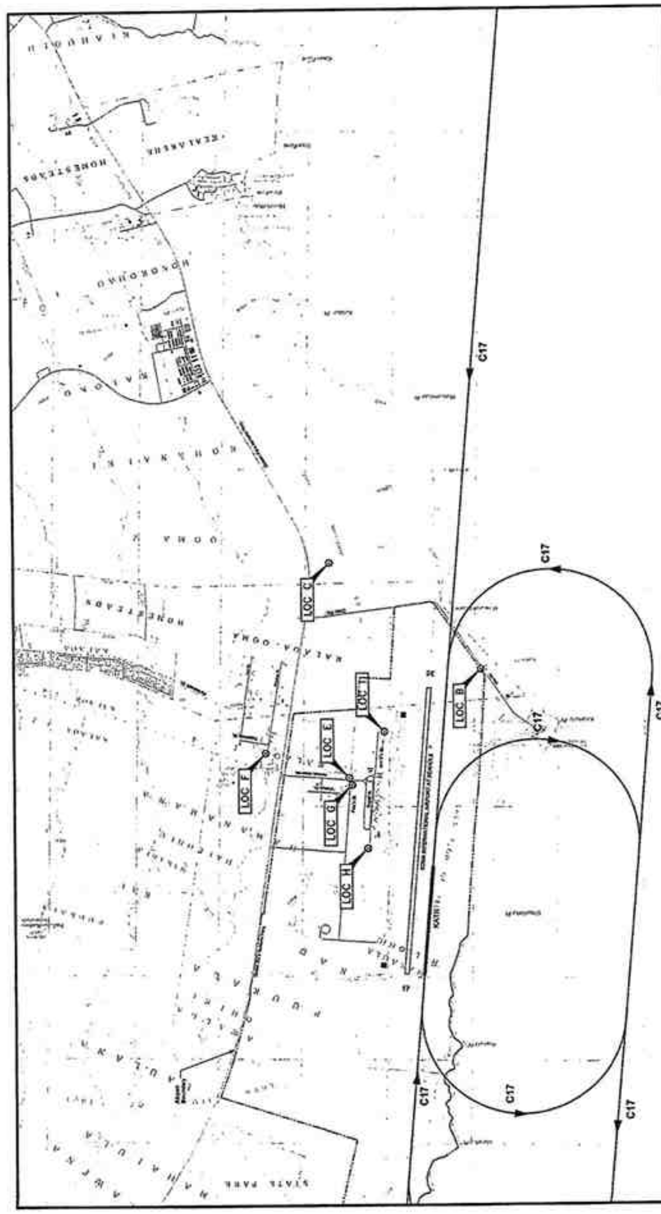


FIGURE 6-1

C-17 FLIGHT TRACKS AT NEW KONA AUXILIARY TRAINING RUNWAY (KATR)

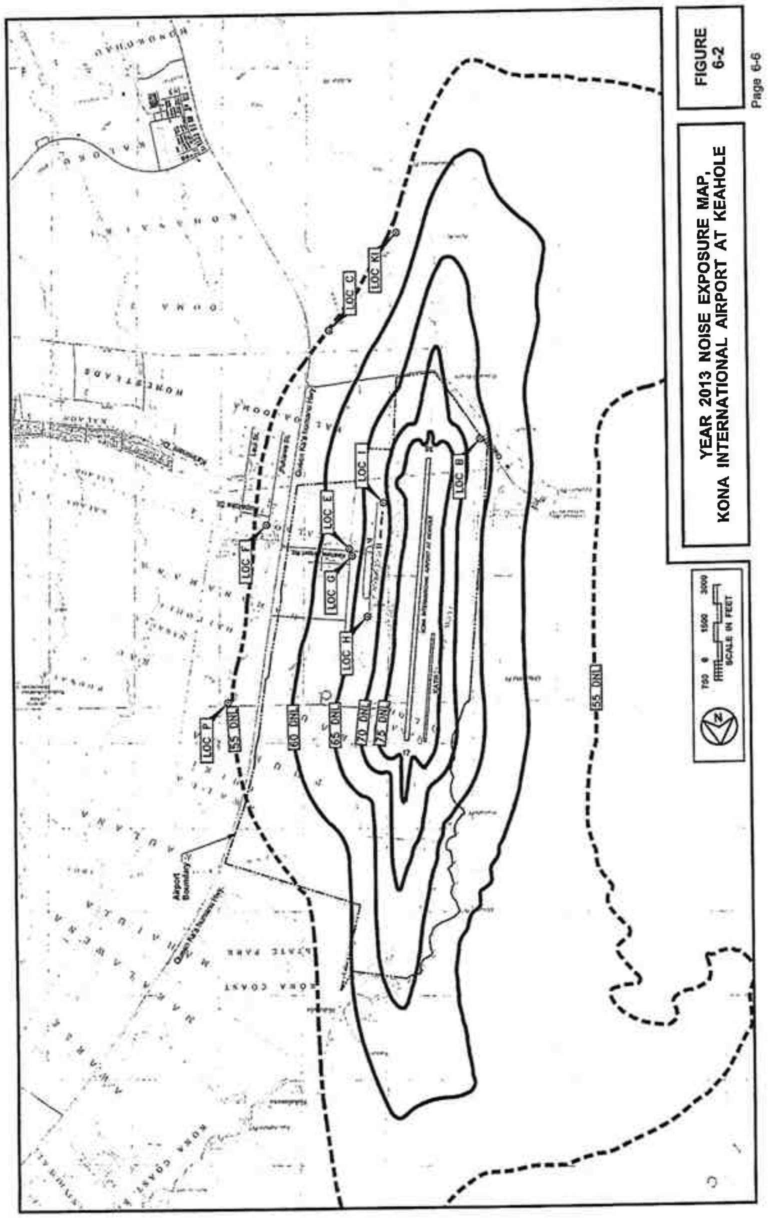


TABLE 6-3
COMPARISON OF AIRCRAFT NOISE LEVELS ASSOCIATED WITH EXISTING AND FUTURE NOISE EXPOSURE MAPS, KONA INTERNATIONAL AIRPORT AT KEAHOLE

	DNL AT NOISE MEASUREMENT LOCATIONS								
	B	C	E	F	G	H	I	KI	P
2008 BASE YEAR NEM	65.1*	53.7	62.2	54.6	62.8	67.3	67.9	54.4	53.1
2013 5-YEAR NEM	66.3*	54.9	63.2	56.0	63.7	67.7	69.1	55.7	54.7
Change from 2008 to 2013	1.2	1.2	1.0	1.4	0.9	0.4	1.2	1.3	1.6
Long Range with New Parallel Rwy.	69.6*	54.2	62.3	55.2	62.7	65.7	67.3	54.7	55.9
Change from 2008 to Long Range	4.5**	0.5	0.1	0.6	-0.1	-1.6	-0.6	0.3	2.8
Long Range without New Parallel Rwy.	67.2*	55.4	63.7	56.0	64.2	67.9	69.3	57.0	56.7
Change from 2008 to Long Range	2.1**	1.7	1.5	1.4	1.4	0.6	1.4	2.6	3.6

Notes:
* Exceeds 60 DNL land use compatibility criteria for a noise sensitive land use, such as educational facility.
** Increase in DNL value by 1.5 DNL or more is considered to be a significant change at noise sensitive land uses which experience aircraft noise levels at or above 60 DNL.

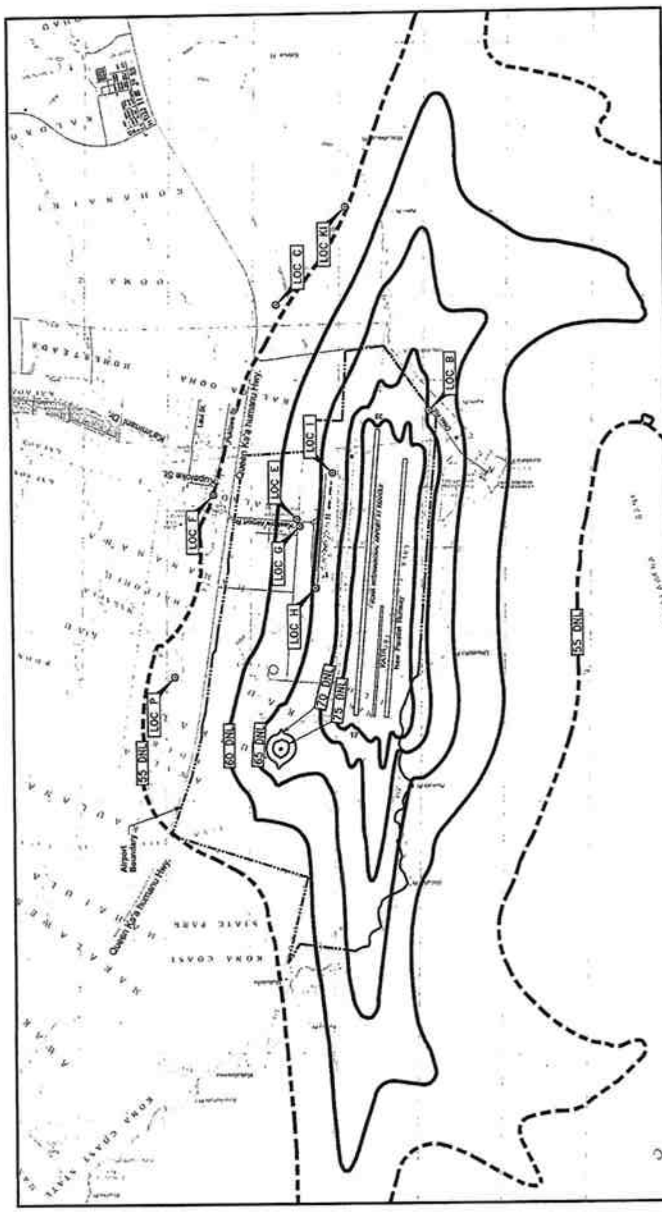


FIGURE 6-3

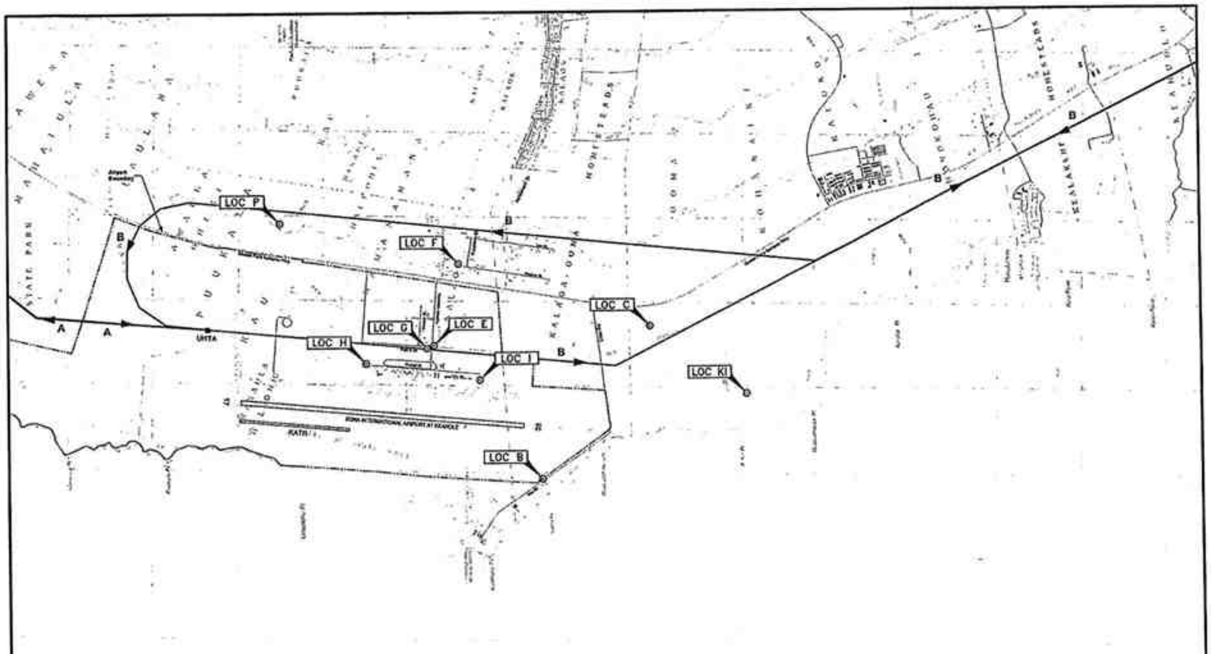
LONG RANGE NOISE EXPOSURE MAP, KONA INTERNATIONAL AIRPORT AT KEAHOLE

Page 6-8

building as well as the effects of the addition of a new parallel runway on the west side of Runway 17/35 and the KATR. The new helicopter flight tracks at the new helicopter general aviation facility under the Long Range Action Scenario are shown in Figures 6-4 and 6-5. Because the new parallel runway is not included within the 2022 time frame of this project, Figure 6-3 is included for information only, to depict the potential Long Range noise contours following implementation of this project's construction items. Table 6-3 depicts the expected aircraft noise levels at the 9 noise monitoring and receptor locations shown in Figure 6-3.

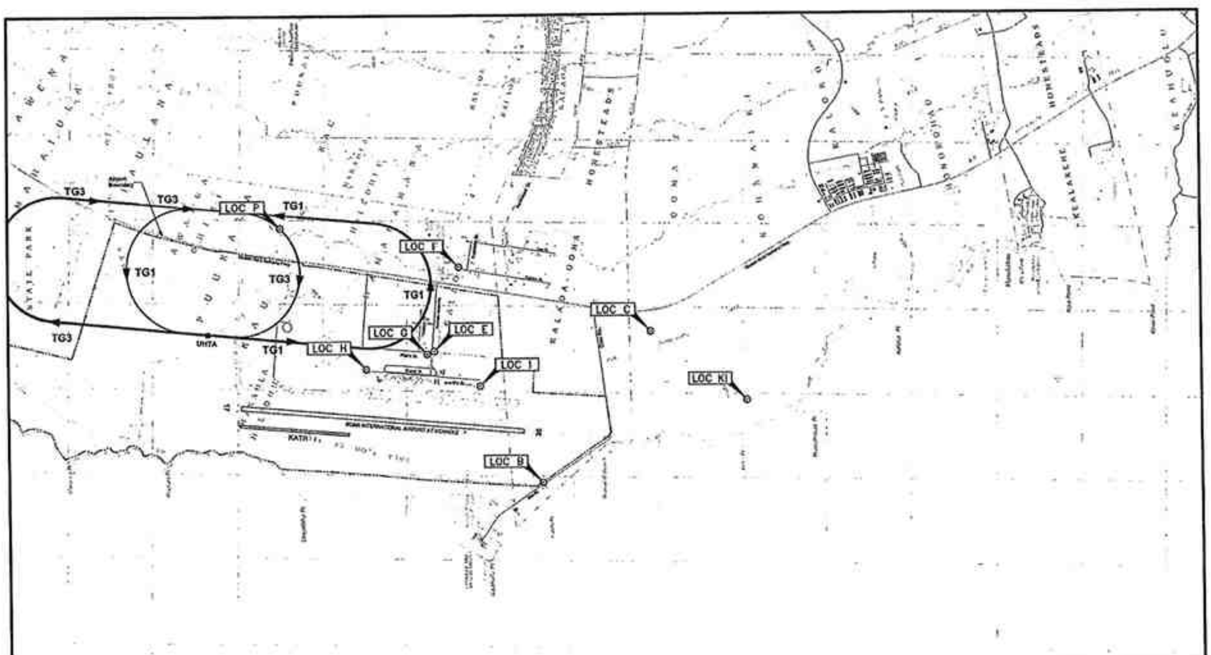
Figure 6-6 was developed using the Long Range aircraft operations forecast information contained in Reference 8, but without inclusion of the new parallel runway. Therefore, Figure 6-6 is more representative of the Long Range aircraft contours under the proposed Action Scenario which excludes the construction of a new parallel runway. Table 6-3 depicts the expected aircraft noise levels at the 9 noise monitoring and receptor locations shown in Figure 6-6. Using the Long Range aircraft operations forecasts from Reference 8, aircraft noise levels at KOA are expected to increase by 0.6 to 3.6 DNL above CY 2008 levels. New incompatible land uses are not expected to result from the growth in the airport noise contours by CY 2022 under the Action Scenario. For this reason, it was concluded that additional aircraft noise mitigation measures for improving the land use compatibility situation at KOA would not be required in 2022 under the Action Scenario. It should be noted that the future site of the charter school is near Location C, which should be compatible with the 2022 noise levels under the Action Scenario.

The planned facilities on the Airport property such as the relocated Onizuka Museum, ARFF Regional Training Facility, and the Medical Transitional Facility are shown in Figure 6-6, and will be located within the future 60 DNL airport contour. As such, sound attenuation measures to limit the interior noise levels of critical spaces to 45 DNL should be included in the design of the exterior envelopes of these facilities.



FUTURE HELICOPTER DEPARTURE AND ARRIVAL FLIGHT TRACKS AT NEW HELICOPTER FACILITY

FIGURE 6-4



FUTURE HELICOPTER TRAINING FLIGHT TRACKS AT NEW HELICOPTER FACILITY

FIGURE 6-5

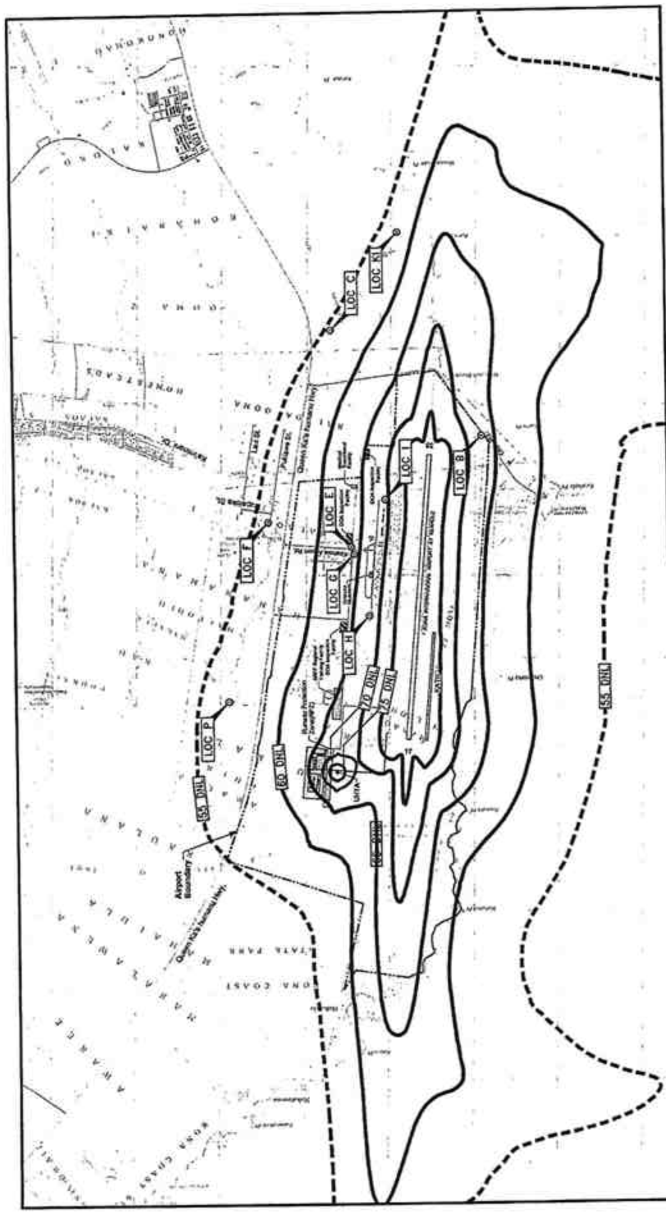


FIGURE 6-6

LONG RANGE NOISE EXPOSURE MAP WITHOUT NEW PARALLEL RUNWAY, KONA INTERNATIONAL AIRPORT AT KEAHOLE

Page 6-12

CHAPTER 7. DISCUSSION OF PROJECT RELATED NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

Traffic Noise. Risks of future traffic noise impacts resulting from the proposed KOA improvements are considered to be low due to the relatively small increases in traffic noise associated with the Action Alternative. The largest increases in traffic noise attributable to the KOA improvements are anticipated to occur along roadways within the Airport property, and the forecast traffic noise levels along these roadways should not impact existing or planned facilities located along these roadways. Traffic noise level increases associated with the Action Alternative are not expected to exceed the DOT-HWYS "15 dB increase" criteria.

Potential noise impacts along Queen Kaahumanu Highway, which services KOA, are possible irrespective of the selected development alternative for KOA. Existing and future residences which are located along Queen Kaahumanu Highway may be impacted by traffic noise if their setback distances to the 66 Leq(h) contours are less than those indicated in Table 5-2. Because traffic noise along public roadways are generated by non-project as well as project traffic, mitigation of off-site traffic noise impacts are generally performed by individual property owners fronting the roadways' Right-of-Way or by public agencies during roadway improvement projects. These mitigation measures generally take the form of increased setbacks, sound attenuating walls, total closure and air conditioning, or the use of sound attenuating windows.

Aircraft Noise. Evaluation of the existing and forecast aircraft noise contours for KOA indicate that incremental increases in aircraft noise levels are expected to occur between 2008 and 2022. The addition of the KATR runway at KOA is expected to result in a large increase in C-17 operations at KOA. From 2008 to 2013, the noise contributions of military aircraft to the noise contours at KOA are expected to increase from approximately 25 percent in 2008 to approximately 54 percent in 2013, due to the increased number of operations by C-17 and F-22A aircraft at KOA. The percentage contributions from military aircraft to the total DNL contour values differ at various locations around the Airport.

The addition of the planned helicopter general aviation facility by 2022 will expand the noise contours in the area northeast of the airport terminal. The 60 DNL contour should still remain west of Queen Kaahumanu Highway by 2022, so that sound attenuation measures for existing and planned noise sensitive land uses east of Queen Kaahumanu Highway should not be required. By 2022, the major contributors to the aircraft noise contours in the areas east of Queen Kaahumanu Highway are: military aircraft (47 percent); overseas jet aircraft (11 percent); interisland jet aircraft (11 percent); fixed wing propeller and rotary wing aircraft (31 percent); and others (less than 1 percent).

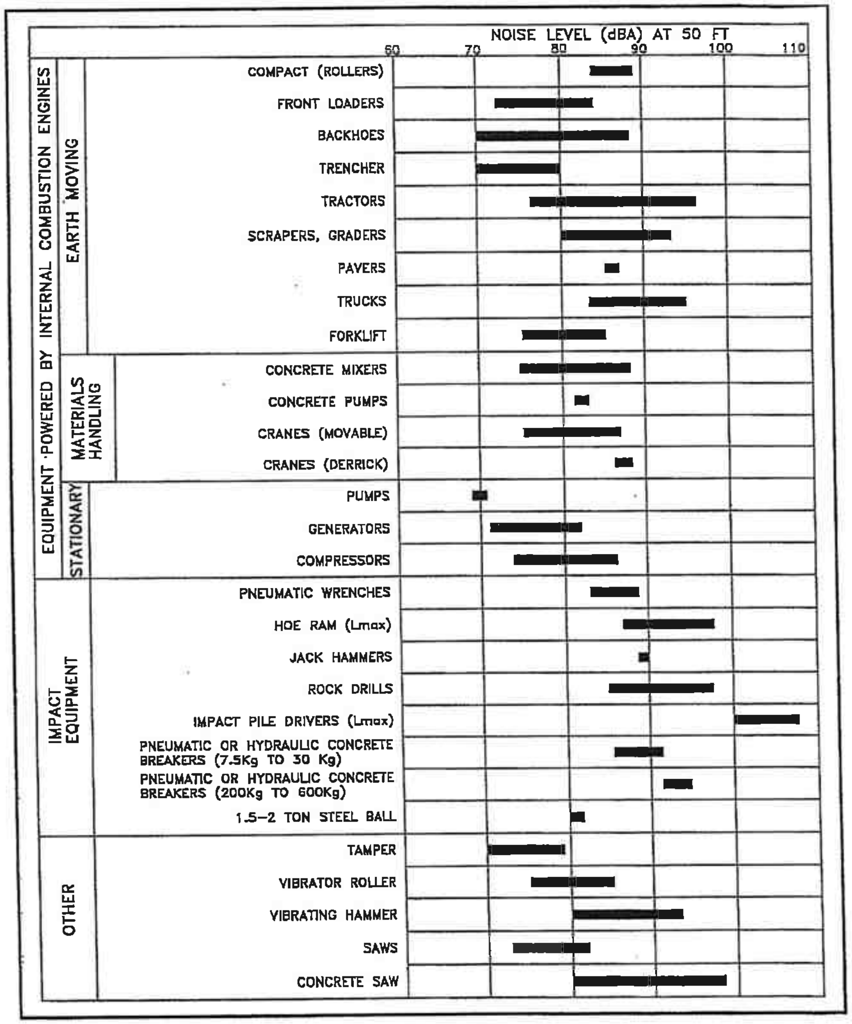
The planned noise sensitive facilities on Airport property should include sound attenuation measures which reduce the interior noise levels of living quarters, classrooms, training room, clinics and medical examination rooms, etc. to 45 DNL or less. The use of sound attenuation glazing, doors, exterior wall and roof construction, and the addition of sound attenuation devices in the outside air and exhaust ducts will be required to achieve the 45 DNL interior noise level goal. Planned noise sensitive facilities located within the 70 to 75 DNL contours of Figure 6-6 should be provided with a minimum 30 dBA of exterior-to-interior noise reduction; planned noise sensitive facilities located within the 65 to 70 DNL contours of Figure 6-6 should be provided with a minimum 25 dBA of exterior-to-interior noise reduction; and planned noise sensitive facilities located within the 60 to 65 DNL contours of Figure 6-6 should be provided with a minimum 20 dBA of exterior-to-interior noise reduction.

CHAPTER 8. OTHER NOISE IMPACT CONSIDERATIONS

Noise from Other On-Site Airport Facilities. Noise from other on-site facilities or equipment at KOA are primarily associated with mechanical equipment such as air conditioning and refrigeration condensers and chillers, blowers, portable generator equipment, and ground transportation vehicles. Because the existing and planned airport facilities are located at relatively large (500+ FT) distances from noise sensitive areas, adverse noise impacts from these on-site facilities and equipment are not anticipated. Additionally, if airport equipment or facilities need to be located near noise sensitive properties, sound attenuation treatment may be applied to the airport equipment or facilities to minimize the possible adverse noise impacts from these units.

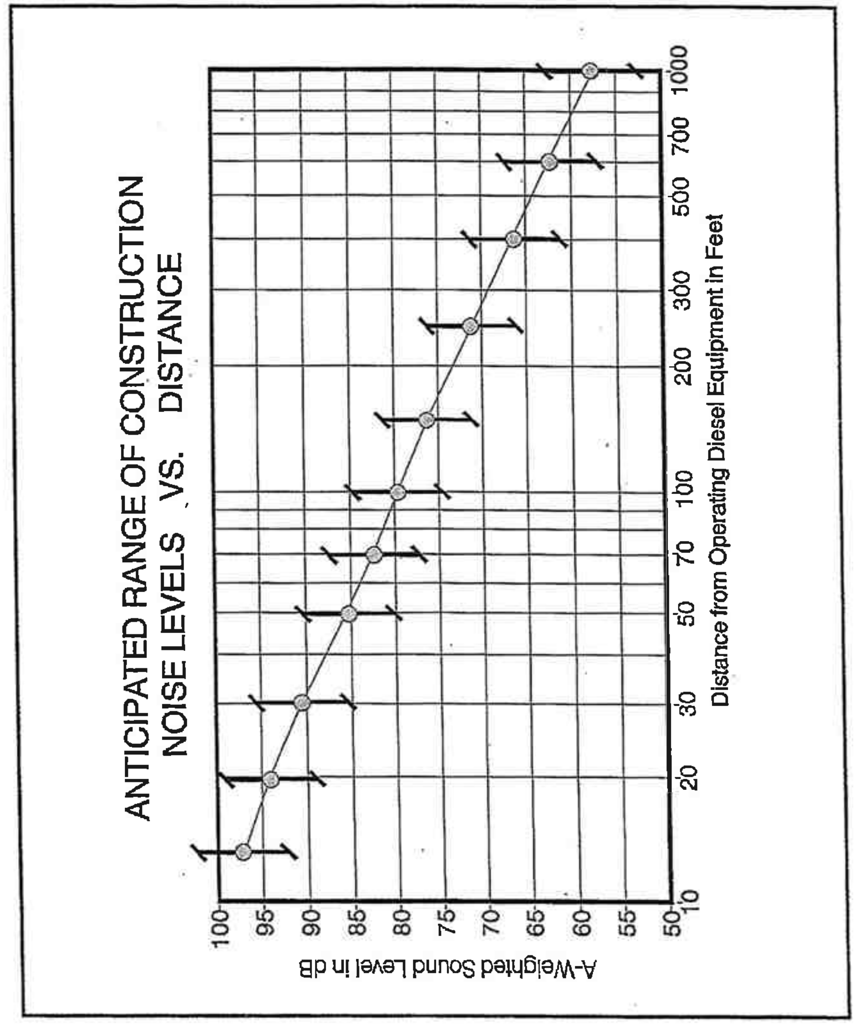
Construction Noise. Audible construction noise will probably be unavoidable during the entire airport construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the airport site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of noise from construction equipment and activities (excluding pile driving activity) are shown in Figures 8-1 and 8-2. The noise sensitive properties which are predicted to experience the highest noise levels during construction activities on the airport site are the existing residences at the agricultural subdivision east of Queen Kaahumanu Highway, the existing charter school, and the future noise sensitive facilities added to the Airport complex. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the various construction sites.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job sites. The incorporation of State Department of Health (DOH) construction noise limits and curfew times, which are applicable on the island of Hawaii (Reference 6), is another noise mitigation measure which can be applied to this project. Figure 8-3 depicts the allowed hours of construction which exceed the noise DOH limits of Reference 6. Noisy construction activities are not allowed on Sundays or holidays under the DOH permit procedures.



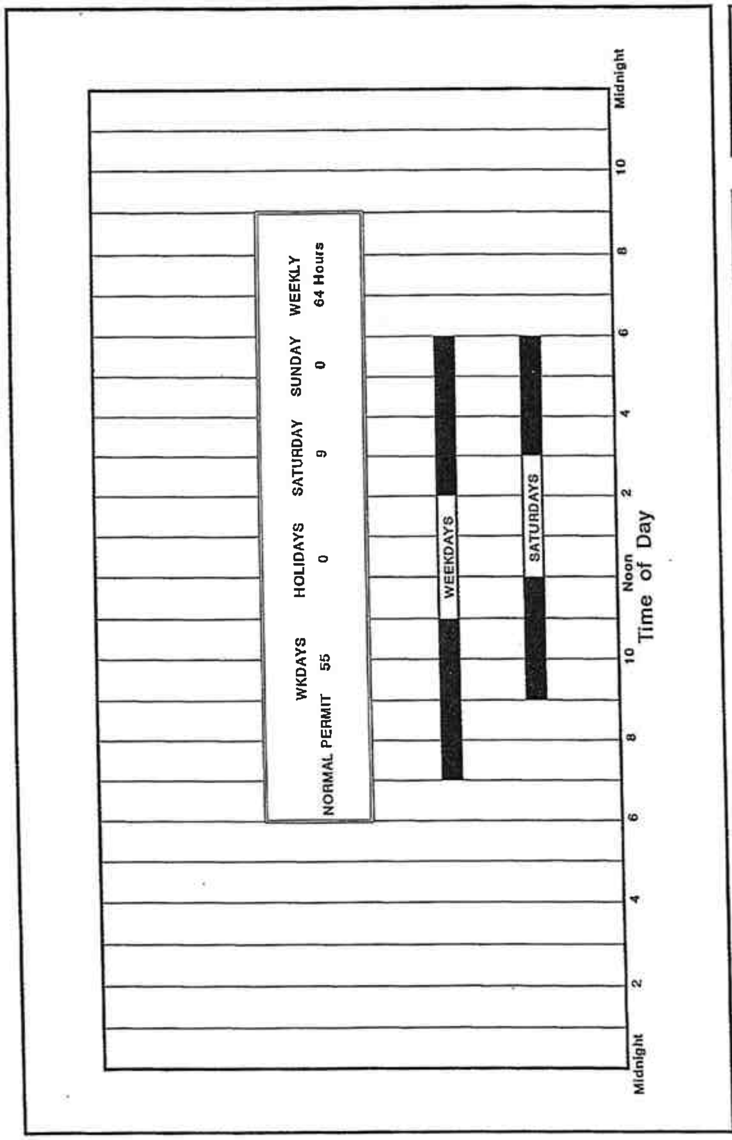
RANGES OF CONSTRUCTION EQUIPMENT NOISE LEVELS

FIGURE 8–1



CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 8–2



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 8-3

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(3) "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety;" Environmental Protection Agency (EPA 550/9-74-004); March 1974.

(4) "Mandatory Seller Disclosures in Real Estate Transactions;" Chapter 508D, Hawaii Revised Statutes; July 1, 1996.

(5) "Highway Noise Policy and Abatement Guidelines;" State of Hawaii, Department of Transportation, Highways Division and U.S. Department of Transportation, Federal Highway Administration; April 25, 2011; with corrections dated November 29, 2011.

(6) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(7) "FHWA Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(8) "14 CFR Part 150 Noise Compatibility Study; Noise Exposure Maps Update; Kona International Airport At Keahole, Hawaii;" Hawaii State Department of Transportation, Airports Division; April 2009.

(9) "Traffic Impact Report for the Kona International Airport At Keahole;" Wilson Okamoto Corporation; March 2012.

(10) February 6, 2012, 24-Hour Traffic Counts; Station 000T8M; Queen Kaahumanu Highway, 0.25 Miles North of OTEC Access Road; Hawaii State Department of Transportation.

(11) "FAA Order No. 1050.1E - Environmental Impacts: Policies and Procedures;" Federal Aviation Administration; March 20, 2006 (Change 1).

(12) "Integrated Noise Model (INM) Version 7.0 User's Guide;" FAA-AEE-07-04; April 2007.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND FUTURE YEAR TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2011 **** AM VPH	**** CY 2011 **** PM VPH	CY 2022 (W/O PROJ.) AM VPH	CY 2022 (W/O PROJ.) PM VPH	CY 2022 (WITH PROJ.) AM VPH	CY 2022 (WITH PROJ.) PM VPH
Q. Kaahumanu Hwy. - North of Keahole Airport Rd. (NB)	611	516	746	630	752	654
Q. Kaahumanu Hwy. - North of Keahole Airport Rd. (SB)	378	755	461	921	485	925
Two-Way	989	1,271	1,207	1,551	1,237	1,579
Q. Kaahumanu Hwy. - South of Keahole Airport Rd. (NB)	878	652	950	796	1,046	813
Q. Kaahumanu Hwy. - South of Keahole Airport Rd. (SB)	415	978	506	1,192	520	1,288
Two-Way	1,293	1,630	1,456	1,988	1,566	2,101
Keahole Airport Rd. At Q. Kaahumanu Hwy. (EB)	124	334	151	407	171	527
Keahole Airport Rd. At Q. Kaahumanu Hwy. (WB)	354	247	310	302	430	323
Two-Way	478	581	461	709	601	850
Keahole Airport Rd. E. of Halalu St. (EB)	124	328	151	401	171	521
Keahole Airport Rd. E. of Halalu St. (WB)	254	250	310	305	430	326
Two-Way	378	578	461	706	601	847
Keahole Airport Rd. Between Halalu and Pao`o (EB)	130	318	159	388	179	508
Keahole Airport Rd. Between Halalu and Pao`o (WB)	202	189	247	231	367	252
Two-Way	332	507	406	619	546	760
Keahole Airport Rd. W. of Pao`o St. (EB)	130	286	159	349	159	349
Keahole Airport Rd. W. of Pao`o St. (WB)	217	226	265	276	265	276
Two-Way	347	512	424	625	424	625
Halalu St. N. of Keahole Airport Rd. (NB)	87	131	106	160	106	160
Halalu St. N. of Keahole Airport Rd. (SB)	29	80	35	99	35	99
Two-Way	116	211	141	259	141	259
Pao`o St. N. of Keahole Airport Rd. (NB)	0	0	0	0	90	0
Pao`o St. N. of Keahole Airport Rd. (SB)	15	69	18	84	18	174
Two-Way	15	69	18	84	108	174
Pao`o St. S. of Keahole Airport Rd. (NB)	N/A	N/A	N/A	N/A	20	30
Pao`o St. S. of Keahole Airport Rd. (SB)	N/A	N/A	N/A	N/A	30	21
Two-Way	N/A	N/A	N/A	N/A	50	51

APPENDIX F

Traffic Impact Report for the Kona International Airport

Wilson Okamoto Corporation

March 2012

Traffic Impact Report

Prepared For
DOT Airports Division

Prepared By
Wilson Okamoto Corporation

March 2012

TRAFFIC IMPACT REPORT

FOR THE

KONA INTERNATIONAL AIRPORT AT KEAHOLE

Prepared for:

State of Hawaii
Department of Transportation
Airports Division

Prepared by:

Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii 96826
WOC Ref #8027-02

March 2012

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICIES

I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to identify and assess the traffic impacts resulting from the proposed improvements at the Kona International Airport at Keahole (KOA) on the island of Hawaii. The proposed improvements include the expansion of the existing general aviation facilities, a new Medical Transitional facility, a new Aircraft Rescue Fire Fighting (ARFF) Regional Training Facility, a secondary emergency runway, and other terminal modifications.

B. Scope of Study

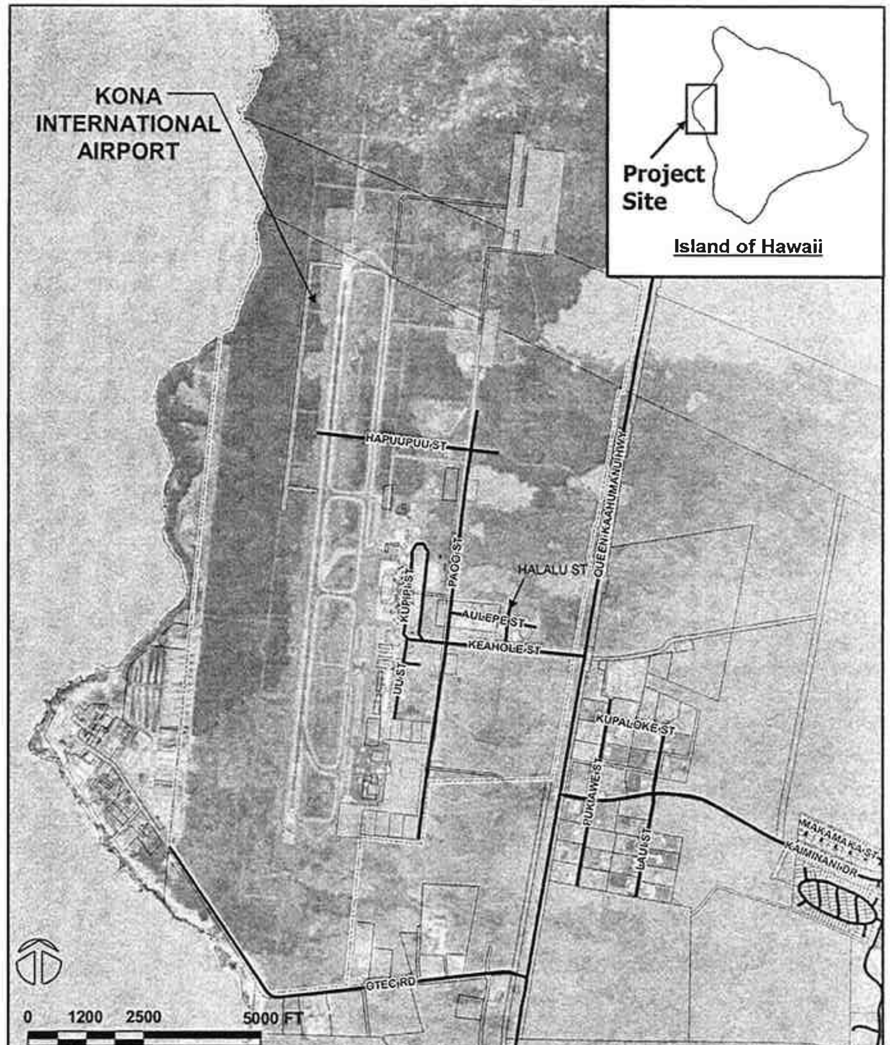
This report presents the findings and conclusions of the traffic study, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future roadway and traffic conditions without the proposed project.
4. Analysis and development of trip generation characteristics for the proposed project.
5. Superimposing site-generated traffic over future traffic conditions.
6. The identification and analysis of traffic impacts resulting from the proposed project.
7. Recommendations of improvements, if appropriate, that would mitigate the traffic impacts resulting from the proposed project.

II. PROJECT DESCRIPTION

A. Location

The existing KOA is situated on an approximately 3,450-acre site located west of Queen Kaahumanu Highway in Keahole on the island of Hawaii. The project site is further identified as Tax Map Keys: 7-3-043: por. 001, 002, 003 and 7-2-005: 007 (see Figure 1). Access to the airport is currently provided via Keahole Airport Road off Queen Kaahumanu Highway.



WILSON OKAMOTO CORPORATION ENGINEERS - PLANNERS | KONA INTERNATIONAL AIRPORT | LOCATION MAP AND VICINITY MAP | FIGURE 1

B. Project Characteristics

The State of Hawaii Department of Transportation Airports Division is proposing various improvements at the existing KOA. These improvements are part of the long-range master plan for the airport and include the following:

- Expansion of the existing general aviation facilities adjacent to U'u Street to alleviate current congestion at that facility.
- Construction of a new helicopter general aviation facility adjacent to Pao'o Street north of Keahole Airport Road and relocation of those activities to the new facility. The new facility will include a new helicopter runway, touchdown and lift-off facility (TLOF), hover pads, parking apron, taxi lanes, and maintenance and storage facilities. In conjunction with this new facility, Pao'o will be extended further north.
- Construction of an interim secondary emergency runway.
- Construction of a sea water air conditioning (SWAC) system from the adjacent NELHA facility.
- Relocation of the Astronaut Ellison S. Onizuka Space Center from within the terminal to the former ground transportation area.
- Modernization of the existing terminal to encompass the former Astronaut Ellison S. Onizuka Space Center site to provide a centralized check-in area and in-line baggage handling system
- Construction of a high pressure hydrogen fuel storage and fueling station adjacent to Aulepe Street for use by hydrogen powered vehicles.
- Construction of an ARFF Regional Training Facility adjacent to Pao'o Street north of Keahole Airport Road that includes a fuel spill trainer, specialized air craft fire trainer (SAFT), two-story control tower and classroom facility (~3 classrooms with maximum capacity of 30 people per classroom), and a three-story burn building. The proposed facility is expected to be utilized two to three times a week by airport ARFF personnel, County of Hawaii fire fighting personnel, and other First Responders.
- Construction of a medical transitional facility (~45,000 square feet) adjacent to Pao'o Street south of Keahole Airport Road that will include an emergency room where patients could be received and stabilized prior to being transportation by air to other facilities and an out-patient clinic.
- Interior renovation of the existing ARFF station for a new commuter terminal.
- Construction of a temporary State of Hawaii Department of Agriculture (DOA) inspection facility adjacent to Pao'o Street and relocation of DOA inspection activities to the new facility. A permanent facility is expected to be constructed in the future.

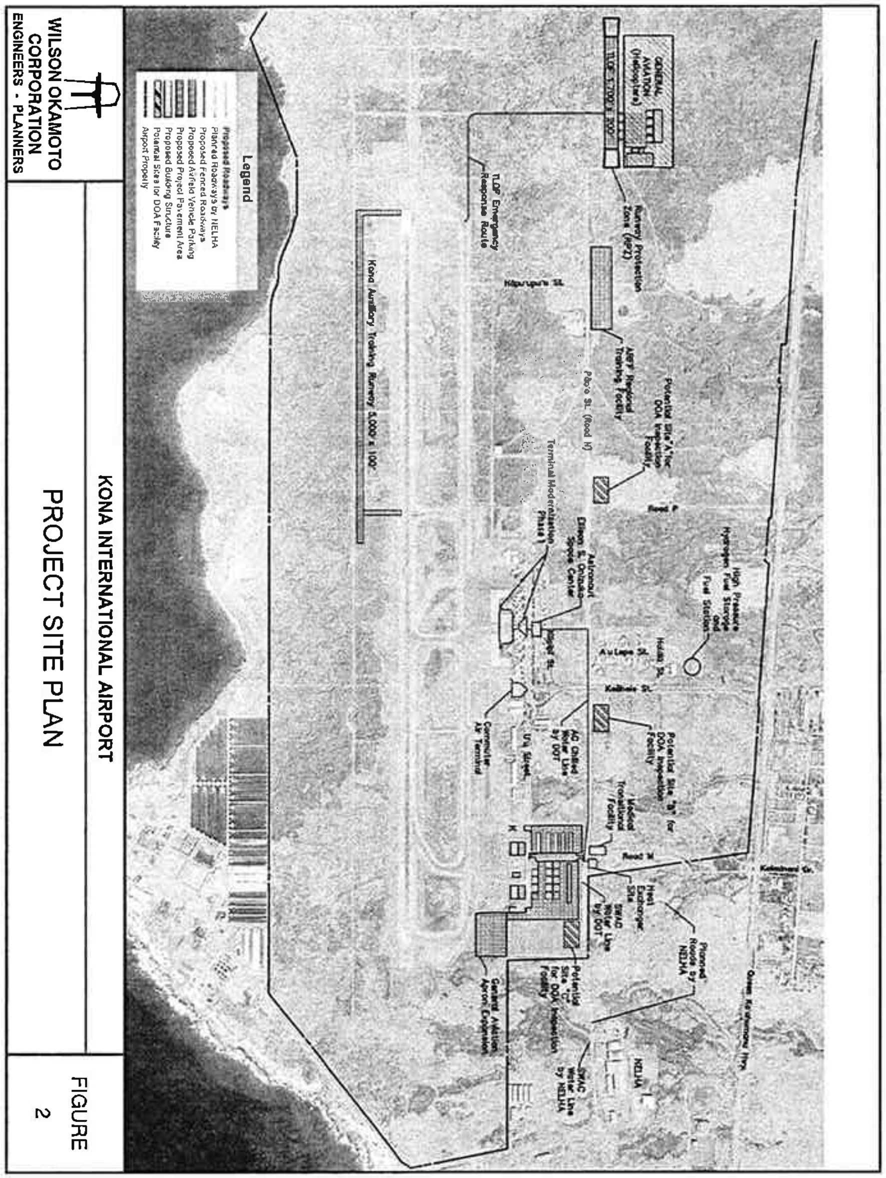
The proposed improvements are expected to be completed by the Year 2022 with access from Queen Kaahumanu Highway continuing to be provided via Keahole Airport Road. Figure 2 shows the proposed site plan.

III. EXISTING TRAFFIC CONDITIONS

A. Area Roadway System

Access to the existing facility is provided off Queen Kaahumanu Highway via Keahole Airport Road. In the vicinity of the airport, Queen Kaahumanu Highway is a predominantly two-lane, two-way roadway generally oriented in the north-south direction. At the signalized intersection with Keahole Airport Road, the northbound approach of the highway has an exclusive left-turn lane and one through lane while the southbound approach has one through lane and an exclusive right-turn lane. In addition, a southbound acceleration lane is provided along the highway to allow right-turning vehicles from Keahole Airport Road to proceed unimpeded through the intersection. Keahole Airport Road is a two-lane, two-way roadway generally oriented in the east-west direction that serves as the primary access for the airport. At the intersection with the highway, the Keahole Airport Road approach has one channelized lane that serves left-turn and right-turn traffic movements. The southbound approach of the intersection is comprised of an access road. Only left-turn-in and right-turn-out traffic movements are allowed with both movements being yield-controlled.

West of the intersection with the highway, Keahole Airport Road intersects Halalu Street. At this unsignalized T-intersection, the eastbound approach of the Keahole Airport Road has one lane that serves left-turn and through traffic movements while the westbound approach has one lane that serves through and right-turn traffic movements. Halalu Street is a two-lane, two-way roadway generally oriented in the north-south direction that provides access to the rental car companies located adjacent to Aulepe Street. At the intersection with Keahole Airport Road, Halalu Street has one stop-controlled lane that serves left-turn and right-turn traffic movements.



Further west, Keahole Airport Road intersects Pao'o Street. At this unsignalized intersection, the eastbound approach of Keahole Airport Road has one lane that serves through traffic movements while the westbound approach has one lane that serves through and right-turn traffic movements. Eastbound left-turn traffic movements are prohibited at this intersection. Pao'o Street is a two-lane, two-way roadway generally oriented in the north-south direction that provides access to the rental car companies adjacent to Aulepe Street and the parking areas along its alignment. At the intersection with Keahole Airport Road, the southbound approach of Pao'o Street has one lane that serves left-turn and right-turn traffic movements. The northbound approach of Pao'o Street is currently closed with barricades placed across the approach.

B. Traffic Volumes and Conditions

1. General

a. Field Investigation

A field investigation was conducted on October 4-5, 2011 and consisted of manual turning movement count surveys during the morning peak hours between 6:30 AM and 8:30 AM, and the afternoon peak hours between 3:00 PM and 6:00 PM at intersections of Keahole Airport Road with Queen Kaahumanu Highway and Halalu Street. In addition, 24-hour mechanical traffic count surveys were conducted along Keahole Airport Road near the highway and west of Pao'o Street. Appendix A includes the existing traffic count data.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Synchro" software developed by Trafficware. The analysis is based on the concept of Level of Service (LOS) to identify the traffic impacts associated with traffic demands during the peak hours of traffic.

LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating at or near capacity. A v/c ratio of greater than 1.00 indicates that the traffic demand exceeds the road's carrying capacity. The LOS definitions are included in Appendix B.

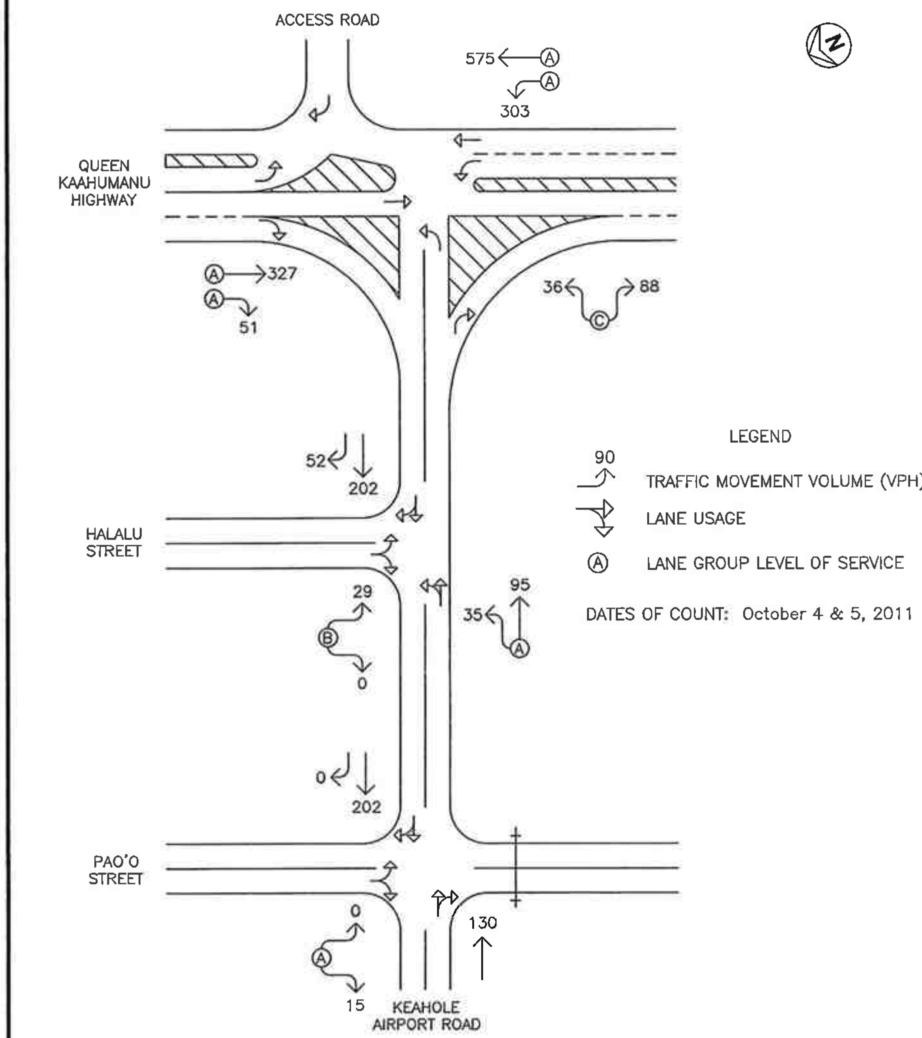
2. Existing Peak Hour Traffic

a. General

Figures 3 and 4 show the existing AM and PM peak hour traffic volumes and operating traffic conditions in the vicinity of the airport. The morning peak hour of traffic generally occurs between 6:45 AM and 7:45 AM in the vicinity of the airport. In the afternoon, the peak hour of traffic generally occurs between the hours of 3:15 PM and 4:15 PM. The analysis is based on these peak hour time periods to identify the traffic impacts resulting from the proposed project. LOS calculations are included in Appendix C.

b. Queen Kaahumanu Highway and Keahole Airport Road

At the intersection with Keahole Airport Road, Queen Kaahumanu Highway carries 778 vehicles northbound and 378 vehicles southbound during the AM peak period. During the PM peak period, the overall traffic volume is higher with 652 vehicles traveling northbound and 755 vehicles traveling southbound. The northbound left-turn traffic movement operates at LOS "A" and LOS "B" during

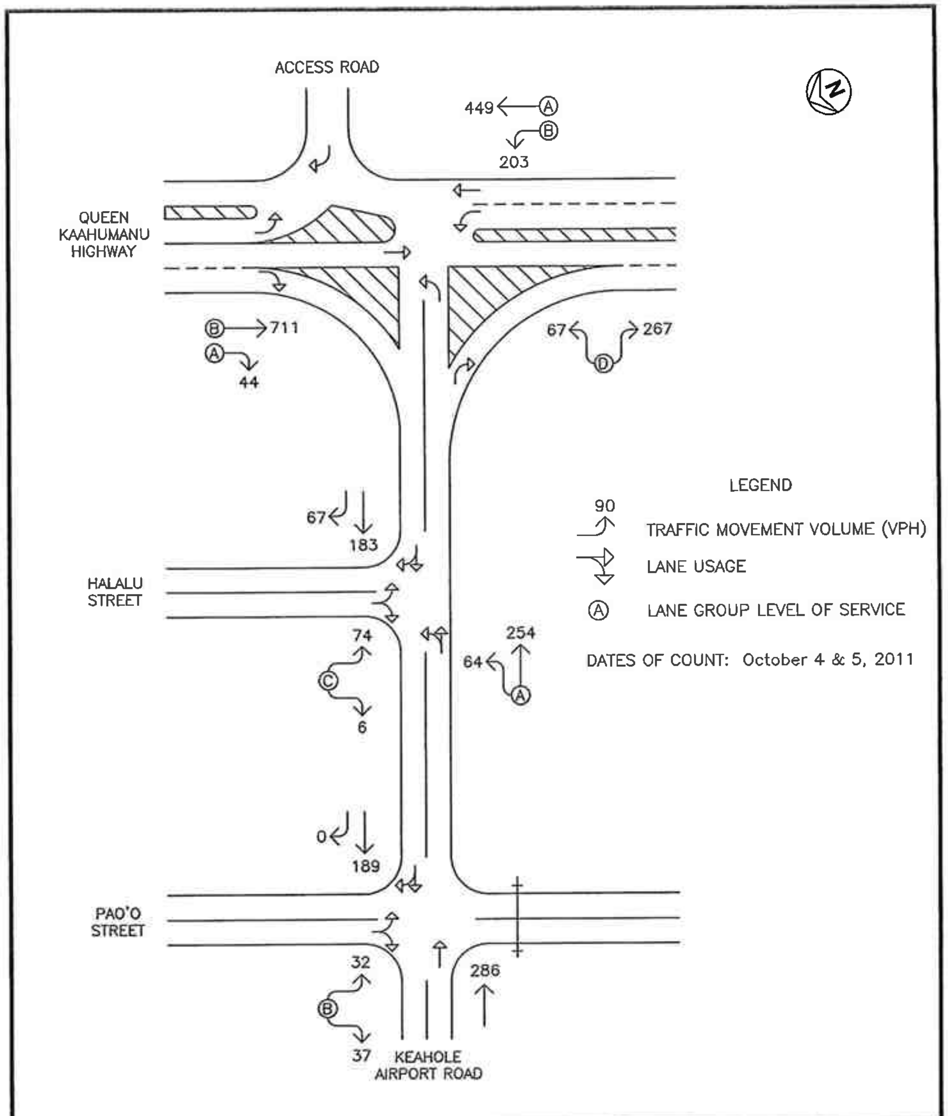


WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

KONA INTERNATIONAL AIRPORT

EXISTING AM PEAK HOUR OF TRAFFIC

FIGURE 3



EXISTING PM PEAK HOUR OF TRAFFIC

FIGURE 4

the AM and PM peak periods, respectively, while the northbound through traffic movement operates at LOS "A" during both peak periods. On the southbound approach of the highway, the through traffic movement operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively, while the right-turn traffic movement operates at LOS "A" during both peak periods. Traffic queues periodically formed on the highway approaches of the intersection with the most significant queuing occurring on the southbound approach. Average queue lengths of 3-5 vehicles were observed during the AM peak period and average queue lengths of 6-8 vehicles were observed during the PM peak period. These queues were observed to clear the intersection after each traffic signal cycle change.

The Keahole Airport Road approach of the intersection carries 124 vehicles and 334 vehicles eastbound during the AM and PM peak periods, respectively. This approach operates at LOS "C" and LOS "D" during the AM and PM peak periods, respectively. Traffic queues periodically formed on this approach with average queue lengths of 1-3 vehicles observed during both peak periods. These queues were observed to clear the intersection after each traffic signal cycle change. The southbound approach of the intersection is comprised of an access road that carries a low volume of traffic throughout the day. No vehicles were observed on this approach during the AM peak period and only 3 vehicles were observed on this approach during the PM peak period.

c. Keahole Airport Road and Halalu Street

At the intersection with Halalu Street, Keahole Airport Road carries 130 vehicles eastbound and 254 vehicles westbound during the AM peak period. During the PM peak period, the overall traffic volume was higher with 318 vehicles traveling eastbound and 250 vehicles traveling westbound. The critical movement on the Keahole Airport Road approaches is the eastbound approach which operates at LOS "A" during both peak periods.

The Halalu Street approach of the intersection carries 29 vehicles and 80 vehicles southbound during the AM and PM peak periods, respectively. This approach operates at LOS "B" and LOS "C" during the AM and PM peak periods, respectively. Traffic queues occasionally formed on this approach with average queue lengths of 1-3 vehicles observed during both peak periods.

d. Keahole Airport Road and Pao'o Street

At the intersection with Pao'o Street, Keahole Airport Road carries 130 vehicles eastbound and 202 vehicles westbound during the AM peak period. During the PM peak period, traffic volumes are higher with 286 vehicles traveling eastbound and 189 vehicles traveling westbound.

The Pao'o approach of the intersection carries 15 vehicles and 69 vehicles southbound during the AM and PM peak periods, respectively. The southbound approach operates at LOS "A" and LOS "B" during the AM and PM peak periods, respectively.

IV. PROJECTED TRAFFIC CONDITIONS

A. Site-Generated Traffic

1. Trip Generation Methodology

The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation, 8th Edition," 2008. The ITE trip generation rates are developed empirically by correlating the vehicle trip generation data with various land use characteristics such as the number of vehicle trips generated per 1,000 square feet of development. The proposed general aviation facilities expansion, emergency runway, SWAC system, Astronaut Ellison S. Onizuka Space Center relocation, terminal expansion,

hydrogen fuel storage and fueling station, existing ARFF station renovation, and temporary DOA inspection facility are not anticipated to generate additional site-generated vehicles since these improvements are intended to serve the existing users and occupants of the airport. The new helicopter general aviation facility is also not expected to generate additional site-generated vehicles during the AM and PM peak periods since most of their operations are assumed to occur during off-peak periods. For the purpose of this report, the trip generation for the ARFF Regional Training Facility was based on the maximum capacity of the classroom facility with all attendees expected to arrive during the AM peak period and depart during the PM peak period. Table 1 summarizes the project site trip generation characteristics applied to the AM and PM peak hours of traffic.

Table 1: Peak Hour Trip Generation

ARFF REGIONAL TRAINING FACILITY INDEPENDENT VARIABLE: Classroom Capacity = 90 people		
		PROJECTED TRIP ENDS
AM PEAK	ENTER	90
	EXIT	0
	TOTAL	90
PM PEAK	ENTER	0
	EXIT	90
	TOTAL	90
HOSPITAL (MEDICAL TRANSITIONAL FACILITY) INDEPENDENT VARIABLE: 1,000 sf of development = 45		
		PROJECTED TRIP ENDS
AM PEAK	ENTER	30
	EXIT	20
	TOTAL	50
PM PEAK	ENTER	21
	EXIT	30
	TOTAL	51

Table 1: Peak Hour Trip Generation (Cont'd)

TOTALS		
		PROJECTED TRIP ENDS
AM PEAK	ENTER	120
	EXIT	20
	TOTAL	140
PM PEAK	ENTER	21
	EXIT	120
	TOTAL	141

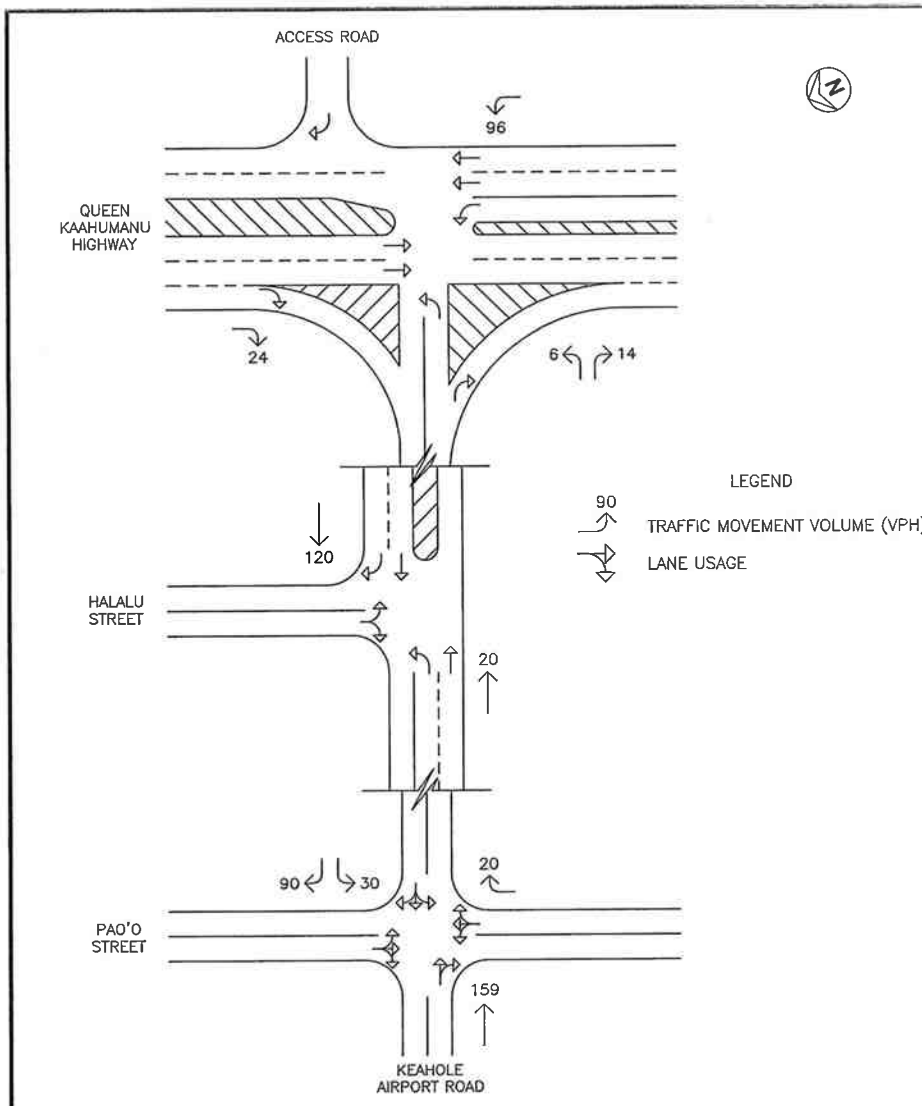
2. Trip Distribution

Figures 5 and 6 show the distribution of site-generated vehicular trips at the study intersections during the AM and PM peak hours of traffic. Access to the airport will continue to be provided off Queen Kaahumanu Highway via Keahole Airport Road. The directional distribution of all site-generated vehicles at the intersection of those roadways was assumed to remain similar to existing conditions. All site generated vehicles were distributed through the roadway network based on their assumed origin/destination and direction of travel.

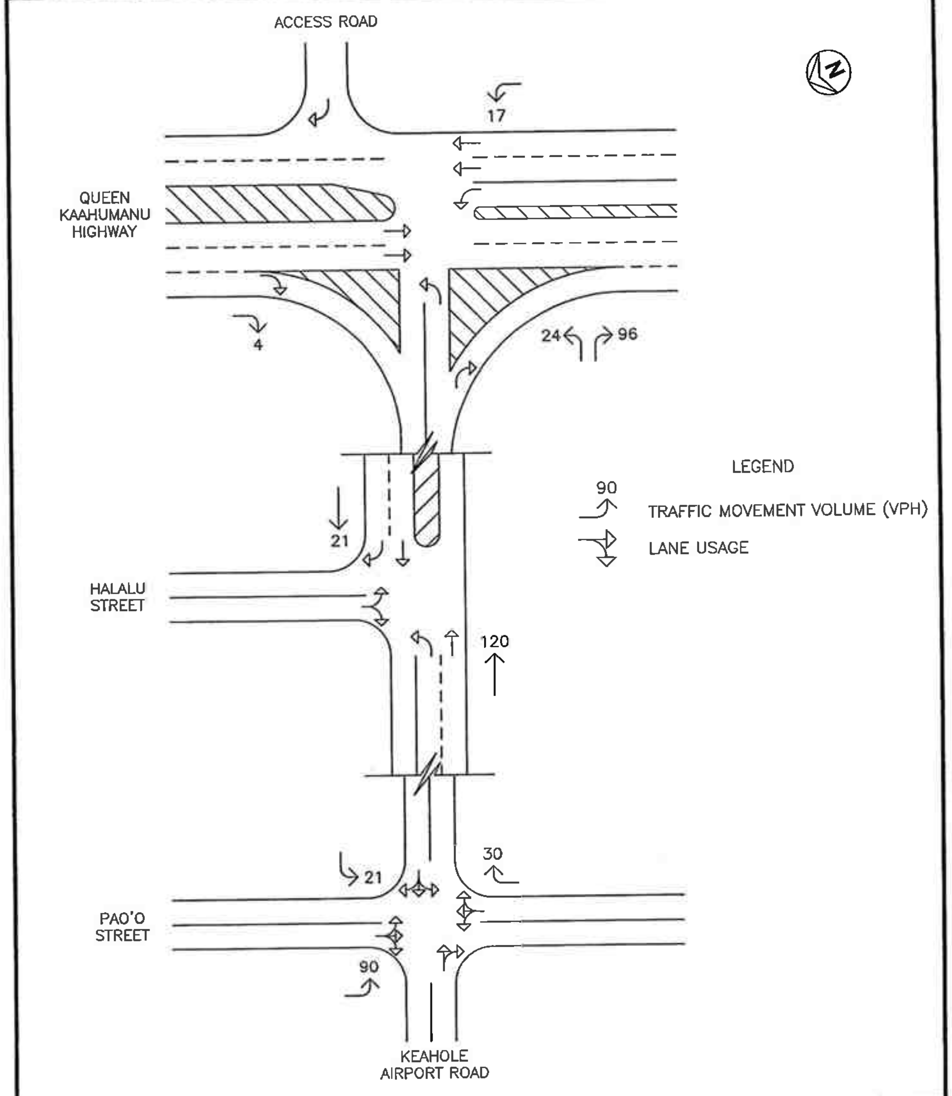
B. Through Traffic Forecasting Methodology

1. Queen Kaahumanu Highway

The travel forecast along Queen Kaahumanu Highway is based upon historical traffic count data obtained from the State Department of Transportation (SDOT), Highway Division survey stations in the vicinity of the project site. The historical data were analyzed by linear regression techniques to obtain an annual traffic growth rate of approximately 1.7%. However, there are a number of future developments planned within the Kona region including projects such as Kaloko Makai, O'oma, Palamanui, UH West Hawaii. As such a more conservative annual traffic growth rate of 2.0% per year was assumed along the highway. Using 2011 as the base year, a growth rate factor of 1.22 was applied to the existing through traffic demands along



WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS	KONA INTERNATIONAL AIRPORT DISTRIBUTION OF SITE-GENERATED VEHICLES - AM PEAK HOUR OF TRAFFIC	FIGURE 5



KONA INTERNATIONAL AIRPORT

DISTRIBUTION OF SITE-GENERATED VEHICLES - PM PEAK HOUR OF TRAFFIC

FIGURE 6

Queen Kaahumanu Highway to simulate projected Year 2022 baseline traffic demands.

2. Kona International Airport at Keahole

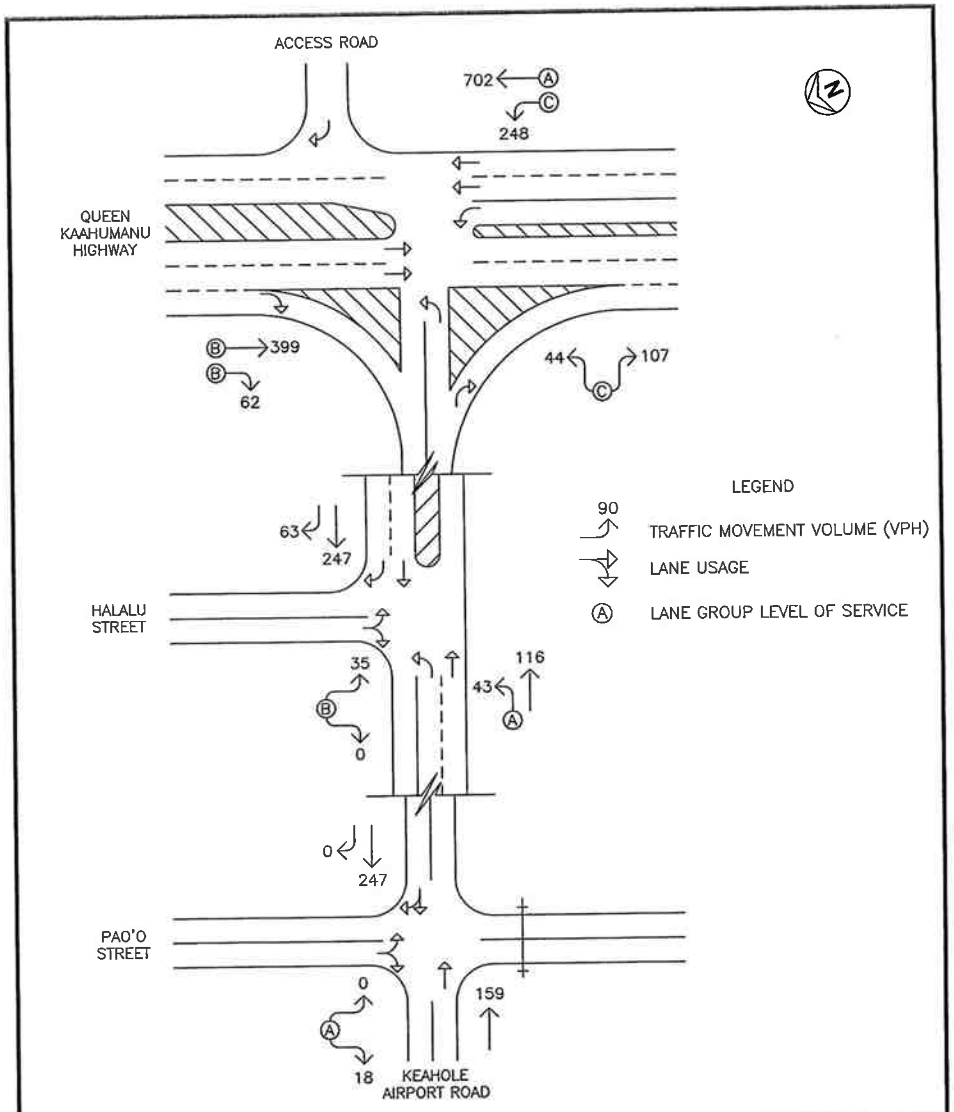
As detailed in the master plan for the KOA, passenger arrivals are anticipated to increase steadily over the next 10-20 years at an annual growth rate of approximately 2% per year. The travel forecast for vehicles accessing the airport is based upon this anticipated increase in passenger arrivals at the airport. As such, traffic volumes entering and exiting the airport were assumed to increase at an annual growth rate of 2% per year. Using 2011 as the base year, a growth rate of 1.22 was applied to the traffic demands along Keahole Airport Road to simulated projected Year 2022 baseline traffic demands.

C. Other Considerations

The State of Hawaii Department of Transportation has plans to widen Queen Kaahumanu Highway between Kealakehe Parkway and Keahole Airport Road from a 2-lane undivided to a 4-lane divided highway. Construction is anticipated to begin in the fall of this year with the widening expected to be completed within 24 months. As such, the widening is assumed to be completed by the Year 2022 and is incorporated into projected baseline conditions.

D. Year 2022 Baseline Total Traffic Volumes

The projected Year 2022 baseline AM and PM peak hour traffic volumes and operating conditions without the implementation of the proposed improvements at the KOA are shown on Figures 7 and 8, and summarized in Table 2. The intersection of Keahole Airport Road and Halalu Street is assumed to be modified to provide exclusive turning lanes along Keahole Airport Road to accommodate the anticipated increases in traffic. The existing levels of service are provided for comparison purposes. LOS calculations are included in Appendix D.

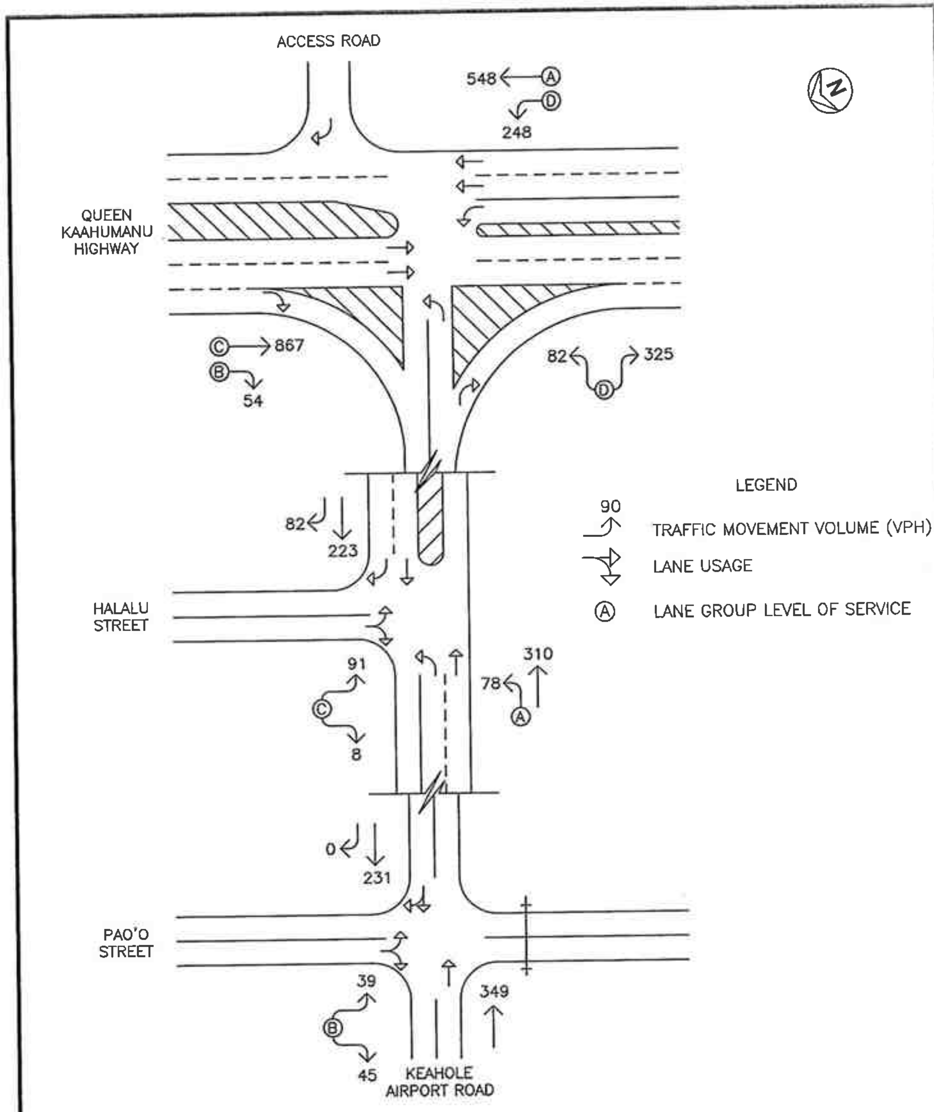


WILSON OKAMOTO CORPORATION ENGINEERS · PLANNERS

KONA INTERNATIONAL AIRPORT

YEAR 2022 BASELINE
AM PEAK HOUR OF TRAFFIC

FIGURE 7



WILSON OKAMOTO CORPORATION ENGINEERS · PLANNERS

KONA INTERNATIONAL AIRPORT

YEAR 2022 BASELINE
PM PEAK HOUR OF TRAFFIC

FIGURE 8

Table 2: Existing and Projected Year 2022 Baseline Traffic Operating Conditions

Intersection	Critical Traffic Movement		AM Exist	AM Year 2022	PM Exist	PM Year 2022
Queen Kaahumanu Hwy/Keahole Airport Rd*	Eastbound	LT-RT	C	C	D	D
	Northbound	LT	A	C	B	D
		TH	A	A	A	A
	Southbound	TH	A	B	B	C
		RT	A	B	A	B
Keahole Airport Rd/Halalu St	Eastbound	LT	A	A	A	A
		TH		-		-
	Southbound	LT-RT	B	B	C	C
Keahole Airport Rd/Pao'o St	Southbound	LT-TH-RT	A	A	B	B

*Highway widened to a 4-lane divided highway.

Traffic volumes in the vicinity of the KOA are anticipated to increase significantly due to increases in passenger arrivals at the airport and the ambient growth in traffic along the highway. However, traffic operations at the study intersection are anticipated to remain similar to existing conditions due to the widening of Queen Kaahumanu Highway and the provision of exclusive turning lanes at the intersection of Keahole Airport Road with Halalu Street. The traffic movements at the intersection of Queen Kaahumanu Highway with Keahole Airport Road are expected to continue operating at LOS "C" or better during the AM peak period and LOS "D" or better during the PM peak period. Similarly, the critical movements at the intersection of Keahole Airport Road with Halalu Street are expected to continue operating at LOS "B" or better during the AM peak period and LOS "C" or better during the PM peak period while those at the intersection with Pao'o Street are expected to continue operating at LOS "A" and LOS "B" during the AM and PM peak periods, respectively.

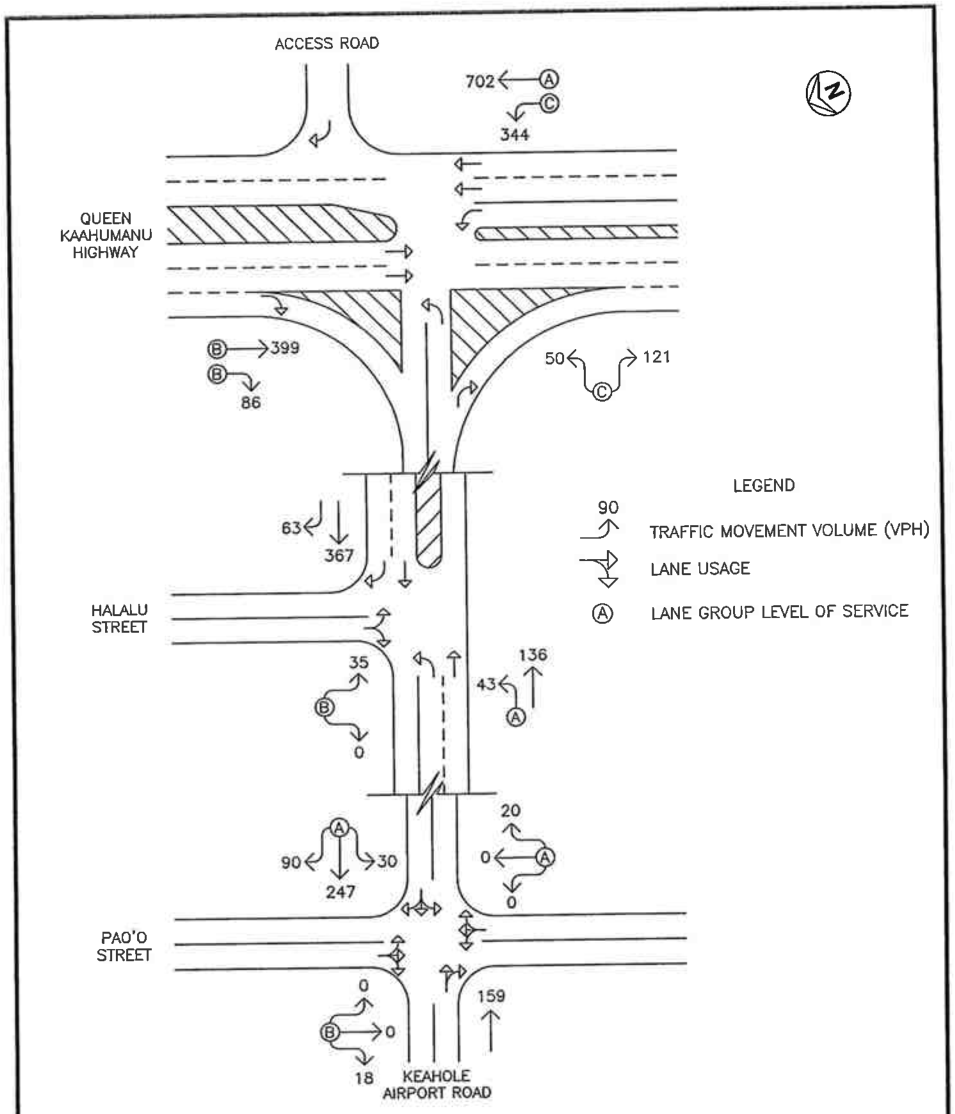
E. Year 2022 Total Traffic Volumes With Project

The projected Year 2022 cumulative AM and PM peak hour traffic conditions with the implementation of the proposed improvements at the KOA are show in Figures 9 and 10, and summarized in Table 3. The cumulative volumes consist of site-generated traffic superimposed over Year 2022 projected traffic demands. The projected Year 2022 baseline operating conditions are provided for comparison purposes. LOS calculations are included in Appendix E.

Table 3: Projected Year 2022 Baseline and With Project Traffic Operation Conditions

Intersection	Critical Traffic Movement		AM Year 2022	AM Year 2022 w/ Proj	PM Year 2022	PM Year 2022 w/ Proj
Queen Kaahumanu Hwy/Keahole Airport Rd	Eastbound	LT-RT	C	C	D	D
	Northbound	LT	C	C	D	D
		TH	A	A	A	A
	Southbound	TH	B	B	C	C
		RT	B	B	B	B
Keahole Airport Rd/Halalu St	Eastbound	LT	A	A	A	A
	Southbound	LT-RT	B	B	C	C
Keahole Airport Rd/Pao'o St	Westbound	LT-TH-RT	-	A	-	A
	Northbound	LT-TH-RT	-	A	-	B
	Southbound	LT-TH-RT	A	B	B	C

Traffic operations in the vicinity of the KOA with the implementation of the proposed improvements are generally expected to remain similar to Year 2022 baseline conditions. The westbound approach of the intersection of Keahole Airport Road with Pao'o Street is anticipated to operate at LOS "A" during both peak periods while the northbound approach is anticipated to operate at LOS "A" and LOS "B" during the AM and PM peak periods, respectively. The southbound approach of the intersection is expected to operate at LOS "B" and LOS "C" during the AM and PM peak periods, respectively. The critical traffic movements at the other study intersections are expected to operate at levels of service

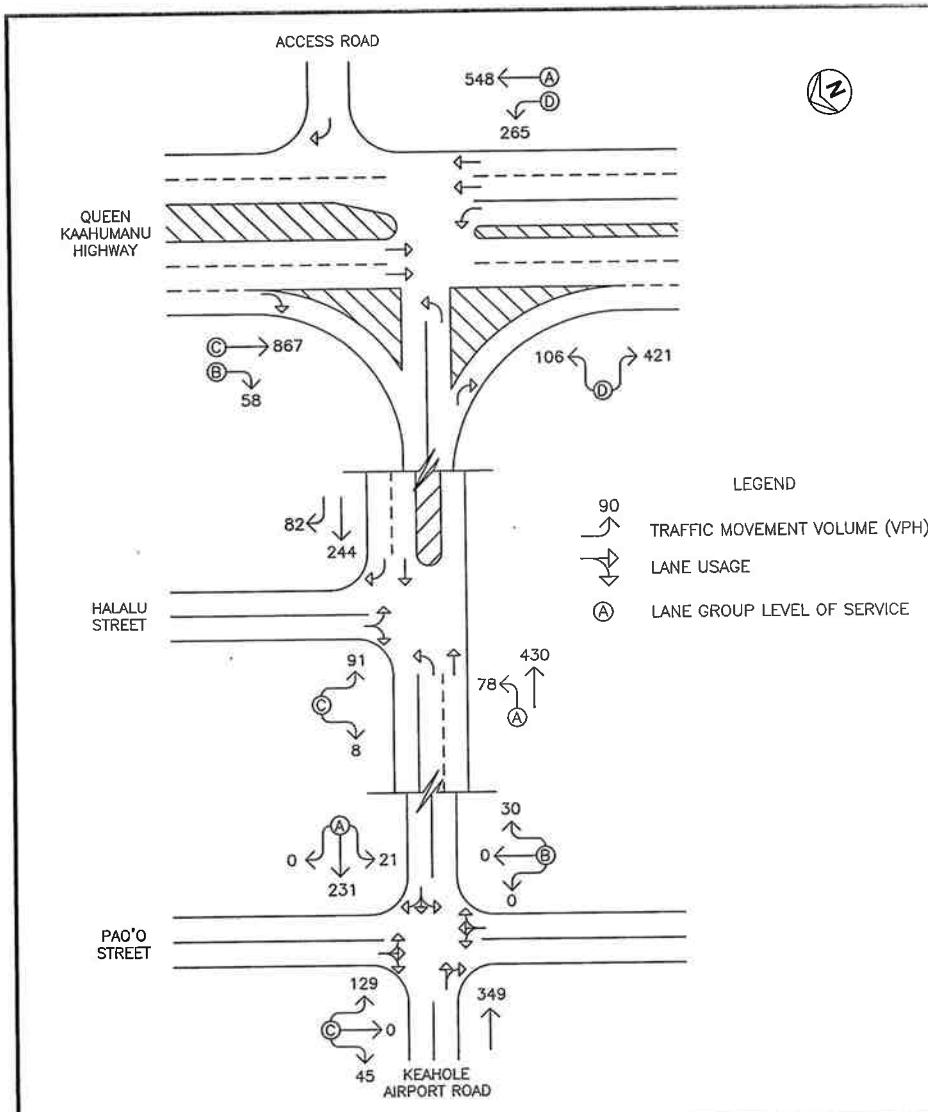


WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

KONA INTERNATIONAL AIRPORT

YEAR 2022 AM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 9



WILSON OKAMOTO CORPORATION ENGINEERS • PLANNERS

KONA INTERNATIONAL AIRPORT

YEAR 2022 PM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 10

similar to Year 2022 baseline conditions despite the addition of site-generated traffic to the surrounding roadways.

V. RECOMMENDATIONS

A. Year 2022 Baseline

Based on the analysis of the traffic data, the following are the recommendations of this study to be implemented prior to the Year 2022:

1. Provide an exclusive eastbound left-turn lane along Keahole Airport Road at the intersection with Halalu Street to minimize the impact of turning vehicles on the through traffic along Keahole Airport Road. The dimensions and layout of this lane should be determined during the design phase of the project.

2. Provide an exclusive westbound right-turn lane along Keahole Airport Road at the intersection with Halalu Street to minimize the impact of turning vehicles on the through traffic along Keahole Airport Road. The dimensions and layout of this lane should be determined during the design phase of the project.

B. Year 2022 With Project

Based on the analysis of the traffic data, the following are the recommendations of this study associated with the proposed improvements:

1. Provide sufficient sight distance for motorists to safely enter and exit all project driveways/roadways.

2. Provide adequate on-site loading and off-loading service areas and prohibit off-site loading operations.

3. Provide adequate turn-around area for service, delivery, and refuse collection vehicles to maneuver on-site to avoid vehicle-reversing maneuvers onto adjacent roadways.

4. Provide sufficient turning radii at all project driveways/roadways to avoid or minimize vehicle encroachments to oncoming traffic lanes.

VI. CONCLUSION

The State of Hawaii Department of Transportation Airports Division plans to implement improvements at the existing Kona International Airport at Keahole (KOA). These improvements include the expansion of the existing general aviation facilities, a new

helicopter general aviation facility, expansion of the existing terminal to replace the relocated Onizuka Museum, a secondary emergency runway, an ARFF Regional Fire Training facility, and a medical transitional facility. With the implementation of the aforementioned recommendations, the critical movements at the study intersections along Keahole Airport Road are expected to continue operating at levels of service similar to Year 2022 baseline conditions. As such, the proposed improvements at the KOA are not expected to have a significant impact on traffic operations in the vicinity.

Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Counter:TU-0650, TU-0651
Counted By:CL, PP
Weather:Clear

File Name : QueKea AM
Site Code : 00000003
Start Date : 10/5/2011
Page No : 1

Groups Printed- Unshifted

	Queen Kaahumanu Highway Southbound					Dirt Road Westbound					Queen Kaahumanu Highway Northbound					Keahole Airport Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	0	59	10	0	69	0	0	0	1	1	41	113	0	0	154	9	0	23	0	32	256
06:45 AM	0	74	9	0	83	0	0	0	0	0	59	160	0	0	219	6	0	22	0	28	330
Total	0	133	19	0	152	0	0	0	1	1	100	273	0	0	373	15	0	45	0	60	586
07:00 AM	0	82	23	0	105	0	0	0	0	0	46	139	0	0	185	13	0	26	0	39	329
07:15 AM	1	82	11	0	94	0	0	0	0	0	45	141	0	0	186	11	0	23	0	34	314
07:30 AM	0	89	8	0	97	0	0	0	0	0	53	135	0	0	188	6	0	17	0	23	308
07:45 AM	0	113	5	0	118	0	0	0	0	0	50	123	0	0	173	3	0	25	0	28	319
Total	1	366	47	0	414	0	0	0	0	0	194	538	0	0	732	33	0	91	0	124	1270
08:00 AM	0	80	7	0	87	0	0	1	0	1	47	119	0	0	166	3	0	30	0	33	287
08:15 AM	0	90	17	0	107	0	0	0	0	0	35	114	0	0	149	9	0	46	0	55	311
Grand Total	1	669	90	0	760	0	0	1	1	2	376	1044	0	0	1420	60	0	212	0	272	2454
Apprch %	0.1	88	11.8	0		0	0	50	50		26.5	73.5	0	0		22.1	0	77.9	0		
Total %	0	27.3	3.7	0	31	0	0	0	0	0.1	15.3	42.5	0	0	57.9	2.4	0	8.6	0	11.1	

	Queen Kaahumanu Highway Southbound				Dirt Road Westbound				Queen Kaahumanu Highway Northbound				Keahole Airport Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 06:45 AM																	
06:45 AM	0	74	9	83	0	0	0	0	59	160	0	219	6	0	22	28	330
07:00 AM	0	82	23	105	0	0	0	0	46	139	0	185	13	0	26	39	329
07:15 AM	1	82	11	94	0	0	0	0	45	141	0	186	11	0	23	34	314
07:30 AM	0	89	8	97	0	0	0	0	53	135	0	188	6	0	17	23	308
Total Volume	1	327	51	379	0	0	0	0	203	575	0	778	36	0	88	124	1281
% App. Total	0.3	86.3	13.5		0	0	0		26.1	73.9	0		29	0	71		
PHF	.250	.919	.554	.902	.000	.000	.000	.000	.860	.898	.000	.888	.692	.000	.846	.795	.970

APPENDIX A

EXISTING TRAFFIC COUNT DATA

Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Counter:TU-0649, TU-0652
Counted By:PP, CL
Weather:Clear

File Name : KeaHal AM
Site Code : 00000002
Start Date : 10/5/2011
Page No : 1

Groups Printed- Unshifted

	Halalu Street Southbound					Keahole Airport Road Westbound					Northbound	Keahole Airport Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:30 AM	8	0	0	0	8	0	51	7	0	58	0	11	29	0	0	40	106
06:45 AM	8	0	0	0	8	0	52	17	0	69	0	10	24	0	0	34	111
Total	16	0	0	0	16	0	103	24	0	127	0	21	53	0	0	74	217
07:00 AM	9	0	0	0	9	0	54	12	0	66	0	7	25	0	0	32	107
07:15 AM	7	0	0	0	7	0	45	12	0	57	0	9	24	0	0	33	97
07:30 AM	5	0	0	0	5	0	51	11	0	62	0	9	20	0	0	29	96
07:45 AM	6	0	0	0	6	0	46	11	0	57	0	7	18	0	0	25	88
Total	27	0	0	0	27	0	196	46	0	242	0	32	87	0	0	119	388
08:00 AM	6	0	0	0	6	0	45	7	0	52	0	9	21	0	0	30	88
08:15 AM	23	0	0	0	23	0	46	7	0	53	0	12	24	0	0	36	112
Grand Total	72	0	0	0	72	0	390	84	0	474	0	74	185	0	0	259	805
Apprch %	100	0	0	0		0	82.3	17.7	0			28.6	71.4	0	0		
Total %	8.9	0	0	0	8.9	0	48.4	10.4	0	58.9	0	9.2	23	0	0	32.2	

	Halalu Street Southbound				Keahole Airport Road Westbound				Northbound	Keahole Airport Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 07:30 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 06:45 AM														
06:45 AM	8	0	0	8	0	52	17	69	0	10	24	0	34	111
07:00 AM	9	0	0	9	0	54	12	66	0	7	25	0	32	107
07:15 AM	7	0	0	7	0	45	12	57	0	9	24	0	33	97
07:30 AM	5	0	0	5	0	51	11	62	0	9	20	0	29	96
Total Volume	29	0	0	29	0	202	52	254	0	35	93	0	128	411
% App. Total	100	0	0		0	79.5	20.5			27.3	72.7	0		
PHF	.806	.000	.000	.806	.000	.935	.765	.920	.000	.875	.930	.000	.941	.926

Wilson Okamoto Corporation

1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Counter:TU-0650, TU-0651
Counted By:CL, PP
Weather:Clear

File Name : QueKea PM
Site Code : 00000003
Start Date : 10/4/2011
Page No : 1

Groups Printed- Unshifted

	Queen Kaahumanu Highway Southbound					Dirt Road Westbound					Queen Kaahumanu Highway Northbound					Keahole Airport Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:00 PM	1	154	12	0	167	0	0	0	0	0	49	109	0	0	158	17	0	57	0	74	399
03:15 PM	2	154	14	0	170	0	0	2	0	2	53	107	0	0	160	17	0	63	0	80	412
03:30 PM	0	179	10	0	189	0	0	0	0	0	60	98	0	0	158	14	0	66	0	80	427
03:45 PM	0	185	9	0	194	0	0	1	0	1	49	121	0	0	170	21	0	73	0	94	459
Total	3	672	45	0	720	0	0	3	0	3	211	435	0	0	646	69	0	259	0	328	1697
04:00 PM	1	193	11	0	205	0	0	0	0	0	41	123	0	0	164	15	0	65	0	80	449
04:15 PM	0	165	7	0	172	0	0	1	0	1	52	101	0	0	153	11	0	43	0	54	380
04:30 PM	0	113	15	0	128	0	0	0	0	0	51	85	0	0	136	15	0	43	0	58	322
04:45 PM	0	136	6	0	142	0	0	0	0	0	44	106	0	0	150	15	0	56	0	71	363
Total	1	607	39	0	647	0	0	1	0	1	188	415	0	0	603	56	0	207	0	263	1514
05:00 PM	0	123	6	0	129	0	0	0	0	0	42	93	0	0	135	23	0	66	0	89	353
05:15 PM	0	133	4	0	137	0	0	0	0	0	37	70	0	0	107	15	0	48	0	63	307
05:30 PM	0	109	12	0	121	0	0	0	0	0	43	77	0	0	120	14	0	47	0	61	302
05:45 PM	0	68	9	0	77	0	0	0	0	0	34	76	0	0	110	14	0	47	0	61	248
Total	0	433	31	0	464	0	0	0	0	0	156	316	0	0	472	66	0	208	0	274	1210
Grand Total	4	1712	115	0	1831	0	0	4	0	4	555	1166	0	0	1721	191	0	674	0	865	4421
Apprch %	0.2	93.5	6.3	0		0	0	100	0		32.2	67.8	0	0		22.1	0	77.9	0		
Total %	0.1	38.7	2.6	0	41.4	0	0	0.1	0	0.1	12.6	26.4	0	0	38.9	4.3	0	15.2	0	19.6	

	Queen Kaahumanu Highway Southbound				Dirt Road Westbound				Queen Kaahumanu Highway Northbound				Keahole Airport Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:15 PM																	
03:15 PM	2	154	14	170	0	0	2	2	53	107	0	160	17	0	63	80	412
03:30 PM	0	179	10	189	0	0	0	0	60	98	0	158	14	0	66	80	427
03:45 PM	0	185	9	194	0	0	1	1	49	121	0	170	21	0	73	94	459
04:00 PM	1	193	11	205	0	0	0	0	41	123	0	164	15	0	65	80	449
Total Volume	3	711	44	758	0	0	3	3	203	449	0	652	67	0	267	334	1747
% App. Total	0.4	93.8	5.8		0	0	100		31.1	68.9	0		20.1	0	79.9		
PHF	.375	.921	.786	.924	.000	.000	.375	.375	.846	.913	.000	.959	.798	.000	.914	.888	.952

Wilson Okamoto Corporation
1907 S. Beretania St., Suite 400
Honolulu, HI 96826

West of Queen K
Site Code: Apollyon
Station ID: SN:023226

Latitude: 0' 0.000 South

Eastbound Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/4/11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:45	0	15	12	0	10	0	0	0	0	0	0	0	0	1	38
	0	15	12	0	10	0	0	0	0	0	0	0	0	1	38
09:00	0	20	14	0	4	0	0	0	1	0	0	0	0	0	39
09:15	0	30	10	0	7	0	0	0	0	0	0	0	0	1	48
09:30	0	18	5	0	1	0	0	0	0	0	0	0	0	0	24
09:45	1	33	6	1	3	0	0	2	0	0	0	0	0	2	48
	1	101	35	1	15	0	0	2	1	0	0	0	0	3	159
10:00	0	35	6	0	6	0	0	0	1	0	0	0	0	3	51
10:15	0	23	12	0	0	1	0	0	0	0	0	0	0	2	38
10:30	1	54	9	0	3	0	0	0	0	0	0	0	0	3	70
10:45	1	35	8	0	2	0	0	0	0	0	0	0	0	3	49
	2	147	35	0	11	1	0	0	1	0	0	0	0	11	208
11:00	1	57	7	1	1	1	0	0	0	0	0	0	0	1	69
11:15	0	56	13	0	4	2	0	0	0	0	0	0	0	3	78
11:30	2	94	15	0	4	0	0	0	1	0	0	0	0	8	124
11:45	1	65	13	0	2	0	0	0	0	0	0	0	0	5	86
	4	272	48	1	11	3	0	0	1	0	0	0	0	17	357
Total	7	535	130	2	47	4	0	2	3	0	0	0	0	32	762
Percent	0.9%	70.2%	17.1%	0.3%	6.2%	0.5%	0.0%	0.3%	0.4%	0.0%	0.0%	0.0%	0.0%	4.2%	

Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, Hawaii

Counter:TU-0649, TU-0652
Counted By:PP, CL
Weather:Clear

File Name : KeaHal PM
Site Code : 00000002
Start Date : 10/4/2011
Page No : 1

Groups Printed- Unshifted

	Halalu Street Southbound					Keahole Airport Road Westbound					Northbound	Keahole Airport Road Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:00 PM	18	0	4	0	22	0	45	20	0	65	0	20	65	0	0	85	172
03:15 PM	16	0	1	0	17	0	50	15	0	65	0	21	68	0	0	89	171
03:30 PM	17	0	2	0	19	0	53	20	0	73	0	15	73	0	0	88	180
03:45 PM	14	0	2	0	16	0	44	17	0	61	0	16	67	0	0	83	160
Total	65	0	9	0	74	0	192	72	0	264	0	72	273	0	0	345	683
04:00 PM	27	0	1	0	28	0	36	15	0	51	0	12	46	0	0	58	137
04:15 PM	13	0	1	0	14	0	44	15	0	59	0	11	27	0	0	38	111
04:30 PM	12	0	2	0	14	0	45	20	0	65	0	12	50	0	0	62	141
04:45 PM	8	0	4	0	12	0	38	15	0	53	0	15	56	0	0	71	136
Total	60	0	8	0	68	0	163	65	0	228	0	50	179	0	0	229	525
05:00 PM	24	0	7	0	31	0	31	9	0	40	0	14	74	0	0	88	159
05:15 PM	18	0	4	0	22	0	31	7	0	38	0	14	45	0	0	59	119
05:30 PM	18	0	5	0	23	0	47	10	0	57	0	13	43	0	0	56	136
05:45 PM	16	0	1	0	17	0	28	13	0	41	0	13	46	0	0	59	117
Total	76	0	17	0	93	0	137	39	0	176	0	54	208	0	0	262	531
Grand Total	201	0	34	0	235	0	492	176	0	668	0	176	660	0	0	836	1739
Apprch %	85.5	0	14.5	0		0	73.7	26.3	0			21.1	78.9	0	0		
Total %	11.6	0	2	0	13.5	0	28.3	10.1	0	38.4	0	10.1	38	0	0	48.1	

	Halalu Street Southbound				Keahole Airport Road Westbound				Northbound	Keahole Airport Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:00 PM														
03:00 PM	18	0	4	22	0	45	20	65	0	20	65	0	85	172
03:15 PM	16	0	1	17	0	50	15	65	0	21	68	0	89	171
03:30 PM	17	0	2	19	0	53	20	73	0	15	73	0	88	180
03:45 PM	14	0	2	16	0	44	17	61	0	16	67	0	83	160
Total Volume	65	0	9	74	0	192	72	264	0	72	273	0	345	683
% App. Total	87.8	0	12.2		0	72.7	27.3			20.9	79.1	0		
PHF	.903	.000	.563	.841	.000	.906	.900	.904	.000	.857	.935	.000	.969	.949

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

West of Queen K
Site Code: Apollyon
Station ID: SN:023226

Latitude: 0' 0.000 South

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
12 PM	1	57	5	0	2	0	0	0	0	0	0	0	0	2	67
12:15	0	55	10	0	3	0	0	0	0	0	0	0	0	2	70
12:30	2	66	10	0	0	0	0	0	0	0	0	0	0	3	81
12:45	0	65	16	1	6	0	0	1	0	0	0	0	0	0	89
	3	243	41	1	11	0	0	1	0	0	0	0	0	7	307
13:00	1	42	13	0	1	0	0	0	0	0	0	0	0	0	57
13:15	3	57	8	0	2	0	0	0	0	0	0	0	0	3	73
13:30	5	56	17	1	13	1	0	0	1	0	0	0	0	5	99
13:45	0	74	14	0	2	0	0	0	0	0	0	0	0	5	95
	9	229	52	1	18	1	0	0	1	0	0	0	0	13	324
14:00	1	85	12	0	5	1	0	0	0	0	0	0	0	1	105
14:15	1	115	17	0	3	1	0	0	0	0	0	0	0	5	142
14:30	1	121	14	1	1	0	0	0	0	0	0	0	0	5	143
14:45	3	71	15	0	0	0	0	0	0	0	0	0	0	1	90
	6	392	58	1	9	2	0	0	0	0	0	0	0	12	480
15:00	2	60	13	0	0	0	0	0	0	0	0	0	0	2	77
15:15	0	60	15	0	5	0	0	0	0	0	0	0	0	4	84
15:30	2	64	19	0	2	0	0	0	0	0	0	0	0	3	90
15:45	0	72	17	0	3	0	0	0	0	0	0	0	0	4	96
	4	256	64	0	10	0	0	0	0	0	0	0	0	13	347
16:00	0	67	13	0	2	0	0	0	1	0	0	0	0	0	83
16:15	2	36	9	0	1	1	0	0	0	0	0	0	0	2	51
16:30	4	44	7	0	3	0	0	0	0	0	0	0	0	3	61
16:45	2	53	12	1	2	0	0	0	0	0	0	0	0	2	72
	8	200	41	1	8	1	0	0	1	0	0	0	0	7	267
17:00	2	71	11	0	0	0	0	0	0	0	0	0	0	5	89
17:15	0	60	5	0	1	0	0	0	0	0	0	0	0	0	66
17:30	1	52	8	0	0	0	0	0	0	0	0	0	0	4	65
17:45	2	56	3	0	0	1	0	0	0	0	0	0	0	0	62
	5	239	27	0	1	1	0	0	0	0	0	0	0	9	282
18:00	2	31	3	0	2	0	0	0	0	0	0	0	0	0	38
18:15	1	28	4	0	1	0	0	0	0	0	0	0	0	2	36
18:30	2	18	7	1	0	0	0	0	0	0	0	0	0	1	29
18:45	0	25	7	0	3	0	0	0	0	0	0	0	0	4	39
	5	102	21	1	6	0	0	0	0	0	0	0	0	7	142
19:00	2	68	11	0	3	1	0	0	0	0	0	0	0	7	92
19:15	0	77	3	0	1	1	0	0	0	0	0	0	0	2	84
19:30	0	67	10	1	2	1	0	0	0	0	0	0	0	8	89
19:45	4	65	10	0	1	0	0	0	0	0	0	0	0	5	85
	6	277	34	1	7	3	0	0	0	0	0	0	0	22	350
20:00	1	47	7	0	0	1	0	0	0	0	0	0	0	3	59
20:15	0	68	10	0	5	0	0	0	0	0	0	0	0	1	84
20:30	1	77	12	0	1	0	0	0	0	0	0	0	0	2	93
20:45	1	50	4	0	2	0	0	0	0	0	0	0	0	1	58
	3	242	33	0	8	1	0	0	0	0	0	0	0	7	294
21:00	4	61	5	0	0	0	0	0	0	0	0	0	0	2	72
21:15	0	28	4	0	0	0	0	0	0	0	0	0	0	2	34
21:30	2	30	7	0	0	0	0	0	1	0	0	0	0	0	40
21:45	0	31	6	0	0	0	0	0	0	0	0	0	0	0	37
	6	150	22	0	0	0	0	0	1	0	0	0	0	4	183
22:00	2	18	6	0	0	0	0	0	0	0	0	0	0	0	26
22:15	0	19	5	0	0	0	0	0	0	0	0	0	0	0	24
22:30	1	37	8	0	0	0	0	0	0	0	0	0	0	1	47
22:45	2	20	4	0	0	0	0	0	0	0	0	0	0	0	26
	5	94	23	0	0	0	0	0	0	0	0	0	0	1	123
23:00	2	12	2	0	0	0	0	0	0	0	0	0	0	0	16
23:15	3	4	0	0	0	0	0	0	0	0	0	0	0	0	7
23:30	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
23:45	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	5	18	3	0	0	0	0	0	0	0	0	0	0	0	26
Total	65	2442	419	6	78	9	0	1	3	0	0	0	0	102	3125
Percent	2.1%	78.1%	13.4%	0.2%	2.5%	0.3%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	3.3%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

West of Queen K
Site Code: Apollyon
Station ID: SN:023226

Latitude: 0' 0.000 South

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/5/11	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
00:15	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
00:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	4	2	0	0	0	0	0	0	0	0	0	0	0	6
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
02:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
02:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	0	4	1	0	0	0	0	0	2	0	0	0	0	0	7
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:15	1	10	0	0	0	0	0	0	0	0	0	0	0	0	11
03:30	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
03:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	13	1	0	0	0	0	0	0	0	0	0	0	0	15
04:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:15	0	7	2	0	0	0	0	0	0	0	0	0	0	0	9
04:30	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
04:45	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
	0	15	3	0	0	0	0	0	0	0	0	0	0	0	18
05:00	0	5	3	0	1	0	0	0	0	0	0	0	0	0	9
05:15	0	8	2	0	0	0	0	1	0	0	0	0	0	0	11
05:30	0	11	6	0	0	0	0	0	2	0	0	0	0	0	19
05:45	0	24	3	1	0	0	0	0	0	0	0	0	0	1	29
	0	48	14	1	1	0	0	1	2	0	0	0	0	1	68
06:00	0	20	4	0	0	0	0	0	0	0	0	0	0	1	25
06:15	0	15	5	0	2	0	0	0	1	0	0	0	0	0	23
06:30	1	20	7	0	1	1	0	0	0	0	0	0	0	2	32
06:45	0	23	4	1	1	0	0	0	0	0	0	0	0	2	31
	1	78	20	1	4	1	0	0	1	0	0	0	0	5	111
07:00	0	24	8	1	3	0	0	0	0	0	0	0	0	1	37
07:15	1	20	8	0	4	1	0	0	1	0	0	0	0	1	36
07:30	0	15	5	0	3	0	0	0	0	0	0	0	0	0	23
07:45	1	13	9	0	4	1	0	0	0	0	0	0	0	2	30
	2	72	30	1	14	2	0	0	1	0	0	0	0	4	126
08:00	0	17	6	0	6	1	0	0	0	0	0	0	0	0	30
08:15	0	40	10	0	4	0	0	0	0	0	0	0	0	0	54
08:30	0	37	7	2	2	1	0	0	0	0	0	0	0	2	51
08:45	0	25	6	1	2	0	0	0	0	0	0	0	0	5	39
	0	119	29	3	14	2	0	0	0	0	0	0	0	7	174
09:00	0	17	2	0	1	0	0	0	0	0	0	0	0	1	21
09:15	2	19	7	1	12	1	0	0	0	0	0	0	0	1	43
09:30	0	45	9	0	7	1	0	0	0	0	0	0	0	2	64
09:45	0	42	11	0	10	0	0	0	0	0	0	0	0	2	65
	2	123	29	1	30	2	0	0	0	0	0	0	0	6	193
10:00	1	30	6	0	2	1	0	0	0	0	0	0	0	0	40
10:15	0	35	12	0	4	0	0	0	0	0	0	0	0	2	53
10:30	3	54	9	0	1	0	0	0	0	0	0	0	0	2	69
10:45	1	47	6	0	0	0	0	1	0	0	0	0	0	8	63
	5	166	33	0	7	1	0	1	0	0	0	0	0	12	225
11:00	2	55	6	0	4	0	0	0	0	0	0	0	0	5	72
11:15	1	67	13	0	1	0	0	0	1	0	0	0	0	5	88
11:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	14	764	182	7	75	8	0	2	7	0	0	0	0	45	1104
Percent	1.3%	69.2%	16.5%	0.6%	6.8%	0.7%	0.0%	0.2%	0.6%	0.0%	0.0%	0.0%	0.0%	4.1%	
Grand Total	86	3741	731	15	200	21	0	5	13	0	0	0	0	179	4991
Percent	1.7%	75.0%	14.6%	0.3%	4.0%	0.4%	0.0%	0.1%	0.3%	0.0%	0.0%	0.0%	0.0%	3.6%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

West of Queen K
Site Code: Apollyon
Station ID: SN:023226

Latitude: 0' 0.000 South

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/4/11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:45	0	33	22	0	3	0	0	2	0	0	0	0	0	0	60
	0	33	22	0	3	0	0	2	0	0	0	0	0	0	60
09:00	0	41	17	0	6	0	0	3	0	0	0	0	0	1	68
09:15	2	34	20	0	7	0	0	1	0	0	0	0	0	1	65
09:30	2	37	18	2	2	1	0	0	0	0	0	0	0	2	64
09:45	1	29	15	0	1	0	0	1	0	0	0	0	0	2	49
	5	141	70	2	16	1	0	5	0	0	0	0	0	6	246
10:00	2	37	26	0	3	0	0	0	0	0	0	0	0	2	70
10:15	0	54	31	0	3	0	0	0	0	0	0	0	0	1	89
10:30	0	46	22	0	5	1	0	0	0	0	0	0	0	3	77
10:45	1	55	23	1	3	1	0	0	0	0	0	0	0	1	85
	3	192	102	1	14	2	0	0	0	0	0	0	0	7	321
11:00	1	46	17	0	6	0	0	0	0	0	0	0	0	3	73
11:15	2	48	19	0	3	1	0	0	0	0	0	0	0	8	81
11:30	0	34	18	0	7	1	0	0	0	0	0	0	0	5	65
11:45	2	50	24	1	5	0	0	0	0	0	0	0	0	2	84
	5	178	78	1	21	2	0	0	0	0	0	0	0	18	303
Total	13	544	272	4	54	5	0	7	0	0	0	0	0	31	930
Percent	1.4%	58.5%	29.2%	0.4%	5.8%	0.5%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	3.3%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

West of Queen K
Site Code: Apollyon
Station ID: SN:023226

Latitude: 0' 0.000 South

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
12 PM	1	50	20	0	9	1	0	0	0	0	0	0	0	1	62
12:15	0	37	35	1	8	1	0	0	0	0	0	0	0	1	83
12:30	0	35	29	1	10	0	0	1	1	0	0	0	0	0	77
12:45	1	45	25	0	5	0	0	0	0	0	0	0	0	3	79
	2	167	109	2	32	2	0	1	1	0	0	0	0	5	321
13:00	0	44	20	0	3	0	0	0	0	0	0	0	0	2	69
13:15	2	43	22	1	3	0	0	0	0	0	0	0	0	4	75
13:30	5	62	38	1	7	0	0	1	0	0	0	0	0	6	120
13:45	1	64	31	1	4	0	0	0	0	0	0	0	0	6	107
	8	213	111	3	17	0	0	1	0	0	0	0	0	18	371
14:00	2	45	23	0	4	0	0	0	0	0	0	0	0	0	74
14:15	0	37	18	1	1	0	0	0	0	0	0	0	0	8	65
14:30	0	26	18	0	1	0	0	0	0	0	0	0	0	4	49
14:45	0	29	26	0	3	0	0	0	0	0	0	0	0	0	58
	2	137	85	1	9	0	0	0	0	0	0	0	0	12	246
15:00	1	31	26	0	2	0	0	1	0	0	0	0	0	4	65
15:15	0	36	25	0	3	1	0	0	0	0	0	0	0	3	68
15:30	1	39	15	0	7	0	0	0	1	0	0	0	0	6	69
15:45	0	35	23	0	4	0	0	0	0	0	0	0	0	3	65
	2	141	89	0	16	1	0	1	1	0	0	0	0	16	267
16:00	0	29	18	0	4	0	0	0	0	0	0	0	0	2	53
16:15	0	29	15	1	6	1	0	1	0	0	0	0	0	5	58
16:30	0	32	21	0	6	0	0	0	0	0	0	0	0	5	64
16:45	0	25	17	0	6	0	0	0	0	0	0	0	0	3	51
	0	115	71	1	22	1	0	1	0	0	0	0	0	15	226
17:00	1	27	11	0	3	0	0	0	0	0	0	0	0	3	45
17:15	2	25	15	0	1	0	0	0	0	0	0	0	0	1	44
17:30	0	28	19	0	3	0	0	0	0	0	0	0	0	3	53
17:45	0	27	11	0	3	0	0	0	0	0	0	0	0	3	44
	3	107	56	0	10	0	0	0	0	0	0	0	0	10	186
18:00	0	14	11	0	4	0	0	0	0	0	0	0	0	0	29
18:15	0	35	17	0	4	0	0	0	0	0	0	0	0	1	57
18:30	0	33	11	1	2	0	0	0	0	0	0	0	0	1	48
18:45	1	52	22	0	3	0	0	0	0	0	0	0	0	0	78
	1	134	61	1	13	0	0	0	0	0	0	0	0	2	212
19:00	0	54	23	0	2	0	0	0	0	0	0	0	0	3	82
19:15	1	42	22	1	0	0	0	0	0	0	0	0	0	4	70
19:30	1	41	16	0	0	0	0	0	0	0	0	0	0	7	65
19:45	1	19	21	0	3	0	0	1	0	0	0	0	0	0	45
	3	156	82	1	5	0	0	1	0	0	0	0	0	14	262
20:00	0	30	22	0	3	0	0	0	0	0	0	0	0	1	56
20:15	2	17	13	0	2	0	0	0	0	0	0	0	0	2	36
20:30	0	18	10	0	0	0	0	0	0	0	0	0	0	0	28
20:45	0	15	10	0	0	0	0	0	0	0	0	0	0	1	26
	2	80	55	0	5	0	0	0	0	0	0	0	0	4	146
21:00	1	11	5	0	1	0	0	0	0	0	0	0	0	1	19
21:15	0	4	9	0	1	0	0	0	0	0	0	0	0	0	14
21:30	0	16	0	0	0	0	0	0	0	0	0	0	0	1	17
21:45	0	4	2	0	1	0	0	0	0	0	0	0	0	0	7
	1	35	16	0	3	0	0	0	0	0	0	0	0	2	57
22:00	0	4	2	0	0	0	0	0	0	0	0	0	0	0	6
22:15	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
22:30	0	3	3	0	0	0	0	0	0	0	0	0	0	0	6
22:45	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3
	0	9	8	0	0	0	0	0	0	0	0	0	0	0	17
23:00	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
23:15	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
23:30	0	3	0	0	0	0	0	0	2	0	0	0	0	0	5
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	8	2	0	0	0	0	0	2	0	0	0	0	0	12
Total	24	1302	745	9	132	4	0	5	4	0	0	0	0	98	2323
Percent	1.0%	56.0%	32.1%	0.4%	5.7%	0.2%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	4.2%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

West of Queen K
Site Code: Apollyon
Station ID: SN:023226

Latitude: 0' 0.000 South

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/5/11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
00:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
01:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
03:15	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
03:30	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
03:45	0	7	2	0	0	0	0	0	1	0	0	0	0	0	10
	0	13	5	0	0	0	0	0	1	0	0	0	0	0	19
04:00	0	8	3	0	1	0	0	0	0	0	0	0	0	0	12
04:15	0	10	7	0	0	0	0	0	0	0	0	0	0	0	17
04:30	1	23	7	0	0	0	0	0	1	0	0	0	0	0	32
04:45	2	26	14	1	3	0	0	0	0	0	0	0	0	0	46
	3	67	31	1	4	0	0	0	1	0	0	0	0	0	107
05:00	0	20	8	0	0	0	0	1	0	0	0	0	0	0	29
05:15	0	33	19	0	2	0	0	0	0	0	0	0	0	0	54
05:30	1	30	11	0	5	0	0	0	0	0	0	0	0	0	47
05:45	2	27	20	2	1	0	0	0	1	0	0	0	0	0	53
	3	110	58	2	8	0	0	1	1	0	0	0	0	0	183
06:00	2	28	21	0	2	0	0	0	0	0	0	0	0	0	53
06:15	0	28	16	1	5	1	0	0	0	0	0	0	0	0	51
06:30	2	23	19	0	8	0	0	0	1	0	0	0	0	0	53
06:45	2	34	19	1	11	0	0	0	0	0	0	0	0	0	67
	6	113	75	2	26	1	0	0	1	0	0	0	0	0	224
07:00	1	37	21	1	11	0	0	0	0	0	0	0	0	1	72
07:15	0	32	17	0	2	0	0	1	0	0	0	0	0	2	54
07:30	2	35	15	0	5	0	0	0	0	0	0	0	0	0	57
07:45	3	26	21	1	7	0	0	0	0	0	0	0	0	2	60
	6	130	74	2	25	0	0	1	0	0	0	0	0	5	243
08:00	0	35	9	0	7	0	0	0	0	0	0	0	0	5	56
08:15	1	29	14	2	4	0	0	0	0	0	0	0	0	1	51
08:30	1	35	14	2	3	1	0	0	0	0	0	0	0	4	60
08:45	1	38	29	0	6	1	0	0	0	0	0	0	0	4	79
	3	137	66	4	20	2	0	0	0	0	0	0	0	14	246
09:00	2	33	18	0	3	0	0	1	0	0	0	0	0	0	57
09:15	1	32	18	0	11	1	0	1	0	0	0	0	0	1	65
09:30	1	34	16	0	6	0	0	0	0	0	0	0	0	2	59
09:45	1	37	24	0	4	0	0	0	0	0	0	0	0	2	68
	5	136	76	0	24	1	0	2	0	0	0	0	0	5	249
10:00	1	46	21	0	3	0	0	0	0	0	0	0	0	6	77
10:15	0	36	26	0	5	1	0	0	0	0	0	0	0	1	69
10:30	0	41	43	2	3	0	0	1	0	0	0	0	0	3	93
10:45	1	48	29	0	0	0	0	0	0	0	0	0	0	8	86
	2	171	119	2	11	1	0	1	0	0	0	0	0	18	325
11:00	2	41	17	0	6	0	0	0	0	0	0	0	0	7	73
11:15	0	39	25	0	8	1	0	2	2	0	0	0	0	4	81
11:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	30	959	548	13	132	6	0	7	6	0	0	0	0	53	1754
Percent	1.7%	54.7%	31.2%	0.7%	7.5%	0.3%	0.0%	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%	3.0%	
Grand Total	67	2805	1565	26	318	15	0	19	10	0	0	0	0	162	5007
Percent	1.3%	56.0%	31.3%	0.5%	6.4%	0.3%	0.0%	0.4%	0.2%	0.0%	0.0%	0.0%	0.0%	3.6%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Keahole Airport West
Site Code: Apollyon
Station ID: SN:023227

Latitude: 0' 0.000 South

Westbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/4/11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:30	2	28	26	0	14	0	0	1	0	0	0	0	0	3	74
11:45	0	32	19	1	26	0	0	1	0	0	0	0	0	3	82
	2	60	45	1	40	0	0	2	0	0	0	0	0	6	156
Total	2	60	45	1	40	0	0	2	0	0	0	0	0	6	156
Percent	1.3%	36.5%	28.8%	0.6%	25.6%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	3.8%	

Wilson Okamoto Corporation
1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Keahole Airport West
Site Code: Apollyon
Station ID: SN:023227

Latitude: 0' 0.000 South

Vestbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
12 PM	1	19	16	0	17	0	0	0	0	0	0	0	0	6	59
12:15	0	19	24	1	23	0	0	1	0	0	0	0	0	5	73
12:30	0	26	26	1	22	0	0	0	0	0	0	0	0	3	78
12:45	1	28	23	0	17	0	0	0	0	0	0	0	0	3	72
	2	92	89	2	79	0	0	1	0	0	0	0	0	17	282
13:00	1	26	12	0	13	0	0	0	0	0	0	0	0	0	52
13:15	2	28	16	1	13	0	0	0	0	0	0	0	0	2	64
13:30	1	39	28	0	17	1	0	0	0	0	0	0	0	6	92
13:45	1	43	28	3	15	1	0	0	0	0	0	0	0	8	99
	5	136	86	4	58	2	0	0	0	0	0	0	0	16	307
14:00	1	40	25	0	16	0	0	1	0	0	0	0	0	3	88
14:15	2	38	17	1	17	0	0	0	0	0	0	0	0	3	78
14:30	0	23	17	0	16	0	0	0	0	0	0	0	0	7	63
14:45	1	21	22	0	14	0	0	0	0	0	0	0	0	4	62
	4	122	81	1	65	0	0	1	0	0	0	0	0	17	291
15:00	1	30	18	0	17	0	0	2	0	0	0	0	0	2	70
15:15	0	23	12	0	17	0	0	1	0	0	0	0	0	2	55
15:30	0	25	12	0	17	0	0	0	0	0	0	0	0	4	58
15:45	1	24	20	0	12	0	0	0	2	0	0	0	0	5	64
	2	102	62	0	63	0	0	3	2	0	0	0	0	13	247
16:00	2	22	9	0	14	0	0	1	0	0	0	0	0	1	49
16:15	0	21	17	1	13	0	0	1	0	0	0	0	0	1	54
16:30	0	19	16	0	17	0	0	0	0	0	0	0	0	1	53
16:45	3	14	17	0	18	1	0	0	0	0	0	0	0	1	54
	5	76	59	1	62	1	0	2	0	0	0	0	0	4	210
17:00	1	22	14	0	15	0	0	0	0	0	0	0	0	1	53
17:15	4	24	15	0	10	0	0	0	0	0	0	0	0	2	55
17:30	1	13	18	0	11	1	0	0	0	0	0	0	0	2	46
17:45	0	27	11	0	10	0	0	0	0	0	0	0	0	2	50
	6	86	58	0	46	1	0	0	0	0	0	0	0	7	204
18:00	0	10	9	0	13	0	0	0	0	0	0	0	0	1	33
18:15	0	26	12	0	15	0	0	0	0	0	0	0	0	2	55
18:30	0	23	10	1	13	0	0	0	0	0	0	0	0	0	47
18:45	0	34	16	0	11	0	0	0	0	0	0	0	0	1	62
	0	93	47	1	52	0	0	0	0	0	0	0	0	4	197
19:00	0	43	16	0	11	0	0	0	0	0	0	0	0	4	74
19:15	1	34	14	1	16	0	0	0	0	0	0	0	0	5	71
19:30	0	34	17	0	14	0	0	0	0	0	0	0	0	2	67
19:45	0	29	14	0	14	0	0	0	0	0	0	0	0	4	61
	1	140	61	1	55	0	0	0	0	0	0	0	0	15	273
20:00	0	21	23	0	7	1	0	0	0	0	0	0	0	3	55
20:15	1	24	12	0	13	0	0	0	0	0	0	0	0	4	54
20:30	0	22	11	0	11	0	0	0	0	0	0	0	0	3	47
20:45	0	16	13	0	5	0	0	0	0	0	0	0	0	0	34
	1	83	59	0	36	1	0	0	0	0	0	0	0	10	190
21:00	0	13	6	0	4	1	0	0	0	0	0	0	0	2	26
21:15	0	5	9	0	4	0	0	0	0	0	0	0	0	0	18
21:30	0	12	2	0	2	0	0	0	0	0	0	0	0	2	18
21:45	0	4	1	0	3	0	0	0	0	0	0	0	0	0	8
	0	34	18	0	13	1	0	0	0	0	0	0	0	4	70
22:00	0	4	2	0	1	0	0	0	0	0	0	0	0	0	7
22:15	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
22:30	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
22:45	0	2	3	0	0	0	0	0	0	0	0	0	0	0	5
	0	10	8	0	1	0	0	0	0	0	0	0	0	0	19
23:00	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3
23:15	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
23:30	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
23:45	0	1	0	0	0	0	0	0	2	0	0	0	0	0	3
	0	9	2	0	0	0	0	0	2	0	0	0	0	0	13
Total	26	983	630	10	530	6	0	7	4	0	0	0	0	107	2303
Percent	1.1%	42.7%	27.4%	0.4%	23.0%	0.3%	0.0%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	4.6%	

Wilson Okamoto Corporation
1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Keahole Airport West
Site Code: Apollyon
Station ID: SN:023227

Latitude: 0' 0.000 South

Nestbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/5/11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:15	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
00:30	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
00:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
01:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:15	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
03:30	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
03:45	0	5	1	0	0	0	0	0	1	0	0	0	0	0	7
	0	10	4	0	0	0	0	0	1	0	0	0	0	0	15
04:00	0	6	4	0	0	0	0	0	0	0	0	0	0	0	10
04:15	0	6	3	0	0	0	0	0	0	0	0	0	0	0	9
04:30	1	12	2	0	0	0	0	0	1	0	0	0	0	0	16
04:45	2	7	6	0	2	0	0	0	0	0	0	0	0	0	17
	3	31	15	0	2	0	0	0	1	0	0	0	0	0	52
05:00	0	16	2	0	1	0	0	1	0	0	0	0	0	0	20
05:15	0	28	13	0	5	0	0	0	0	0	0	0	0	0	46
05:30	1	13	4	0	7	0	0	0	0	0	0	0	0	1	26
05:45	2	24	9	1	7	0	0	1	0	0	0	0	1	1	46
	3	81	28	1	20	0	0	2	0	0	0	0	1	2	138
06:00	1	27	16	0	7	0	0	0	0	0	0	0	0	2	53
06:15	0	24	10	1	7	0	0	0	0	0	0	0	0	0	42
06:30	1	22	17	0	10	1	0	0	0	0	0	0	0	0	51
06:45	1	21	14	1	14	0	0	0	1	0	0	0	0	1	53
	3	94	57	2	38	1	0	0	1	0	0	0	0	3	199
07:00	1	26	14	0	15	0	0	0	0	0	0	0	0	1	57
07:15	0	33	18	0	7	0	0	0	0	0	0	0	0	0	58
07:30	2	28	6	0	10	0	0	0	0	0	0	0	0	1	47
07:45	1	18	19	0	13	0	0	0	0	0	0	0	0	1	52
	4	105	57	0	45	0	0	0	0	0	0	0	0	3	214
08:00	0	24	6	0	13	1	0	0	0	0	0	0	0	0	44
08:15	1	19	13	1	15	0	0	0	0	0	0	0	0	2	51
08:30	1	26	11	3	9	0	0	0	0	0	0	0	0	5	55
08:45	0	29	19	0	15	1	0	0	0	0	0	0	0	4	68
	2	98	49	4	52	2	0	0	0	0	0	0	0	11	218
09:00	0	23	15	0	13	0	0	0	0	0	0	0	0	2	53
09:15	2	22	19	0	13	1	0	0	0	0	0	0	0	2	59
09:30	2	23	15	0	16	0	0	0	0	0	0	0	0	5	61
09:45	2	26	9	0	15	0	0	0	0	0	0	0	0	1	53
	6	94	58	0	57	1	0	0	0	0	0	0	0	10	226
10:00	0	32	15	0	14	0	0	0	0	0	0	0	0	1	62
10:15	0	22	27	0	15	0	0	0	0	0	0	0	0	5	69
10:30	0	31	34	0	15	0	0	0	0	0	0	0	0	2	82
10:45	1	41	21	1	13	0	0	0	0	0	0	0	0	6	83
	1	126	97	1	57	0	0	0	0	0	0	0	0	14	296
11:00	0	36	24	0	10	0	0	0	0	0	0	0	0	8	78
11:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	22	677	392	8	281	4	0	2	3	0	0	0	1	51	1441
Percent	1.5%	47.0%	27.2%	0.6%	19.5%	0.3%	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.1%	3.5%	
Grand Total	50	1720	1067	19	851	10	0	11	7	0	0	0	1	164	3900
Percent	1.3%	44.1%	27.4%	0.5%	21.8%	0.3%	0.0%	0.3%	0.2%	0.0%	0.0%	0.0%	0.0%	4.2%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Keahole Airport West
Site Code: Apollyon
Station ID: SN:023227

Latitude: 0' 0.000 South

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/4/11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
00:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:30	2	51	35	0	20	0	0	3	0	0	0	0	0	6	117
11:45	1	28	20	0	16	0	0	1	0	0	0	0	0	2	68
	3	79	55	0	36	0	0	4	0	0	0	0	0	8	185
Total	3	79	55	0	36	0	0	4	0	0	0	0	0	8	185
Percent	1.6%	42.7%	29.7%	0.0%	19.5%	0.0%	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	

Wilson Okamoto Corporation

1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Keahole Airport West
Site Code: Apollyon
Station ID: SN:023227

Latitude: 0' 0.000 South

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
12 PM	0	23	10	0	16	0	0	0	0	0	0	0	0	1	50
12:15	1	22	23	0	14	0	0	0	0	0	0	0	0	3	63
12:30	3	24	22	1	14	0	0	1	0	0	0	0	0	3	68
12:45	1	24	24	1	25	0	0	0	0	0	0	0	0	6	81
	5	93	79	2	69	0	0	1	0	0	0	0	0	13	262
13:00	1	17	15	0	18	0	0	0	0	0	0	0	0	1	52
13:15	1	32	13	0	14	0	0	0	0	0	0	0	0	3	63
13:30	3	16	15	1	24	1	0	0	0	0	0	0	0	6	66
13:45	1	34	27	0	17	0	0	0	0	0	0	0	0	5	84
	6	99	70	1	73	1	0	0	0	0	0	0	0	15	265
14:00	1	51	27	1	22	1	0	0	0	0	0	0	0	4	107
14:15	2	52	39	0	19	0	0	1	0	0	0	0	0	5	118
14:30	1	47	27	2	19	0	0	1	0	0	0	0	0	1	98
14:45	3	27	18	0	13	1	0	0	0	0	0	0	0	2	64
	7	177	111	3	73	2	0	2	0	0	0	0	0	12	387
15:00	0	30	15	0	14	0	0	0	0	0	0	0	0	1	60
15:15	0	29	21	0	17	0	0	0	0	0	0	0	0	6	73
15:30	2	36	17	1	12	0	0	0	0	0	0	0	0	3	71
15:45	2	37	23	0	22	0	0	1	0	0	0	0	0	3	88
	4	132	76	1	65	0	0	1	0	0	0	0	0	13	292
16:00	0	20	14	0	14	0	0	0	1	0	0	0	0	5	54
16:15	2	20	10	0	11	0	0	0	0	0	0	0	0	0	43
16:30	1	18	16	0	16	0	0	2	1	0	0	0	0	5	59
16:45	2	32	25	1	14	1	0	0	0	0	0	0	0	3	78
	5	90	65	1	55	1	0	2	2	0	0	0	0	13	234
17:00	1	29	20	0	10	1	0	2	0	0	0	0	0	3	66
17:15	1	33	11	0	14	0	0	0	0	0	0	0	0	4	63
17:30	1	15	10	0	10	0	0	0	0	0	0	0	0	5	41
17:45	1	23	12	0	9	0	0	1	0	0	0	0	0	2	48
	4	100	53	0	43	1	0	3	0	0	0	0	0	14	218
18:00	1	24	6	0	10	0	0	0	0	0	0	0	0	0	41
18:15	2	19	9	0	14	0	0	0	0	0	0	0	0	0	44
18:30	1	14	7	0	12	0	0	0	0	0	0	0	0	0	34
18:45	0	14	8	1	12	0	0	0	0	0	0	0	0	2	37
	4	71	30	1	48	0	0	0	0	0	0	0	0	2	156
19:00	0	56	23	0	14	0	0	1	0	0	0	0	0	4	98
19:15	0	48	15	0	12	0	0	1	0	0	0	0	0	4	80
19:30	0	47	27	1	17	0	0	0	0	0	0	0	0	4	96
19:45	2	51	11	0	13	0	0	1	0	0	0	0	0	3	81
	2	202	76	1	56	0	0	3	0	0	0	0	0	15	355
20:00	2	23	16	0	9	0	0	0	0	0	0	0	0	2	52
20:15	0	45	27	0	12	0	0	0	0	0	0	0	0	3	87
20:30	0	39	36	0	13	0	0	0	0	0	0	0	0	1	89
20:45	1	23	16	0	10	0	0	0	0	0	0	0	0	0	50
	3	130	95	0	44	0	0	0	0	0	0	0	0	6	278
21:00	3	26	11	0	3	0	0	0	0	0	0	0	0	3	46
21:15	0	12	10	0	4	0	0	0	0	0	0	0	0	0	26
21:30	2	11	7	0	3	0	0	0	0	0	0	0	0	0	23
21:45	0	11	3	0	1	0	0	0	0	0	0	0	0	0	15
	5	60	31	0	11	0	0	0	0	0	0	0	0	3	110
22:00	2	8	5	0	3	0	0	0	0	0	0	0	0	0	18
22:15	0	9	6	0	2	0	0	0	0	0	0	0	0	0	17
22:30	2	18	6	0	0	0	0	0	0	0	0	0	0	0	26
22:45	1	6	3	0	0	0	0	0	0	0	0	0	0	0	10
	5	41	20	0	5	0	0	0	0	0	0	0	0	0	71
23:00	2	5	2	0	0	0	0	0	0	0	0	0	0	1	10
23:15	3	4	1	0	0	0	0	0	0	0	0	0	0	0	8
23:30	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
23:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	10	4	0	0	0	0	0	0	0	0	0	0	1	20
Total	55	1205	710	10	542	5	0	12	2	0	0	0	0	107	2648
Percent	2.1%	45.5%	26.8%	0.4%	20.5%	0.2%	0.0%	0.5%	0.1%	0.0%	0.0%	0.0%	0.0%	4.0%	

Wilson Okamoto Corporation
1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Keahole Airport West
Site Code: Apollyon
Station ID: SN:023227

Latitude: 0' 0.000 South

Eastbound

Start Time	Bikes	Cars & Trailers	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
10/5/11	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
00:15	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3
00:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
00:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	3	4	0	0	0	0	0	0	0	0	0	0	0	7
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	3	1	0	0	0	0	0	0	0	0	0	0	0	4
02:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
02:45	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	0	3	2	0	0	0	0	0	2	0	0	0	0	0	7
03:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:15	0	8	1	0	0	0	0	0	0	0	0	0	0	1	10
03:30	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3
03:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	12	2	0	0	0	0	0	0	0	0	0	0	1	15
04:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
04:15	0	5	3	0	0	0	0	0	0	0	0	0	0	0	8
04:30	0	4	1	0	0	0	0	0	0	0	0	0	0	0	5
04:45	0	2	2	0	0	0	0	0	0	0	0	0	0	0	4
	0	13	6	0	0	0	0	0	0	0	0	0	0	0	19
05:00	0	3	4	0	2	0	0	0	0	0	0	0	0	0	9
05:15	0	5	4	0	2	0	0	1	0	0	0	0	0	0	12
05:30	0	7	6	0	6	0	0	0	1	0	0	0	0	1	21
05:45	0	18	4	0	5	0	0	0	0	0	0	0	0	0	27
	0	33	18	0	15	0	0	1	1	0	0	0	0	1	69
06:00	0	13	8	0	8	0	0	0	0	0	0	0	0	1	30
06:15	0	11	8	0	6	0	0	0	0	0	0	0	0	0	25
06:30	1	11	11	0	10	1	0	0	1	0	0	0	0	0	35
06:45	0	13	6	1	11	0	0	0	0	0	0	0	0	1	32
	1	48	33	1	35	1	0	0	1	0	0	0	0	2	122
07:00	0	7	8	1	15	0	0	0	0	0	0	0	0	1	32
07:15	0	10	12	0	11	0	0	0	1	0	0	0	0	0	34
07:30	1	13	11	0	7	0	0	0	0	0	0	0	0	2	34
07:45	0	8	6	0	13	0	0	0	0	0	0	0	0	2	29
	1	38	37	1	46	0	0	0	1	0	0	0	0	5	129
08:00	0	9	6	0	11	0	0	0	1	0	0	0	0	2	29
08:15	0	18	11	0	17	0	0	1	0	0	0	0	0	0	47
08:30	0	13	14	3	8	0	0	0	0	0	0	0	0	1	39
08:45	0	12	11	2	14	0	0	0	0	0	0	0	0	1	40
	0	52	42	5	50	0	0	1	1	0	0	0	0	4	155
09:00	0	9	11	0	11	0	0	0	0	0	0	0	0	0	31
09:15	1	10	15	0	22	1	0	0	0	0	0	0	0	2	51
09:30	0	21	18	0	14	3	0	0	0	0	0	0	0	3	59
09:45	0	22	18	0	28	0	0	0	0	0	0	0	0	0	68
	1	62	62	0	75	4	0	0	0	0	0	0	0	5	209
10:00	0	16	8	0	15	0	0	0	0	0	0	0	0	3	42
10:15	0	25	23	0	16	0	0	1	0	0	0	0	0	3	68
10:30	1	26	16	0	19	0	0	0	0	0	0	0	0	2	64
10:45	0	16	19	0	9	1	0	0	0	0	0	0	0	4	49
	1	83	66	0	59	1	0	1	0	0	0	0	0	12	223
11:00	1	36	20	0	14	1	0	1	0	0	0	0	0	4	77
11:15	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:45	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	5	383	293	7	294	7	0	4	6	0	0	0	0	34	1033
Percent	0.5%	37.1%	28.4%	0.7%	28.5%	0.7%	0.0%	0.4%	0.6%	0.0%	0.0%	0.0%	0.0%	3.3%	
Grand Total	63	1667	1058	17	872	12	0	20	8	0	0	0	0	149	3866
Percent	1.6%	43.1%	27.4%	0.4%	22.6%	0.3%	0.0%	0.5%	0.2%	0.0%	0.0%	0.0%	0.0%	3.9%	

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec/veh)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

"Highway Capacity Manual," Transportation Research Board, 2000.

Level of Service E describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

"Highway Capacity Manual," Transportation Research Board, 2000.

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤10.0
B	>10.0 and ≤15.0
C	>15.0 and ≤25.0
D	>25.0 and ≤35.0
E	>35.0 and ≤50.0
F	>50.0

"Highway Capacity Manual," Transportation Research Board, 2000.

APPENDIX C

CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS

HCM Signalized Intersection Capacity Analysis
2: Keahole Airport Rd & Queen K Hwy

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣					↰	↑			↑	↱
Volume (vph)	36	0	88	0	0	0	203	575	0	0	327	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0					5.0	5.0			5.0	5.0
Lane Util. Factor		1.00					1.00	1.00			1.00	1.00
Frt		0.90					1.00	1.00			1.00	0.85
Flt Protected		0.99					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1660					1770	1863			1863	1583
Flt Permitted		0.99					0.48	1.00			1.00	1.00
Satd. Flow (perm)		1660					897	1863			1863	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	37	0	91	0	0	0	209	593	0	0	337	53
RTOR Reduction (vph)	0	82	0	0	0	0	0	0	0	0	0	21
Lane Group Flow (vph)	0	46	0	0	0	0	209	593	0	0	337	32
Turn Type	Split	NA					pm+pt	NA			NA	Perm
Protected Phases	4	4					5	2			6	
Permitted Phases							2					6
Actuated Green, G (s)		7.8					60.1	60.1			47.0	47.0
Effective Green, g (s)		7.8					60.1	60.1			47.0	47.0
Actuated g/C Ratio		0.10					0.77	0.77			0.60	0.60
Clearance Time (s)		5.0					5.0	5.0			5.0	5.0
Vehicle Extension (s)		3.0					3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		166					783	1437			1124	955
v/s Ratio Prot		c0.03					0.03	c0.32			0.18	
v/s Ratio Perm							0.18					0.02
v/c Ratio		0.28					0.27	0.41			0.30	0.03
Uniform Delay, d1		32.4					2.7	3.0			7.5	6.3
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		0.9					0.2	0.9			0.7	0.1
Delay (s)		33.4					2.9	3.9			8.2	6.3
Level of Service		C					A	A			A	A
Approach Delay (s)		33.4			0.0			3.6			7.9	
Approach LOS		C			A			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	77.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Keahole Airport Rd & Queen K Hwy

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣					↰	↑			↑	↱
Volume (vph)	67	0	267	0	0	0	203	449	0	0	711	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0					5.0	5.0			5.0	5.0
Lane Util. Factor		1.00					1.00	1.00			1.00	1.00
Frt		0.89					1.00	1.00			1.00	0.85
Flt Protected		0.99					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1645					1770	1863			1863	1583
Flt Permitted		0.99					0.20	1.00			1.00	1.00
Satd. Flow (perm)		1645					365	1863			1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	0	281	0	0	0	214	473	0	0	748	46
RTOR Reduction (vph)	0	167	0	0	0	0	0	0	0	0	0	20
Lane Group Flow (vph)	0	185	0	0	0	0	214	473	0	0	748	26
Turn Type	Split	NA					pm+pt	NA			NA	Perm
Protected Phases	4	4					5	2			6	
Permitted Phases							2					6
Actuated Green, G (s)		13.2					62.2	62.2			48.7	48.7
Effective Green, g (s)		13.2					62.2	62.2			48.7	48.7
Actuated g/C Ratio		0.15					0.73	0.73			0.57	0.57
Clearance Time (s)		5.0					5.0	5.0			5.0	5.0
Vehicle Extension (s)		3.0					3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		254					406	1357			1062	903
v/s Ratio Prot		c0.11					c0.05	0.25			c0.40	
v/s Ratio Perm							0.33					0.02
v/c Ratio		0.73					0.53	0.35			0.70	0.03
Uniform Delay, d1		34.4					9.3	4.2			13.2	8.0
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		9.9					1.2	0.7			3.9	0.1
Delay (s)		44.3					10.5	4.9			17.1	8.1
Level of Service		D					B	A			B	A
Approach Delay (s)		44.3			0.0			6.7			16.6	
Approach LOS		D			A			A			B	

Intersection Summary			
HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
6: Keahole Airport Rd & Halalu St

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	35	95	202	52	29	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	100	213	55	31	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	267				414	240
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	267				414	240
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				95	100
cM capacity (veh/h)	1296				578	799

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	137	267	31
Volume Left	37	0	31
Volume Right	0	55	0
cSH	1296	1700	578
Volume to Capacity	0.03	0.16	0.05
Queue Length 95th (ft)	2	0	4
Control Delay (s)	2.3	0.0	11.6
Lane LOS	A		B
Approach Delay (s)	2.3	0.0	11.6
Approach LOS			B

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	34.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Keahole Airport Rd & Halalu St

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	64	254	183	67	74	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	71	282	203	74	82	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	278				665	241
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	278				665	241
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				80	99
cM capacity (veh/h)	1285				402	798

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	353	278	89
Volume Left	71	0	82
Volume Right	0	74	7
cSH	1285	1700	417
Volume to Capacity	0.06	0.16	0.21
Queue Length 95th (ft)	4	0	20
Control Delay (s)	2.0	0.0	16.0
Lane LOS	A		C
Approach Delay (s)	2.0	0.0	16.0
Approach LOS			C

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Pao'o St & Keahole Airport Rd

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	130	0	0	202	0	0	0	0	0	0	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	137	0	0	213	0	0	0	0	0	0	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	213			137			365	349	137	349	349	213
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	213			137			365	349	137	349	349	213
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	98
cM capacity (veh/h)	1358			1447			580	575	912	605	575	827

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	137	213	0	16
Volume Left	0	0	0	0
Volume Right	0	0	0	16
cSH	1700	1447	1700	827
Volume to Capacity	0.08	0.00	0.00	0.02
Queue Length 95th (ft)	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	9.4
Lane LOS			A	A
Approach Delay (s)	0.0	0.0	0.0	9.4
Approach LOS			A	A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Pao'o St & Keahole Airport Rd

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	286	0	0	189	0	0	0	0	32	0	37
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	318	0	0	210	0	0	0	0	36	0	41
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	210			318			569	528	318	528	528	210
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	210			318			569	528	318	528	528	210
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	92	100	95
cM capacity (veh/h)	1361			1242			412	456	723	461	456	830

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	318	210	0	77
Volume Left	0	0	0	36
Volume Right	0	0	0	41
cSH	1700	1242	1700	606
Volume to Capacity	0.19	0.00	0.00	0.13
Queue Length 95th (ft)	0	0	0	11
Control Delay (s)	0.0	0.0	0.0	11.8
Lane LOS			A	B
Approach Delay (s)	0.0	0.0	0.0	11.8
Approach LOS			A	B

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	25.8%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D

CAPACITY ANALYSIS CALCULATIONS PROJECTED YEAR 2022 BASELINE PEAK HOUR TRAFFIC ANALYSIS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥					↰	↑↑			↑↑	↱
Volume (vph)	44	0	107	0	0	0	248	702	0	0	399	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0					5.0	5.0			5.0	5.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.90					1.00	1.00			1.00	0.85
Flt Protected		0.99					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1660					1770	3539			3539	1583
Flt Permitted		0.99					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1660					1770	3539			3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	45	0	110	0	0	0	256	724	0	0	411	64
RTOR Reduction (vph)	0	98	0	0	0	0	0	0	0	0	0	33
Lane Group Flow (vph)	0	57	0	0	0	0	256	724	0	0	411	31
Turn Type	Split	NA					Prot	NA			NA	Perm
Protected Phases	4	4					5	2			6	
Permitted Phases												6
Actuated Green, G (s)		8.2					16.2	59.1			37.9	37.9
Effective Green, g (s)		8.2					16.2	59.1			37.9	37.9
Actuated g/C Ratio		0.11					0.21	0.76			0.49	0.49
Clearance Time (s)		5.0					5.0	5.0			5.0	5.0
Vehicle Extension (s)		3.0					3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		176					371	2706			1735	776
v/s Ratio Prot		c0.03					c0.14	c0.20			0.12	
v/s Ratio Perm												0.02
v/c Ratio		0.32					0.69	0.27			0.24	0.04
Uniform Delay, d1		32.0					28.2	2.7			11.4	10.2
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		1.1					5.4	0.2			0.3	0.1
Delay (s)		33.0					33.7	2.9			11.7	10.3
Level of Service		C					C	A			B	B
Approach Delay (s)		33.0			0.0			11.0			11.5	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	77.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Keahole Airport Rd & Queen K Hwy

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥					↰	↑↑			↑↑	↱
Volume (vph)	82	0	325	0	0	0	248	548	0	0	867	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0					5.0	5.0			5.0	5.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.89					1.00	1.00			1.00	0.85
Flt Protected		0.99					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1645					1770	3539			3539	1583
Flt Permitted		0.99					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1645					1770	3539			3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	86	0	342	0	0	0	261	577	0	0	913	57
RTOR Reduction (vph)	0	174	0	0	0	0	0	0	0	0	0	33
Lane Group Flow (vph)	0	254	0	0	0	0	261	577	0	0	913	24
Turn Type	Split	NA					Prot	NA			NA	Perm
Protected Phases	4	4					5	2			6	
Permitted Phases												6
Actuated Green, G (s)		16.6					16.2	56.3			35.1	35.1
Effective Green, g (s)		16.6					16.2	56.3			35.1	35.1
Actuated g/C Ratio		0.20					0.20	0.68			0.42	0.42
Clearance Time (s)		5.0					5.0	5.0			5.0	5.0
Vehicle Extension (s)		3.0					3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		329					346	2403			1498	670
v/s Ratio Prot		c0.15					c0.15	0.16			c0.26	
v/s Ratio Perm												0.02
v/c Ratio		0.77					0.75	0.24			0.61	0.04
Uniform Delay, d1		31.4					31.5	5.1			18.6	14.0
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		10.8					9.0	0.2			1.9	0.1
Delay (s)		42.1					40.5	5.3			20.4	14.1
Level of Service		D					D	A			C	B
Approach Delay (s)		42.1			0.0			16.3			20.1	
Approach LOS		D			A			B			C	

Intersection Summary

HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	82.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
6: Keahole Airport Rd & Halalu St

3/7/2012

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	Y	
Volume (veh/h)	43	116	247	63	35	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	45	122	260	66	37	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	326				473	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	326				473	260
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				93	100
cM capacity (veh/h)	1233				530	779

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	45	122	260	66	37
Volume Left	45	0	0	0	37
Volume Right	0	0	0	66	0
cSH	1233	1700	1700	1700	530
Volume to Capacity	0.04	0.07	0.15	0.04	0.07
Queue Length 95th (ft)	3	0	0	0	6
Control Delay (s)	8.0	0.0	0.0	0.0	12.3
Lane LOS	A				B
Approach Delay (s)	2.2		0.0		12.3
Approach LOS					B

Intersection Summary

Average Delay	1.5		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Keahole Airport Rd & Halalu St

3/7/2012

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	Y	
Volume (veh/h)	78	310	223	82	91	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	87	344	248	91	101	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	339				766	248
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	339				766	248
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				71	99
cM capacity (veh/h)	1220				345	791

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	87	344	248	91	110
Volume Left	87	0	0	0	101
Volume Right	0	0	0	91	9
cSH	1220	1700	1700	1700	361
Volume to Capacity	0.07	0.20	0.15	0.05	0.30
Queue Length 95th (ft)	6	0	0	0	32
Control Delay (s)	8.2	0.0	0.0	0.0	19.3
Lane LOS	A				C
Approach Delay (s)	1.6		0.0		19.3
Approach LOS					C

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Pao'o St & Keahole Airport Rd

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			✣			✣			✣	
Volume (veh/h)	0	159	0	0	247	0	0	0	0	0	0	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	167	0	0	260	0	0	0	0	0	0	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	260			167			446	427	167	427	427	260
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	260			167			446	427	167	427	427	260
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	98
cM capacity (veh/h)	1304			1410			510	520	877	538	520	779

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	167	260	0	19
Volume Left	0	0	0	0
Volume Right	0	0	0	19
cSH	1700	1410	1700	779
Volume to Capacity	0.10	0.00	0.00	0.02
Queue Length 95th (ft)	0	0	0	2
Control Delay (s)	0.0	0.0	0.0	9.7
Lane LOS			A	A
Approach Delay (s)	0.0	0.0	0.0	9.7
Approach LOS			A	A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			✥			✥			✥	
Volume (veh/h)	0	349	0	0	231	0	0	0	0	39	0	45
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	388	0	0	257	0	0	0	0	43	0	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	257			388			694	644	388	644	644	257
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	257			388			694	644	388	644	644	257
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	100	100	89	100	94
cM capacity (veh/h)	1308			1171			334	391	660	386	391	782

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	388	257	0	93
Volume Left	0	0	0	43
Volume Right	0	0	0	50
cSH	1700	1171	1700	529
Volume to Capacity	0.23	0.00	0.00	0.18
Queue Length 95th (ft)	0	0	0	16
Control Delay (s)	0.0	0.0	0.0	13.3
Lane LOS			A	B
Approach Delay (s)	0.0	0.0	0.0	13.3
Approach LOS			A	B

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.0%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX E

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2022 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

HCM Signalized Intersection Capacity Analysis
2: Keahole Airport Rd & Queen K Hwy

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣					↰	↑↑			↓↓	↱
Volume (vph)	50	0	121	0	0	0	344	702	0	0	399	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0					5.0	5.0			5.0	5.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.90					1.00	1.00			1.00	0.85
Flt Protected		0.99					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1661					1770	3539			3539	1583
Flt Permitted		0.99					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1661					1770	3539			3539	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	52	0	125	0	0	0	355	724	0	0	411	89
RTOR Reduction (vph)	0	109	0	0	0	0	0	0	0	0	0	50
Lane Group Flow (vph)	0	68	0	0	0	0	355	724	0	0	411	39
Turn Type	Split	NA					Prot	NA			NA	Perm
Protected Phases	4	4					5	2			6	
Permitted Phases												6
Actuated Green, G (s)		8.8					21.0	61.1			35.1	35.1
Effective Green, g (s)		8.8					21.0	61.1			35.1	35.1
Actuated g/C Ratio		0.11					0.26	0.76			0.44	0.44
Clearance Time (s)		5.0					5.0	5.0			5.0	5.0
Vehicle Extension (s)		3.0					3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		183					465	2706			1555	695
v/s Ratio Prot		c0.04					c0.20	c0.20			0.12	
v/s Ratio Perm												0.02
v/c Ratio		0.37					0.76	0.27			0.26	0.06
Uniform Delay, d1		33.0					27.2	2.8			14.2	12.9
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		1.3					7.3	0.2			0.4	0.2
Delay (s)		34.3					34.5	3.0			14.6	13.0
Level of Service		C					C	A			B	B
Approach Delay (s)		34.3			0.0			13.4			14.3	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	79.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
2: Keahole Airport Rd & Queen K Hwy

2/29/2012

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣					↰	↑↑			↓↓	↱
Volume (vph)	106	0	421	0	0	0	265	548	0	0	867	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0					5.0	5.0			5.0	5.0
Lane Util. Factor		1.00					1.00	0.95			0.95	1.00
Frt		0.89					1.00	1.00			1.00	0.85
Flt Protected		0.99					0.95	1.00			1.00	1.00
Satd. Flow (prot)		1645					1770	3539			3539	1583
Flt Permitted		0.99					0.95	1.00			1.00	1.00
Satd. Flow (perm)		1645					1770	3539			3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	112	0	443	0	0	0	279	577	0	0	913	61
RTOR Reduction (vph)	0	165	0	0	0	0	0	0	0	0	0	39
Lane Group Flow (vph)	0	390	0	0	0	0	279	577	0	0	913	22
Turn Type	Split	NA					Prot	NA			NA	Perm
Protected Phases	4	4					5	2			6	
Permitted Phases												6
Actuated Green, G (s)		23.3					16.5	53.2			31.7	31.7
Effective Green, g (s)		23.3					16.5	53.2			31.7	31.7
Actuated g/C Ratio		0.27					0.19	0.62			0.37	0.37
Clearance Time (s)		5.0					5.0	5.0			5.0	5.0
Vehicle Extension (s)		3.0					3.0	3.0			3.0	3.0
Lane Grp Cap (vph)		443					338	2177			1297	580
v/s Ratio Prot		c0.24					c0.16	0.16			c0.26	
v/s Ratio Perm												0.01
v/c Ratio		0.88					0.83	0.27			0.70	0.04
Uniform Delay, d1		30.3					33.6	7.7			23.4	17.6
Progression Factor		1.00					1.00	1.00			1.00	1.00
Incremental Delay, d2		18.1					15.0	0.3			3.2	0.1
Delay (s)		48.3					48.7	8.0			26.6	17.7
Level of Service		D					D	A			C	B
Approach Delay (s)		48.3			0.0			21.2			26.1	
Approach LOS		D			A			C			C	

Intersection Summary			
HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	Y	
Volume (veh/h)	43	136	367	63	35	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	45	143	386	66	37	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	453				620	386
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	453				620	386
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				91	100
cM capacity (veh/h)	1108				433	662

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	45	143	386	66	37
Volume Left	45	0	0	0	37
Volume Right	0	0	0	66	0
cSH	1108	1700	1700	1700	433
Volume to Capacity	0.04	0.08	0.23	0.04	0.09
Queue Length 95th (ft)	3	0	0	0	7
Control Delay (s)	8.4	0.0	0.0	0.0	14.1
Lane LOS	A				B
Approach Delay (s)	2.0		0.0		14.1
Approach LOS					B

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑	↱	Y	
Volume (veh/h)	78	430	244	82	91	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	87	478	271	91	101	9
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	362				922	271
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	362				922	271
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				64	99
cM capacity (veh/h)	1196				278	768

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	87	478	271	91	110
Volume Left	87	0	0	0	101
Volume Right	0	0	0	91	9
cSH	1196	1700	1700	1700	293
Volume to Capacity	0.07	0.28	0.16	0.05	0.38
Queue Length 95th (ft)	6	0	0	0	42
Control Delay (s)	8.2	0.0	0.0	0.0	24.5
Lane LOS	A				C
Approach Delay (s)	1.3		0.0		24.5
Approach LOS					C

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	34.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Pao'o St & Keahole Airport Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			✥			✥			✥	
Volume (veh/h)	0	159	0	30	247	90	0	0	20	0	0	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	167	0	32	260	95	0	0	21	0	0	19
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	355			167			557	585	167	559	538	307
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	355			167			557	585	167	559	538	307
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			100	100	98	100	100	97
cM capacity (veh/h)	1204			1410			422	413	877	422	440	733

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	167	386	21	19
Volume Left	0	32	0	0
Volume Right	0	95	21	19
cSH	1700	1410	877	733
Volume to Capacity	0.10	0.02	0.02	0.03
Queue Length 95th (ft)	0	2	2	2
Control Delay (s)	0.0	0.8	9.2	10.0
Lane LOS		A	A	B
Approach Delay (s)	0.0	0.8	9.2	10.0
Approach LOS			A	B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Pao'o St & Keahole Airport Rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			✥			✥			✥	
Volume (veh/h)	0	349	0	21	231	0	0	0	30	129	0	45
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	388	0	23	257	0	0	0	33	143	0	50
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	257			388			741	691	388	724	691	257
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	257			388			741	691	388	724	691	257
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			100	100	95	55	100	94
cM capacity (veh/h)	1308			1171			306	360	660	319	360	782

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	388	280	33	193
Volume Left	0	23	0	143
Volume Right	0	0	33	50
cSH	1700	1171	660	376
Volume to Capacity	0.23	0.02	0.05	0.51
Queue Length 95th (ft)	0	2	4	71
Control Delay (s)	0.0	0.9	10.7	24.2
Lane LOS		A	B	C
Approach Delay (s)	0.0	0.9	10.7	24.2
Approach LOS			B	C

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX G

Public Information Meeting Summary

Environmental Assessment for Various Airfield, Terminal, and Facility Improvements at the Kona International Airport at Keahole

PUBLIC INFORMATION MEETING #1

February 9, 2012

Meeting Summary

The public information meeting (PIM) was held at the Kealakehe Elementary School Cafeteria from 6:30 to 8:00 P.M. The purpose of the meeting was to present the project to the public and solicit verbal and written comments, in conjunction with the pre-assessment consultation process.

Presentation Summary

Mr. Chauncey Wong Yuen from the State Department of Transportation Airports Division (DOT-A), opened the meeting.

Mr. Earl Matsukawa from Wilson Okamoto Corporation (WOC) was introduced to present and review DOT-A's proposed improvements at the Kona International Airport (KOA) located in Keahole, North Kona, Hawai'i.

The formal presentation consisted of an overview of the project site and proposed improvements. Below is a list of the improvements discussed:

1. Expand General Aviation facilities
2. Construct a new helicopter general aviation facility:
3. Construct an interim secondary emergency runway by extending and widening the planned Kona Auxiliary Training Runway (KATR)
4. Initiate construction of new parallel runway as a new secondary emergency runway
5. Initiate construction of a new road (Road M) AC) system
6. Relocate the Onizuka Museum
7. Expand the terminal area
8. Construct a high pressure hydrogen fuel storage and fueling station
9. Construct a new Aircraft Rescue Fire Fighting (ARFF) Station
10. Construct an ARFF Regional Training Facility
11. Construct a medical transitional facility
12. Construct a temporary State of Hawai'i Department of Agriculture (DOA) inspection facility

Questions and Comments

Attendees were encouraged to ask questions and share their thoughts throughout the course of presentation as well as in a formal Question and Answer Session conducted immediately following the presentation. Questions, comments, and responses provided at the meeting are summarized below:

- Question: Has an agreement in principal, memorandum of agreement, or memorandum of understanding been reached with Natural Energy Laboratory of Hawaii Authority (NELHA) regarding Road M? Is there a timetable for the implementation construction?

  Response: Presently, there is no agreement in place, nor is there a timetable for construction.

- Question: I understand that NELHA will conduct an Environmental Assessment for various improvements to its facilities, would it be possible for DOT-A to work with collectively NELHA to have the improvements to Road M incorporated uniformly into both EA's. It would seem that this would facilitate development/construction.

  Response: DOT-A acknowledges your suggestion, and will work towards coordinating with NELHA regarding joint KOA and NELHA facilities.

- Question: Is there a timeframe for implementation (of the Medical Transitional Facility)?

  Response: There is no definite timeframe. The proposed Medical Transitional Facility is still being conceptually developed, however its development is anticipated to fall within a 5-10 year timeframe for implementation.

- Question: How do these improvements fit within the community, and how are they aligned with the Kona Community Development Plan (CDP)? It looks like access with NELHA is well underway, and the tying in with the Kaiminani Drive intersection, which is being done in conjunction with the Queen Kaahumanu Highway widening. What is the timeframe for the completion of the second major access point (Further north, intersecting with University Drive)? How far off will this be?

  Response: It (second major access – Road "P" intersection) will definitely be a part of future plans, however it will fall outside of the timeframe of this EA.

- Question: How do these improvements fit in with Transit? – it was nice to see the inclusion of a hydrogen storage fueling facility? Are there plans along with the infrastructure and new economic development opportunities to expand with transit, in conjunction with the county's transportation service? Are there plans to incorporate additional mass-transit?

  Response: DOT-A has informally discussed mass transit with the County; and is open to accepting all of the mass transit it can offer. There are no formal plans, but informal discussions have explored the implementation of transit to and from the Palamanui/University of Hawaii (UH) West Hawaii Campus (DOT-A envisions that the

Airport could encourage and facilitate educational opportunities), as well as to major resort areas.

- Question: This deals with an expansion of discussion on transit – this Airport is either #1 or #2 daily destination – the Kona CDP contains a shared use pathway/coastal route – how will pedestrians and bicyclists be integrated/aligned with existing plans?

  Response: DOT-A has no formalized plans, however the open-air architecture and nature of the KOA lends itself to the integration of pedestrians and bicyclists. For example, a scenic pedestrian trail mauka of the Kupipi Street parking lot could be developed to facilitate accessibility to nearby cultural resources (petroglyphs) as well as tell the story of area around KOA.

- Question: Could you provide more details regarding the terminal area expansion?

  Response: DOT-A reviewed in detail the proposed terminal area expansion.

  Key Features/Points
  - Goal of expansion is to modernize and streamline the airport to improve efficiency and technological integration.
    - Relocate the Onizuka Museum - where the expansion will be located.
    - Centralized passenger and baggage check-in and TSA Checkpoint for both.
    - Centralized Baggage Handling Systems
    - Communication Systems (FIDS-Flight Information Systems/BIDS-Baggage Information Systems/GIDS-Gate Information Systems)
  - DOT-A will emphasize retaining the architectural "Village hut" character of the terminal building.
  - DOT-A will set up stakeholder meetings to provide an opportunity for the interested community to share discussion/inputs into designs/plans.

- Comment: Regarding "Jetways", I understand that there is a legitimate argument for them (incorporation of Jet ways into facility design), but are measures being taken to mitigate their visual impact? Do you have any renderings?

  Response: DOT-A intends to maintain the architectural presence/character of the terminal building. DOT-A is still in the conceptual development phase for currently proposed Terminal Expansion improvements, and has no renderings to offer. To clarify, "jetways" are not included among the currently proposed terminal improvements.

- Question: To clarify, will the proposed terminal improvements result in a multilevel structure? Could measures be taken (in terms of design), to reduce the height/visual impact of the proposed changes?

  Response: Currently, DOT-A is in the conceptual planning phase for future Terminal Expansion improvements beyond the currently proposed terminal area improvements. Height will be taken into consideration, however Aircraft Dimensions dictate design parameters. DOT-A has, and will continue to emphasize the existing aesthetic character and atmosphere of KOA throughout the design and planning process.

APPENDIX H

Pre-Assessment Comment and Response Letters

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF: CEPOH-EC-T

January 27, 2012

Civil Works Technical Branch

RECEIVED
FEB 01 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

Thank you for the opportunity to review and comment on the Pre-Assessment Consultation dated January 17, 2012 for the Kona International Airport at Keahole, Island of Hawaii (Tax Map Keys 7-3-43: 1, 2, 3; and, 7-2-5: 7).

According to the latest Flood Insurance Rate Map (FIRM), Panel No. 1551660681C dated September 16, 1988, the project sites are located in Unshaded Zone X (areas outside of the 500-year/0.2% annual chance flood).

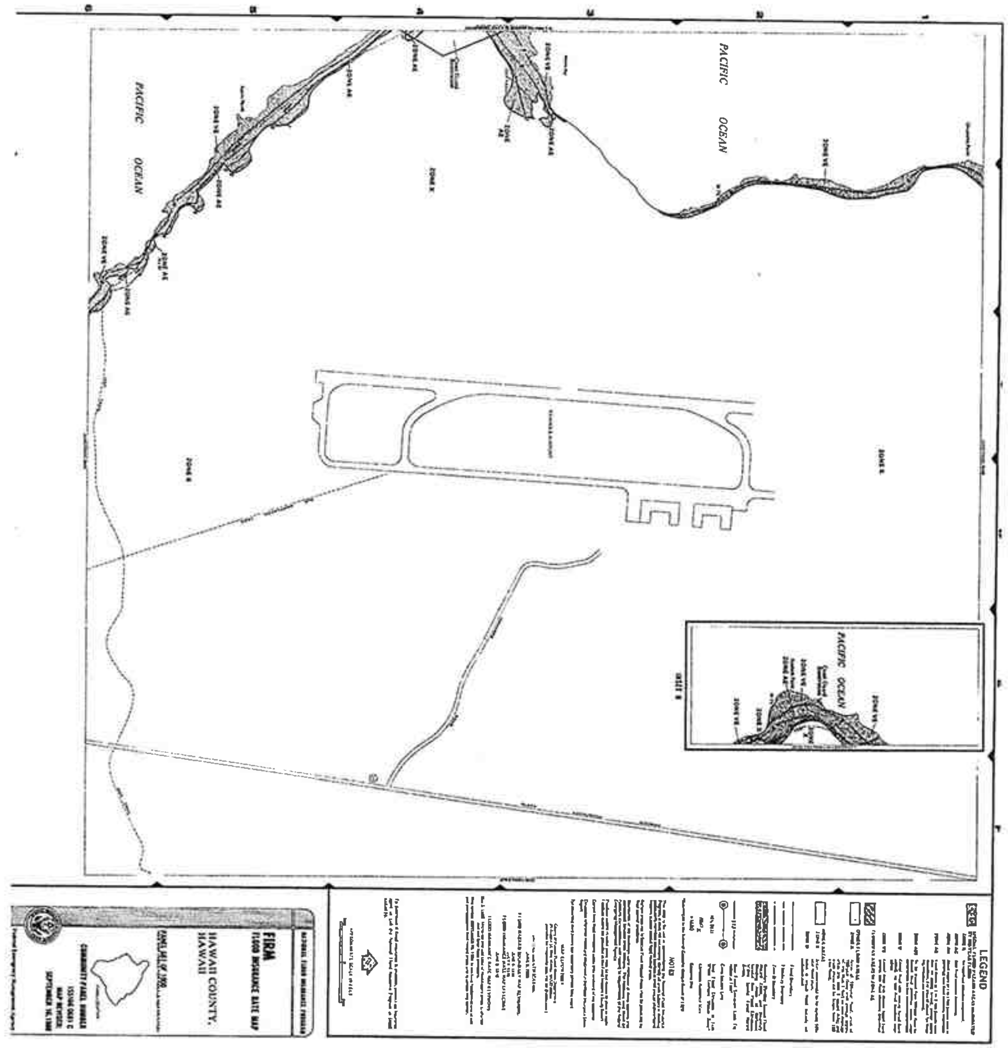
Should you require additional information, please contact Ms. Jessie Dobinchick of my staff at (808) 438-8876.

Sincerely,

Michael F. Wong

Michael F. Wong, P.E.
Chief, Civil Works Technical Branch

Enclosure



WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Michael F. Wong, P.E., Chief
Department of the Army
U.S. Army Corps of Engineers, Honolulu District
Civil Works Technical Branch
Fort Shafter, Hawaii 96858-5440

Attention: Ms. Jessie Dobinchick

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Wong:

Thank you for your letter dated January 27, 2012 (CEPOH-EC-T) regarding the subject Draft EA pre-assessment consultation. We acknowledge that the project site is located in Unshaded Zone X (areas outside of the 500-year/0.2% annual chance flood). The Draft EA will include a discussion of this flood zone.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

EM

REPLY TO
ATTENTION OF:

March 26, 2012

Regulatory Branch

Corps File No. POH-2012-00021

RECEIVED
MAR 28 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

This letter is in response to your request for our comments on the draft Environmental Assessment (EA) for the proposed ***Kona International Airport at Keahole Improvements Project*** located in Keahole, North Kona, Hawai'i (TMK: (3) 7-3-043: portions 001, 002, and 003; TMK: (3) 7-2-005: 007). The proposed project involves the expansion of the general aviation facilities, extending the existing aircraft parking apron and two existing taxiways, construction of a new helicopter general aviation facility, construction of a temporary and permanent secondary emergency runway, construction of new Road M, construction of a sea water air conditioning system from an existing facility, relocation of the Onizuka Museum, expansion of the terminal area, construction of a high pressure hydrogen fuel storage and fueling station, construction of a new Aircraft Rescue Fire Fighting (ARFF) station, construction of an ARFF regional training facility, construction of a medical transitional facility, and construction of a temporary State of Hawai'i Department of Agriculture inspection facility. The proposed project site and work description were reviewed pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404).

Section 10 requires that a Department of the Army (DA) permit be obtained for certain structures or work in or affecting navigable waters of the United States (U.S.) prior to conducting the work (33 U.S.C. 403). Navigable waters of the U.S. are those waters subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or other waters identified as navigable by the Honolulu District. In addition, a Section 10 permit is required for structures or work outside this limit if they affect the course, capacity, or condition of the water body.

Section 404 requires that a DA permit be obtained for the placement or discharge of dredged and/or fill material into waters of the U.S., including wetlands, prior to conducting the work (33 U.S.C. 1344). The area of the Corps' jurisdiction under Section 404 extends to the Ordinary High Water Mark (OHWM) for non-tidal waters, and to the upland boundary of any adjacent wetlands. Typical examples of projects involving discharges regulated under Section 404 include placement of fill material for impoundments, causeways, road fills, dams and dikes, riprap, groins, breakwaters, revetments, and beach nourishment. Section 404 also regulates

discharges of dredged material incidental to certain activities such as grading, mechanized land-clearing, ditching or other excavation activities, and the installation of certain pile-supported structures.

Therefore, we recommend you conduct an aquatic resource inventory of the project site, including areas that may be temporarily impacted during construction. The inventory should record drainage features, streams, ditches, gulches, wetlands, etc., since these aquatic features may be jurisdictional waterbodies subject to our Section 404 regulations. Wetland delineations must be conducted in accordance with the Corps 1987 *Wetland Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Hawaii and Pacific Islands Region.* Information regarding the physical, chemical, and biological characteristics of each aquatic resource should also be documented.

Once an aquatic resource inventory is conducted, the State of Hawai'i Department of Transportation (HDOT), Airports Division should submit a request to our office for a jurisdictional determination. HDOT or its designated agent would need to submit an application and drawings as outlined on our website at http://www.poh.usace.army.mil/EC-R/EC-R.htm for any regulated impacts to jurisdictional aquatic resources and obtain authorization from our office prior to commencement of the activities. Impacts to aquatic resources must be avoided and minimized to the maximum extent practicable. Further, any unavoidable impacts that result in lost functions and services of jurisdictional aquatic resources may require compensatory mitigation.

In addition, any regulated project activity will need to comply with Section 7 of the Endangered Species Act, the Manguson-Stevens Fishery Conservation and Management Act, and Section 106 of the National Historic Preservation Act. If a Department of the Army permit authorization is required, you may also require a Section 401 water quality certification from the State of Hawaii, Department of Health, Clean Water Branch, as well as coastal zone management consistency from the State of Hawaii, Coastal Zone Program, prior to the Corps authorizing any work regulated under Section 404.

Thank you for the opportunity to review and comment for the preparation of your EA. If you need further assistance, please contact Ms. Emilee Stevens, Regulatory Biologist, by phone at (808) 438-2303 or by e-mail at emilee.r.stevens2@usace.army.mil and reference file number **POH-2012-00021.** If you would like to provide comments on your experience with the Corps' Honolulu District Regulatory Branch, please fill out our web-based customer survey form located at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

WILSON OKAMOTO CORPORATION
ENGINEERS PLANNERS CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. George P. Young, Chief, Regulatory Branch
Department of the Army
U.S. Army Corps of Engineers,
Honolulu District
Fort Shafter
Honolulu, HI 96858-5540

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Young:

Thank you for your letter dated March 26, 2012 regarding the subject Draft EA pre-assessment consultation. Subsequent to distributing the Pre-Assessment Consultation, State DOT, Airports Division has decided to forego the proposed development of the water rescue facility/boat launch facility portion of the proposed Aircraft Rescue Fire Fighting (ARFF) regional training facility. Except for the shoreline along the airport property, there are no surface waters or intermittent streams on airport property. The highly porous lava substrate underlying the airport property prevents the natural formation of surface waters. Therefore, it is unanticipated that any waters of the U.S. would be affected by the proposed project improvements.

Compliance with Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act will be achieved through processing of a separate Environmental Assessment pursuant to the National Environmental Policy Act and FAA Order 1050.1E and 5050.4B.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

U.S. Department of Transportation
Federal Aviation Administration

Honolulu Control Facility
760 Worchester Avenue
Honolulu, HI 96818-5125

February 17, 2012

RECEIVED
FEB 22 2012
WILSON OKAMOTO CORPORATION

Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Honolulu, HI 96826

Dear Mr. Matsukawa:

We appreciate the opportunity to comment on the proposed Kona Airport projects as part of the Environmental Assessment process. An airspace study should also be included in the EA to comply with the requirements of Part 77 of Title 14 of the Code of Federal Regulations.

With regard to what is being proposed, we have the following comments:

a. The expansion of the General Aviation Facilities may have an adverse effect on the VORTAC navigational system located approximately 1,600 feet southeast of the proposed general aviation apron. Parked aircraft may cause electromagnetic interference with the signals of the VORTAC system.

b. To improve its efficiency, the proposed parallel runway should have an exit taxiway at each end. These exit taxiways should also align with the existing taxiways. In the proposal, taxiway C should be modified to align with an exit taxiway at the south end of the proposed runway.

c. In the proposal, the ARFF Regional Training Facility appears to be a hard-surface paved area. Any structures that may be planned for this area could interfere with Control Tower line of sight to the heliport area or penetrate heliport imaginary surfaces.

Should you have any questions, please call Moses Akana, Support Specialist, at 840-6135.

Sincerely,

Robert A. Rabideau
Air Traffic Manager

WILSON OKAMOTO CORPORATION
ENGINEERS PLANNERS CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Robert A. Rabideau, Air Traffic Manager
U.S. Department of Transportation
Federal Aviation Administration
Honolulu Control Facility
760 Worchester Avenue
Honolulu, HI 96818-5125

Attention: Mr. Moses Akana, Support Specialist

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Rabideau:

Thank you for your letter dated February 17, 2012 regarding the subject Draft EA pre-assessment consultation. An airspace study, in compliance with the requirements set forth by Part 77 of Title 14 of the Code of Federal Regulations, will be included in the forthcoming Draft EA.

Under context of the forthcoming Draft EA, the following responses are offered in the order of your comments:

A. Potential adverse impacts to the VHF Omni-directional Radio Range Tactical (VORTAC) navigational system as a result of the proposed expansion of the General Aviation Facilities will be considered in the design phase.

B. The incorporation of exit taxiways at each end of the parallel runway, aligned with existing taxiways, will be considered to improve operational efficiency.

C. Planned improvements, such as the ARFF Regional Training Facility will be constructed so that it will not interfere with Control Tower line of sight to the heliport area, or penetrate heliport imaginary surfaces.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850

In Reply Refer To:
2012-TA-181

RECEIVED
FEB 21 2012
WILSON OKAMOTO CORPORATION

FEB 17 2012

Mr. Earl Matsukawa
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii 96826

Subject: Pre-Draft Environmental Assessment for the Proposed Improvements at the Kona International Airport at Keahole, Kailua-Kona, Hawaii

Dear Mr. Matsukawa:

We are in receipt of your letter dated January 17, 2012, notifying the U.S. Fish and Wildlife Service (Service) regarding the preparation of a draft Environmental Assessment (DEA) to analyze the proposed project impacts associated with the various improvements at Kona International Airport (KIA) at Keahole. It is our understanding that the proposed improvements are expected to commence within the next five to ten years, and will include the following:

- Extending of the General Aviation area and associated taxiway improvements;
- Extending and expanding the planned Kona Auxiliary Training Runway;
- Initiating development of a new parallel runway located makai of the existing runway;
- Installing a sea water air conditioning system;
- Relocating the Onizuka Museum;
- Expanding the terminal area;
- Constructing a new connector road (Road M);
- Establishing a hydrogen fuel station;
- Replacing the Airport Rescue Fire Fighting Station (ARFF) with a larger facility in a different location;
- Developing an ARFF Regional Training Facility;
- Replacing the helicopter facility with a large facility in a different location;
- Developing a medical transitional facility; and
- Constructing a Department of Agriculture Inspection Facility.

The DEA will also include studies pertaining to air quality, noise, botanical and faunal surveys, water quality and cultural impact assessments, including archaeological literature research and field inspection.

There are two issues of concern regarding this proposed project and the potential direct and indirect impacts to threatened and endangered species that should be addressed and analyzed in the DEA. These two issues are: 1) biosecurity risks; and 2) ongoing and increased airport operations that directly impact listed species at KIA (e.g., bird air strike and bird air strike management). The proposed expansion at KIA may pose an increased risk for the introduction and establishment of invasive species in the State of Hawaii that could negatively impact federally listed species. The Service recommends the DEA contain the following assessments: 1) biosecurity risks and mitigation measures that address these risks; and 2) the increased risk of direct impacts to federally listed birds. Both of these assessments should include future and cumulative impacts as they relate to both federally listed species and invasive species associated with the proposed action.

Biosecurity Issues

Biological invasions, both from organisms already present and those that may arrive pose a significant threat to diverse native ecosystems in the Pacific region. The movement of plants, animals, and other organisms beyond their natural range is increasing due to the increased volume of transport, trade and travel. Fortunately, most species are not problematic; however, some foreign species have become established and proliferated impacting biodiversity, natural resources, food security, economic development, human health, and ecosystem services. For example, the brown treesnake (*Boiga irregularis*), which was accidentally introduced to Guam in the late 1940s or early 1950s, has caused the extinction of nine of Guam's 13 native forest birds. The brown treesnake has also impacted Guam's power grid by physically causing power outages. This impact is estimated to cost Guam around $4.5 million annually. Snakebites to humans have increased emergency room visits on Guam particularly for infants and young children. Like what has happened in Guam, the establishment of the brown treesnake in Hawaii would severely impact listed threatened and endangered species in the State of Hawaii and cost the state's economy an estimated $593 million to $2.14 billion annually. Since 1981, eight brown treesnakes have been found in Hawaii associated with the movement of civilian and military vehicles and cargo from Guam. Many more snakes would have likely stowed away in cargo from Guam without the interdiction program operated on Guam by U.S. Department of Agriculture, Animal and Plant Health Inspection Service – Wildlife Services since 1994. The Hawaii Department of Agriculture (HDOA), Plant Quarantine Branch (PQB), operates a reciprocal program that inspects for brown treesnakes in Hawaii associated with flights from Guam, but unfortunately, this program is currently not functioning at full capacity due to the lack of detector dogs.

With 90 percent of Hawaii's consumer goods imported into the state, approximately 20 new insects become established in Hawaii annually with two to three becoming a significant pest to agriculture, public health, natural resources, and the environment. Recent examples of pest introductions include the coffee berry borer (*Hypothenemus hampei*) that threatens the Kona coffee industry with the potential of affecting over 80 percent of the coffee berry production when there are severe infestations. The naio thrip (*Klambothrips myopori*), discovered in March 2009 in the Waikoloa area of Hawaii Island, has caused heavy galling to the terminals and young leaves of the indigenous plant naio (*Myoporum sandwicense*), and has been observed attacking naio with known infestations on the northwestern part of Hawaii Island from Kona Palisades through Waikoloa and up to Waimea. In October 2008, the banded cucumber beetle (*Diabrotica balteata*), a serious agricultural pest of a wide range of plants, was collected between the Kahului Airport and the Kanaha Beach park on Maui, and has been documented feeding on the native plant Ae ae or baby tears (*Bacopa monnieri*) in wetland areas. These pests have not yet been detected on neighboring islands, therefore, the key for adequate protection from the introduction and spread of invasive species in the State of Hawaii is prevention and the implementation of a sound biosecurity program.

To mitigate the invasive species threat to the State of Hawaii, the Service recommends that the Hawaii Department of Transportation (HDOT) work closely with Federal and State biosecurity/quarantine agencies (USDHS-US Customs and Border Protection, USDA-APHIS-Plant Protection and Quarantine, USFWS-Office of Law Enforcement, and HDOA-PQB) and the Federal Aviation Administration (FAA) to ensure that as a result of this project, their capacity to adequately respond to the anticipated increase of use at KIA as a result of the proposed action is assured. This capacity includes:

1. Appropriate number of personnel, including canine teams, commensurate with the increased traffic through KIA as a result of the proposed action to detect invasive alien species and conduct inspections, and other dispositions of passengers, baggage, cargo and mail parcels;

2. Inspection facilities adjacent to or sufficiently near cargo facilities that have the capacity to hold safeguarded commodities under strict quarantine measures. These inspection facilities provide capacity for pest detection and determination of risk, infested commodity, cargo, and baggage treatment and destruction, and support laboratories;

3. Rapid response capacity to deal with new pest detections and introductions on KIA properties, or at other sites associated with articles or goods that were shipped through KIA; and

4. Adequate operational needs, including office and kennel space, equipment, vehicles and other administrative capabilities.

The Service acknowledges the proposed improvement includes the construction of an inspection facility at KIA for the Department of Agriculture. As highlighted in the project site plan, the inspection facility would be a good starting point to prevent the introduction, establishment, and spread of invasive species throughout the State of Hawaii; however, we recommend the inspection facility include support laboratories, and treatment and destruction capabilities to adequately disinfect contaminated materials that would be imported into or exported from KIA. The Service also recommends the additional facility design and work space requirements should be developed in coordination with HDOA as

well as other Federal agencies that would be involved in biosecurity/quarantine functions and regulations at KIA.

Section 7 of the Endangered Species Act

The scope of the project with increased air traffic may increase the risk of adversely affecting four species of federally listed waterbirds. The Service recommends FAA and the HDOT-Airports address airport operations pursuant to section 7 of the Endangered Species Act of 1973, as amended, [16 U.S.C. 1531 et seq.]. We recommend the FAA, as the lead Federal agency, address impacts to federally listed species as a result of ongoing airport operations as well as the proposed airport expansion. In addition, as explained in detail in this letter, increased aircraft traffic amplifies the potential for the introduction of invasive species thereby increasing the risk of adversely affecting federally listed species in their native habitat across the state. We recommend FAA address these potential effects pursuant to section 7 of the Endangered Species Act.

If you have questions regarding this letter, please contact Domingo Cravalho, Invasive Species Biologist, at 808-792-9445. For questions regarding responsibilities pursuant to section 7 of the Endangered Species Act, please contact Patrice Ashfield, Consultation and Habitat Conservation Program Lead, at 808-792-9400.

Sincerely,

Loyal Mehrhoff
Field Supervisor

cc: Vernon Harrington, USDA-APHIS-Plant Protection and Quarantine
Russell Kokubun, HDOA, Board of Agriculture
Bruce Murley, USDHS, U.S. Customs and Border Protection
Carol Okada, HDOA, Plant Quarantine Branch
George Phocas, USFWS, Office of Law Enforcement
Mike Pitzler, USDA-APHIS-Wildlife Services
Ron Simpson, Federal Aviation Administration

WILSON OKAMOTO
CORPORATION
907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Dr. Loyal Mehrhoff, Field Supervisor
United States Department of the Interior
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, HI 96850

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Dr. Mehrhoff:

Thank you for your letter dated February 17, 2012 (2012-TA-181) regarding the subject Draft EA pre-assessment consultation. Your concerns will be addressed by The Federal Aviation Administration through Section 7 of the Endangered Species Act of 1973, as amended, [16 U.S.C. 1531 et seq.].

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Pacific Islands Water Science Center
677 Ala Moana Blvd., Suite 415
Honolulu, Hawaii 96813
Phone: (808) 587-2400/Fax: (808) 587-2401

January 27, 2012

RECEIVED
JAN 3 0 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

Subject: Environmental Assessment (EA) Pre-Assessment Consultation, Kona International Airport at Keahole Environmental Assessment, Tax Map Key: (3) 7-3-043: portions of 001, 002 and 003 and TMK (3) 7-2-005: 007, Kailua-Kona, Hawaii

Thank you for forwarding the subject EA Pre-Assessment Consultation for review and comment by the staff of the U.S. Geological Survey Pacific Islands Water Science Center. We regret however, that due to prior commitments and lack of available staff, we are unable to review this document.

We appreciate the opportunity to participate in the review process.

Sincerely,

SSAh

Stephen S. Anthony
Center Director

WILSON OKAMOTO CORPORATION

907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Stephen S. Anthony, Center Director
United States Department of the Interior
U.S. Geological Survey
Pacific Islands Water Science Center
677 Ala Moana Boulevard, Suite 415
Honolulu, HI 96813

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Anthony:

Thank you for your letter dated January 27, 2012 regarding the subject Draft EA pre-assessment consultation. We acknowledge that your department was unable to review this document due to prior commitments and lack of available staff.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

From: Danielle Jayewardene [danielle.jayewardene@noaa.gov]
Sent: Friday, February 17, 2012 11:54 AM
To: Kona Airport Project
Cc: NMFS PIRO HCD EFH; Jayne LeFors
Subject: Preliminary EFH comments for improvements proposed at the Kona International Airport at Keahole, Hawaii

Aloha Mr. Matsukawa,

The Habitat Conservation Division of NOAA Fisheries, Pacific Islands Regional Office, has reviewed the Draft Environmental Assessment Pr-Assessment Consultation Project summary provided attached to your January 17, 2012 pre-consultation request letter for the various improvements proposed at the Kona International Airport at Keahole on the Island of Hawaii. We appreciate your effort to consult with us early, and the opportunity to provide the following preliminary Essential Fish Habitat (EFH) recommendations:

1) For *all land-based and in-water construction* activities listed in the summary under item 1-13: implement standard best-management practices, including innovative storm water run-off control measures, to ensure pollutant entry in to the marine environment is avoided/minimized both during construction as well as post-construction.

2) For *the sea water air-conditioning system construction* activity listed under item 6: specify where (location, depth) the return cold water brought in from NELHA will be discharged.
- If at an existing discharge point, clarify if the discharge will add to the current discharge load and identfy any potential additional marine environmental impact associated with this additional discharge.
- If at a new site, clarify where this site is proposed. Also provide i) a quantitative characterization of the marine biological community at the site, ii) an analysis as to how this will impact coral reef resources including EFH, and iii) proposed mitigation measures to avoid/minimize this impact.

3) For *the water rescue facility/boat launch construction* activity listed under item 11: describe i) the scope of work in detail, including the level of fill if any , ii) a quantitative description of the marine biological community, including coral reef resources/EFH that will be impacted from construction as well as from operations, and iii) the mitigation measures proposed to avoid/minimize this impact.

We further recommend, once you have a clear scope of work, that you coordinate a joint pre-consutlation meeting with all resource agencies.

Thanks again for the opportunity to comment, please do not hesitate to contact me should you have any questions or for further guidance.
Aloha!
Danielle

--
Danielle Jayewardene Ph.D.
Coral Reef Ecologist
Habitat Conservation Division
NOAA Fisheries, Pacific Islands Regional Office
1601 Kapiolani Blvd, Suite 1110
Honolulu, HI 96814
Phone # (808) 944 2162
Fax # (808) 973 2941

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. Danielle Jaywardene Ph.D., Coral Reef Ecologist
Habitat Conservation Division
National Oceanic and Atmospheric Administration Fisheries
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Jaywardene:

Thank you for your e-mail dated February 17, 2012 regarding the subject Draft EA pre-assessment consultation. We offer the following responses in the respective order of your comments:

1. Standard best-management practices (BMPs), including innovative storm water run-off controls will be implemented to ensure that potential pollutant entry to the marine environment is avoided/minimized throughout the construction and operation of the proposed project improvements.

2. State DOT, Airports Division is continuing on-going discussion with NELHA to develop the design parameters of the proposed SWAC system. Potential marine environmental impacts will be identified through this process.

3. Subsequent to distributing the Pre-Assessment Consultation, State DOT, Airports Division has decided to forego the proposed development of the water rescue facility/boat launch facility portion of the proposed Aircraft Rescue Fire Fighting (ARFF) regional training facility.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

FEB 13 2012

Mr. Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 S. Beretania St., Suite 400
Honolulu, HI 96826

Dear Mr. Matsukawa,

Thank you for your letter dated January 17, 2012, requesting pre-assessment consultation with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service's Pacific Islands Regional Office (NMFS PIRO) on the Kona Airport at Keahole Environmental Assessment (EA). The Protected Resources Division of NMFS PIRO provides the following comments on our concerns with regards to this project's potential impacts to protected marine species.

The Protected Resources Division of NMFS PIRO is responsible for the conservation and management of marine species that are protected under the federal Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) in the Hawaiian Islands, as well as in the U.S. territories of the Pacific Ocean. In the Hawaiian Islands, this includes all marine mammals and sea turtles found within the waters of the Hawaiian archipelago.

In reviewing the project description provided in your letter, it appears there are 2 components of the proposed project that may affect several of these protected marine species: The proposal to construct a sea water air conditioning (SWAC) system; and the proposal to construct an Aircraft Rescue Fire Fighting (ARFF) regional training facility, which includes a water rescue facility/boat launch facility located at Puukala Point. Both ESA- and MMPA-protected marine species may be affected by the construction and operation of these proposed systems/facilities.

Marine species that are protected under the ESA and found within the nearshore waters of the project area include the endangered humpback whale (*Megaptera novaeangliae*), the endangered Hawaiian monk seal (*Monachus schauinslandi*), the threatened green sea turtle (*Chelonia mydas*), and the endangered hawksbill sea turtle (*Eretmochelys imbricata*). Humpback whales are frequently seen just offshore of the project area during their winter breeding and calf rearing season, which usually occurs from October through May.

The Hawaiian spinner dolphin (*Stenella longirostris*), which is protected under the MMPA, is also known to use the nearshore areas adjacent to the project area for their daily resting and socializing behaviors. In particular, one of the Hawaiian spinner dolphins' primary known resting areas is located at nearby Makako Bay, just south of the proposed project area.

The dolphins are also known to use the bay just to the north of Makako and south of Unualoha Point to rest, as well as the areas off of Mahaiula Bay and Makalawena.

The initial concerns we have are that the construction noise and increase in vessel traffic may disrupt humpback whales' behavior as they breed, give birth, and nurture their young, and may also disrupt the Hawaiian spinner dolphins' daily resting behavior. Hawaiian monk seals and sea turtles may be affected by noise, vessel traffic, and changes in prey availability. There may also be an increased risk of ship strikes on these animals due to the increased vessel traffic from the training facility.

The description of the SWAC system says that cold water will be piped from the nearby NELHA facilities to a heat exchange facility where it will be circulated within the terminal and other airport buildings for air conditioning. However, there is no description of where the heated water will be returned to. We ask that you please provide a thorough description of the location and depth of the return pipes, the volume, temperature, and velocity of the return flow, as well as any pump systems that may located in or near the marine environment, so that we can analyze the potential impacts of the construction and operation of this system.

The construction and operation of the water rescue facility and boat launch as part of the proposed ARFF regional training facility should be thoroughly described as well. This should include details such as the timing and duration of the construction period, whether any blasting of rock or pile driving would occur during construction, the anticipated number and size of the vessels using the facility, and amount of vessel traffic expected once it is fully operational. In-water as well as out-of-water noise impacts should be described, as well as any Best Management Practices (BMPs) used during construction to mitigate noise, turbidity, or other disturbance to protected marine species.

We ask that you carefully consider these comments and endeavor to design the project with the least impact possible to these protected marine species. We are providing you with an attached list of our standard BMPs for in-water construction projects. Should you have any questions about these comments, please contact Jayne LeFors at (858) 546-5653 jayne.lefors@noaa.gov.

Thank you for working with us to protect our nation's living marine resources.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
for Protected Resources

Best Management Practices (BMPs) for General In- and Near-Water Work Including Boat and Diver Operations

June 2011

NMFS Protected Resources Division recommends implementation of the following BMPs to reduce potential adverse affects on protected marine species. These BMPs are in no way intended to supersede or replace measures required by any other agency including, but not limited to the ACOE, USFWS, USEPA, or NMFS Habitat Conservation Division, and compliance with these BMPs shall always be considered secondary to safety concerns.

All workers associated with this project, irrespective of their employment arrangement or affiliation (e.g. employee, contractor, etc.) shall be fully briefed on these BMPs and the requirement to adhere to them for the duration of their involvement in this project.

A. Constant vigilance shall be kept for the presence of ESA-listed marine species during all aspects of the proposed action, particularly in-water activities such as boat operations, diving, and deployment of anchors and mooring lines.

1. The project manager shall designate an appropriate number of competent observers to survey the areas adjacent to the proposed action for ESA-listed marine species.
2. Surveys shall be made prior to the start of work each day, and prior to resumption of work following any break of more than one half hour. Periodic additional surveys throughout the work day are strongly recommended.
3. All work shall be postponed or halted when ESA-listed marine species are within 50 yards of the proposed work, and shall only begin/resume after the animals have voluntarily departed the area. If ESA-listed marine species are noticed within 50 yards after work has already begun, that work may continue only if, in the best judgment of the project supervisor, that there is no way for the activity to adversely affect the animal(s). For example; divers performing surveys or underwater work would likely be permissible, whereas operation of heavy equipment is likely not.
4. In-water tethers, as well as mooring lines for vessels and marker buoys shall be kept to the minimum lengths necessary, and shall remain deployed only as long as needed to properly accomplish the required task.
5. When piloting vessels, vessel operators shall alter course to remain at least 100 yards from whales, and at least 50 yards from other marine mammals and sea turtles.
6. Reduce vessel speed to 10 knots or less when piloting vessels at or within the ranges described above from marine mammals and sea turtles. Operators shall be particularly vigilant to watch for turtles at or near the surface in areas of known or suspected turtle activity, and if practicable, reduce vessel speed to 5 knots or less.
7. If despite efforts to maintain the distances and speeds described above, a marine mammal or turtle approaches the vessel, put the engine in neutral until the animal is at least 50 feet away, and then slowly move away to the prescribed distance.
8. Marine mammals and sea turtles shall not be encircled or trapped between multiple vessels or between vessels and the shore.
9. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed marine species.

B. No contamination of the marine environment shall result from project-related activities.

10. A contingency plan to control toxic materials is required.
11. Appropriate materials to contain and clean potential spills shall be stored at the work site, and be readily available.
12. All project-related materials and equipment placed in the water shall be free of pollutants.
13. The project manager and heavy equipment operators shall perform daily pre-work equipment inspections for cleanliness and leaks. All heavy equipment operations shall be postponed or halted should a leak be detected, and shall not proceed until the leak is repaired and equipment cleaned.
14. Fueling of land-based vehicles and equipment shall take place at least 50 feet away from the water, preferably over an impervious surface. Fueling of vessels shall be done at approved fueling facilities.
15. Turbidity and siltation from project-related work shall be minimized and contained through the appropriate use of erosion control practices, effective silt containment devices, and the curtailment of work during adverse weather and tidal/flow conditions.
16. A plan shall be developed to prevent debris and other wastes from entering or remaining in the marine environment during the project.

WILSON OKAMOTO
CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. Alecia Van Atta, Assistant Regional Administrator for Protected Resources
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Van Atta:

Thank you for your letter dated February 13, 2012 regarding the subject Draft EA pre-assessment consultation. Subsequent to distributing the Pre-Assessment Consultation, State DOT, Airports Division decided to forgo the proposed development of the water rescue facility/boat launch facility portion of the proposed Aircraft Rescue Fire Fighting (ARFF) regional training facility. Regarding the Salt Water Air Conditioning project, the forthcoming Draft EA will clarify that spent seawater will be returned to NELHA, which will be used for other purposes. There will be no new discharge of seawater from the project.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR

DEAN H. SEKI
INTERIM COMPTROLLER

JAN S. GOUVEIA
DEPUTY COMPTROLLER

STATE OF HAWAI'I
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAI'I 96810-0119

(P)1017.2

FEB - 8 2011

FEB 0 9 2012

Mr. Earl Matsukawa
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826

Dear Mr. Matsukawa:

Subject: Pre-Assessment Consultation for Environmental Assessment
Kona International Airport at Keahole
Hawaii Island, Kailua Kona
TMK: (3) 7-3-043: portions of 001, 002, 003 & (3) 7-2-005:007

This is in response to your letter, dated January 17, 2012 regarding the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400, or have your staff call Mr. David DePonte of the Public Works Division at 586-0492.

Sincerely,

DEAN H. SEKI
Interim State Comptroller

c: Mr. Brian Kau, Hawaii Department of Agriculture
Mr. Jerry Watanabe, DAGS Hawaii District

WILSON OKAMOTO
CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Dean H. Seki, Comptroller
State of Hawaii
Department of Accounting and General Services
P.O. Box 119
Honolulu, HI 96810-0119

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Seki:

Thank you for your letter dated February 8, 2012 indicating that you have no comments to offer regarding the subject Draft EA pre-assessment consultation. We appreciate your determination that the proposed improvements will have no impact on your projects or existing facilities.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR

MAJOR GENERAL DARRYLL D. M. WONG
DIRECTOR OF CIVIL DEFENSE

DOUG MAYNE
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

PHONE (808) 733-4300
FAX (808) 733-4287

EM

July 9, 2012

RECEIVED
JUL 10 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

Environmental Assessment/Environmental Impact Statement Review
Kona International Airport Improvements, Kona Airport, Hawaii
TMK Map Keys: (3) 7-3-043: (portions 001,002 and 003)and TMK (3) 7-2-005:007

Thank you for the opportunity to comment on this development. The airport area does not have any outdoor civil defense warning systems. This office recommends two 121dB Omni-Directional sirens to be placed near items 11 and 12 on the project plan off of Pao'o Street (Road N) to cover the airport terminal and support areas. State Civil Defense (SCD) can coordinate siren locations with the designer once detailed design documents are available.

Siren HA611 NELHA (located near the end of the runway) currently does not extend into the flight plane (siren height 40 ft.). State Civil Defense requests the project designer verify that the new runway flight plane will not cause the siren to be in violation of Federal Aviation Administration rules and, if needed, provide for the siren to be relocated.

If you have any questions, please call Ms. Fay Alailima-Rose, SCD Assistant Telecommunications Officer, at (808) 733-4300, ext. 531.

Sincerely,

DOUG MAYNE
Vice Director of Civil Defense

c: Hawaii State Planning Office
Hawaii County Civil Defense

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Doug Mayne, Vice Director of Civil Defense
State of Hawaii
Department of Defense
Office of the Director of Civil Defense
3949 Diamond Head Road
Honolulu, HI 96816-4495

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Mayne:

Thank you for your letter dated February 27, 2012 (12-138A CAB) regarding the subject Draft EA pre-assessment consultation. We acknowledge that the airport area does not have any outdoor civil defense warning systems, as well as your recommendation that two 121dB Omni-Directional sirens be placed near items 11 and 12 on the project plan off of Pao'o Street (Road N) to cover the airport terminal and support areas. Once design documents are available, the designer will coordinate these locations with State Civil Defense (SCD).

We acknowledge SCD's request that the project designer verify that the new runway flight plane will not cause the Siren HA611 NELHA to be in violation of Federal Aviation Administration rules, and if needed, will provide for the siren to be relocated.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR
STATE OF HAWAI'I

ALBERT "ALAPAKI" NAHALE-A
CHAIRMAN
HAWAIIAN HOMES COMMISSION

MICHELLE K. KAUHANE
DEPUTY TO THE CHAIRMAN

M. WAIALEALE SARSONA
EXECUTIVE ASSISTANT

STATE OF HAWAIʻI
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

February 2, 2012

Wilson Okamoto Corporation
Attn: Mr. Earl Matsukawa,
Project Manager
1907 South Beretania
Artesian Plaza, Suite 400
Honolulu, Hawaii 96826

RECEIVED
FEB 17 2012
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa:

Subject: Environmental Assessment (EA) Pre-Assessment Consultation Kona International Airport at Keahole Environmental Assessment
Tax Map Key: (3) 7-3-043: portions of 001, 002, 003
Tax Map Key: (3) 7-2-005: 007
Kailua-Kona Hawaii

Thank you for the opportunity to review the Environmental Assessment (EA) Pre-Assessment Consultation for Kona International Airport at Keahole.

The Department of Hawaiian Home Lands has no comment to offer at this time. If you have any questions, please contact our Planning Office at (0808) 620-9480.

Me ke aloha,

Albert "Alapaki" Nahale-a, Chairman
Hawaiian Homes Commission

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. Jobie Masagatani, Chairman
State of Hawaii
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Masagatani:

Thank you for your Department's letter dated February 2, 2012 indicating that you have no comments to offer at this time regarding the subject Draft EA pre-assessment consultation.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

12-138A CAB

February 17, 2012

RECEIVED
FEB 22 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
Artesian Plaza, Suite 400
1907 South Beretania Street
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

SUBJECT: Draft Environmental Assessment, Pre-Assessment Consultation
Kona International Airport at Keahole
Kailua-Kona, Hawaii

A significant potential for fugitive dust emissions exists during all phases of construction. The proposed activities will occur in proximity to public areas and thoroughfares, thereby exacerbating potential dust problems.

We encourage the contractor to implement a dust control plan, which does not require approval by the Department of Health, and to comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust. The plan should provide adequate measures to control fugitive dust during the various phases of construction.

The measures may include, but are not limited to, the following:

- Planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
- Providing an adequate water source at the site prior to start-up of construction activities;
- Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
- Minimizing dust from shoulders and access roads;
- Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
- Controlling dust from debris being hauled away from the project site.

If you have any questions, please contact Mr. Barry Ching of the Clean Air Branch at 586-4200.

Sincerely,

NOLAN S. HIRAI
Acting Manager, Clean Air Branch

BC:rg

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Nolan S. Hirai, Acting Manager
State of Hawaii
Department of Health
Clean Air Branch
P.O. Box 3378
Honolulu, HI 96801-3378

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Hirai:

Thank you for your letter dated February 27, 2012 (12-138A CAB) regarding the subject Draft EA pre-assessment consultation. We acknowledge concern that fugitive dust emissions will be generated during construction. The forthcoming Draft EA will discuss potential measures to mitigate and control fugitive dust during various phases of construction, as well as the project's compliance with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/CWB

06017PMR.12

June 18, 2012

JUN 2 0 2012

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

SUBJECT: Comments on the Environmental Assessment (EA) Pre-Assessment Consultation for the Kona International Airport at Keahole Kailua-Kona, Island of Hawaii, Hawaii TMK: (3) 7-3-043: portions of 001, 002, and 003 and (3) 7-2-005:007

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated January 17, 2012, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You may be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for an NPDES general permit coverage by submitting a Notice of Intent (NOI) form:

   a. Storm water associated with construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. This includes areas used for a construction base yard and the storage of any construction related equipment, material, and waste products. An NPDES permit is required before the start of the construction activities.

   b. Storm water associated with industrial activities. Please verify the North American Industrial Classification System (NAICS) United States Structure Code(s) and the corresponding Standard Industrial Classification (SIC) Code(s) for the facility. See http://www.census.gov/epcd/www/naicstab.htm to determine the NAICS Code(s) and corresponding SIC Code(s).

      Facilities with SIC Codes categorized in the Code of Federal Regulations, Title 40 (Protection of Environment), Parts 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi) are required to obtain NPDES permit coverage for the discharges of storm water associated with industrial activities.

   c. Once through cooling water less than one (1) million gallons per day.

   d. Hydrotesting waters.

   e. Construction dewatering effluent.

   f. Treated process wastewater associated with petroleum bulk stations and terminals.

   You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

3. For other types of wastewater not listed in Item No. 2 above or wastewater discharging into Class 1 or Class AA waters, an NPDES individual permit will need to be obtained. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://hawaii.gov/health/environmental/water/cleanwater/forms/environmental/water/cleanwater/forms/indiv-index.html.

4. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

5. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Darryl Lum

TA FOR ALEC WONG, P.E., CHIEF
Clean Water Branch

MR:jst

c: DOH-EPO #12-011 [via email only]

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Alec Wong, P.E., Chief
State of Hawaii
Department of Health
Clean Water Branch
P.O. Box 3378
Honolulu, HI 96801-3378

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Wong:

Thank you for your letter dated June 18, 2012 (06017PMR.12) regarding the subject Draft EA pre-assessment consultation. We offer the following responses in the order of your comments:

1. The project will comply with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55, as applicable to the protection of State waters.

2. We acknowledge that construction of the various proposed improvements may require the approval of National Pollutant Discharge Elimination System (NPDES) individual permits for storm water associated with construction activities. It is uncertain if other NPDES permits will be needed at this time; however, all required permits will be obtained.

3. Please refer to our preceding response.

4. Subsequent to distributing the Pre-Assessment Consultation, State DOT, Airports Division has decided to forego the proposed development of the water rescue facility/boat launch facility portion of the proposed Aircraft Rescue Fire Fighting (ARFF) regional training facility. Except for the shoreline along the airport property, there are no surface waters or intermittent streams on airport property. The highly porous lava substrate underlying the airport property prevents the natural formation of surface waters. Therefore, it is unanticipated that any waters of the U.S. would be affected by the proposed project improvements.

WILSON OKAMOTO CORPORATION

5. We acknowledge that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the State's Water Quality Standards and would result in monetary penalties for noncompliance.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR

DWIGHT TAKAMINE
DIRECTOR

AUDREY HIDANO
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
830 PUNCHBOWL STREET, ROOM 321
HONOLULU, HAWAII 96813
www.hawaii.gov/labor
Phone: (808) 586-8844/Fax: (808) 586-9099

February 22, 2012

RECEIVED
FEB 24 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826

Dear Mr. Matsukawa:

This is in response to your request for comments dated January 17, 2012 on the Draft Environmental Assessment for the Kona International Airport project located in Keahole, island of Hawaii.

The Department of Labor and Industrial Relations has no comments, and we foresee no impact on our existing or proposed programs. Should you have any questions, please call me at 586-8844.

Sincerely,

DWIGHT TAKAMINE
Director

WILSON OKAMOTO
CORPORATION
ENGINEERS PLANNERS CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Dwight Takamine, Director
State of Hawaii
Department of Labor and Industrial Relations
830 Punchbowl Street, Room 321
Honolulu, HI 96813

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Takamine:

Thank you for your letter dated February 22, 2012 indicating that you have no comments to offer regarding the subject Draft EA pre-assessment consultation. We appreciate your determination that the proposed improvements will have no impact on you existing or proposed programs.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 16, 2012

Wilson Okamoto Corporation
Attention: Mr. John Sakaguchi, AICP — via email: jsakaguchi@wilsonokamoto.com
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Sakaguchi:

SUBJECT: Environmental Assessment (EA) Pre-Assessment Consultation for Kona International Airport at Keahole, North Kona, Island of Hawaii; TMK: (3) 7-3-043:portions of 001, 002, and 003; and (3) 7-2-005:007

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from (a) the Office of Conservation and Coastal Lands, and (b) Division of Aquatic Resources on the subject matter. Should you have any questions, please feel free to call Kevin Moore at 587-0426. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

HA-12-173

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2012 JAN 24 P 12:16
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

RECEIVED
LAND DIVISION
2012 FEB 21 P 2:56
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 23, 2012

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources
__ Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
X Div. of State Parks
X Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment (EA) Pre-Assessment Consultation for Kona International Airport at Keahole
LOCATION: Kailua-Kona, Island of Hawaii; TMK: (3) 7-3-043:portions of 001, 002, and 003; and (3) 7-2-005:007
APPLICANT: Wilson Okamoto Corporation on behalf of the State DOT

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 15, 2012.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Date: 22 FEB 2012

cc: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

WILLIAM J. AILA, JR.

GUY H. KAULUKUKUI

WILLIAM M. TAM

Ref: OCCL:MC

File No.: Corr HA-12-173

MEMORANDUM:

TO: Russell Y. Tsuji, Land Administrator
Land Division

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: Environmental Assessment (EA) Pre-Assessment Consultation for Kona International Airport at Keahole

LOCATION: Kailua-Kona, Hawai'i

TMKs: (3) 7-3-043:001, 002, 003; 7-2-005:007

APPLICANT: Wilson Okamoto Corporation on behalf of State DOT

The Office of Conservation and Coastal Lands (OCCL) has reviewed the information provided on the proposed expansion of the Kona International Airport. The Keahole Airport site is set aside under Governor's Executive Order No. 2472 to DOT for airport uses. The current airport lies outside the State Land Use Conservation District; however, the expansion will involve lands that are in the General and possibly the Limited Subzones of the Conservation District.

Airports are an identified land use in the Conservation District pursuant to Hawai'i Administrative Rules (HAR) §13-5-22, *Identified Land Uses in the Protective Subzone*, P-6 PUBLIC PURPOSE USES, *Not for profit land uses undertaken in support of a public service by an agency of the county, state, or federal government, or by an independent non-governmental entity, except that an independent non-governmental regulated public utility may be considered to be engaged in a public purpose use. Examples of public purpose uses may include but are not limited to public roads, marinas, harbors, airports, trails, water systems and other utilities, energy generation from renewable resources, communication systems, flood or erosion control projects, recreational facilities, community centers, and other public purpose uses, intended to benefit the public in accordance with public policy and the purpose of the conservation district.* **This use requires a Conservation District Use Permit (CDUP) from the Board of Land and Natural Resources, which has the final authority to grant, modify, or deny any permit.**

OCCL notes that in 1981 the Department of Transportation (DOT) filed Conservation District Use Application (CDUA) HA-1369 for the expanded use of the airport. This expansion also triggered the need for a CDUP. However, the Planning Director of Hawai'i County denied that project's application for a Special Management Area Permit, and ruled that the DOT instead should file and secure a district boundary change from Conservation to Urban use from the State Land Use Commission, and follow up with a zoning change at the County level.

The CDUA was subsequently withdrawn, as an SMA Permit, or determination of exemption, is required before the Land Board can take action on a CDUA.

This boundary change was secured for a portion of TMK (3) 7-3-043:003 on January 9, 1990 (ref. 89-641). The project area was rezoned to "Urban – Industrial," negating the need for a CDUP.

OCCL recommends that the project's consultants meet with our staff to determine which parts of the project trigger a need for a CDUP. We also recommend that the applicant consult with the State Land Use Commission (tel. 808-587-3822) to determine if securing a boundary change is a viable option.

Please contact Michael Cain at 587-0048, should you have any questions on this matter.

c: Chair; LUC

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

AML
WW ✓

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 23, 2012

DAR 4213

MEMORANDUM

TO: **DLNR Agencies:**
✓X Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
X Div. of State Parks
X Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment (EA) Pre-Assessment Consultation for Kona International Airport at Keahole
LOCATION: Kailua-Kona, Island of Hawaii;
TMK: (3) 7-3-043:portions of 001, 002, and 003; and (3) 7-2-005:007
APPLICANT: Wilson Okamoto Corporation on behalf of the State DOT

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 15, 2012.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417. Thank you.

Attachments

(✓) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: [signature]
Date: 7 Feb 2012

cc: Central Files

8027-01
August 10, 2012

WILSON OKAMOTO CORPORATION
ENGINEERS PLANNERS CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

Mr. Russell Y. Tsuji, Land Administrator
State of Hawaii
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Tsuji:

Thank you for your letter dated March 16, 2012 regarding the subject Draft EA pre-assessment consultation. The following responses are offered to address the comments enclosed in your letter from the Office of Conservation and Coastal Lands and the Division of Aquatic Resources.

Office of Conservation and Coastal Lands (Corr HA-12-173): GIS analysis has identified that the following proposed improvements to the Kona International Airport at Keāhole (KOA) are situated within the Conservation District:

- New Helicopter General Aviation Facility
- Aircraft Rescue Fire Fighting Regional (ARFF) Training Facility Site
- Alternative Temporary Site for the State of Hawaii Department of Agriculture (DOA) Inpection Facility (A)
- Extension and widening of the planned Kona Auxiliary Training Runway (KATR), Makai Section

As these proposed improvements progress to the design stage, the State of Hawaiʻi Department of Transportation Airports Division will consult with both your agency as well as the State Land Use Commission, to determine if they would be approved through a Conservation District Use Permit, or whether a State Land Use Boundary Amendment to an Urban designation would be required.

Division of Aquatic Resources: We acknowledge that the Division of Aquatic Resources has no objections or comments to the proposed improvements to the KOA.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

[signature]

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NATURAL ENERGY LABORATORY OF HAWAII AUTHORITY

An Authority of the State of Hawaii attached to the Department of Business, Economic Development & Tourism

February 15, 2012

Mr. Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826

RECEIVED
FEB 17 2012
WILSON OKAMOTO CORPORATION

Dear Mr. Matsukawa:

Subject: **Pre-Assessment Consultation for the Kona International Airport at Keahole Environmental Assessment**
Tax Map Key (3) 7-3-043: Portions of 001, 002 and 003 and (3) 7-2-005:007
Kailua-Kona, Hawaii

Thank you for the opportunity to review and comment on the subject matter which involves various improvements proposed at the Kona International Airport at Keahole (KOA).

The project location is adjacent to the Natural Energy Laboratory of Hawaii Authority (NELHA). We have the following comments regarding the possible impacts the proposed improvements may have on NELHA:

The construction of Road M. This road will have an impact on our road system and the Kaiminani intersection with Queen Kaahumanu Highway. What will be the main purpose of this road? Will it become a secondary ingress/egress road to KOA? In this regard, we would like to review the traffic study that was conducted for this road and the proposed volume. If a traffic study is not available, when will it be completed and available for review by NELHA? In addition, will DOT be providing funds for the construction of Kaiminani west of the intersection at Kahilihili Street?

Use of Pao'o Street (Road N). In the past it was our understanding that the extension of Pao'o street to Makako Bay Drive would be a secondary ingress/egress road for KOA. We were recently informed by DOT that it is your policy that the road will be gated and locked at all times at your property boundary. If this is your official policy what purpose will the construction of this road serve?

SWAC system. The seawater air conditioning system will utilize cold seawater provide by NELHA to the heat exchange facility. What is the anticipated demand for cold seawater and at

73-4460 Queen Kaahumanu Hwy., #101, Kailua-Kona, Hawaii USA 96740-2637
Phone: (808) 327-9585 Fax: (808) 327-9586 Email: nelha@nelha.org Website: http://www.nelha.org

what peak and average flow rates in gallons per minute? How will the seawater be disposed of after it has been run through the air conditioning system?

Temporary DOA Inspection Facility. NELHA has many existing aquaculture and nutraceutical tenants where biosecurity is of utmost importance. NELHA would like to see the temporary Department of Agriculture inspection facility be located at proposed Site A, as far away from the NELHA boundary as possible.

Please include NELHA on the distribution list when the draft and final Environmental Assessments have been published.

If you have any questions or require additional information, please contact Jeff Nichols at 327-9585, ext. 237.

Very truly yours,

Gregory P. Barbour
Executive Director

WILSON OKAMOTO CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Gregory P. Barbour, Executive Director
Natural Energy Laboratory of Hawaii Authority
73-4460 Queen Ka'ahumanu Hwy., #101
Kailua-Kona, HI 96740-2637

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Barbour:

Thank you for your letter dated February 15, 2012 regarding the subject Draft EA pre-assessment consultation. We offer the following responses in the respective order of your comments:

Construction of Road M
Extension of Road M to connect with NELHA's planned roadways will eventually provide another access point to Queen Kaahumanu Highway for both NELHA and KOA. This project was a result of collaboration with NELHA during the master plan process. For KOA, the roadway would provide more direct route between the highway and the South Ram area. The connection would also provide a more direct route between KOA and NELHA without having to use the highway. The Traffic Impact Assessment Report (TIAR), which will be appended to the Draft Environmental Assessment, does not address the new access at the highway because the completion date of the roadway improvements on NELHA's property is unknown at this time. DOT-A participation in funding intersection improvements at Queen Kaahumanu Highway and Kaiminani Street has yet to be determined.

Use of Pao'o Street
The State DOT, Airports Division will continue on-going discussions with NELHA about the use of Pao'o Street. The proposed improvements are long-term and would not be directly related to current restrictions on roadway usage.

SWAC
State DOT, Airports Division will continue On-going discussion with NELHA to develop the design parameters of the proposed SWAC system. With regard to the return flow, it is our understanding that NELHA has opportunities to use seawater at the anticipated temperature.

WILSON OKAMOTO CORPORATION

Temporary DOA Inspection Facility
The biosecurity sensitivity of NELHA's exititng aquaculture and nutraceutical tenants is acknowledged. The purpose of the temporary facility is to improve biosecurity in the short-term for Hawaii Island and the State, as a whole. We do not believe that the relatively minor differences in proximity to NELHA of the alternative sites would have a significant impact on biosecurity risk at NELHA.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

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

HRD12/6089

RECEIVED
FEB 16 2012
WILSON OKAMOTO CORPORATION

February 8, 2012

Earl Matsukawa, Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawai'i 96826

RE: Pre-Draft Environmental Assessment Consultation
Kona International Airport Improvements Project
Keahole, Kona, Island of Hawai'i

Aloha e Earl Matsukawa,

The Office of Hawaiian Affairs (OHA) is in receipt of your January 17, 2012 letter seeking comments ahead of a draft environmental assessment (DEA) which will be prepared to support various improvements at the Kona International Airport (project) which are proposed by the State of Hawai'i-Department of Transportation, Airports Division (SDOT). This project intends to develop improvements recommended in the October 2010 Kona international Airport at Keahole Master Plan over the next five (5) to ten (10) years. The DEA will be prepared pursuant to the requirements of Chapter 343, Hawaii Revised Statutes to facilitate the use of State funds and lands. A separate DEA will also be prepared pursuant to requirements of the National Environmental Policy Act (NEPA).

Your letter (page 2) indicates that an "archaeological literature research and field inspection" will be included in the DEA. OHA is aware that historic properties of religious and cultural significance to the Hawaiian people have been identified within the "footprint" of the Kona International Airport[1] (airport) and thus, we look forward to reviewing the results of the archaeological literature research and field inspection in the DEA. OHA suggests that this project may provide an opportunity to confirm and finalize any needed mitigation measures for previously identified historic properties and complete any necessary archaeological fieldwork to identify historic properties in un-surveyed areas of the airport which the project will develop.

OHA notes that while Chapter 343, HRS allows for any needed mitigation measures (measures) to be developed pursuant to Chapter 6E, HRS after a final environmental assessment is accepted or approved by the appropriate entity, the National Historic Preservation Act allows

[1] Examples of known historic properties within the footprint of the Kona International Airport include, but are not necessarily limited to those identified during the relocation of the Very High Frequency Omni-Directional Range Facility and construction of a new Air Traffic Control Tower.

for coordination with the NEPA and encourages such measures be binding commitments incorporated into a record of decision or a memorandum of agreement before the NEPA process is concluded. Thus, while the SDOT may anticipate preparing Chapter 343, HRS and NEPA documents to support this project separately, efforts to identify historic properties within the project area and develop any warranted mitigation measures in consultation with appropriate parties should be coordinated to ensure compliance with applicable State and federal laws.

We would also like to suggest that utilizing native species common or adapted to the project area be considered should landscaping improvements be a component of the project. We have no additional comments to offer at this time. Please send one electronic version of the DEA to OHA attn: Compliance Monitoring Program when it is prepared. Should you have any questions, please contact Keola Lindsey at 594-0244 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Richard Pezzulo
Interim Chief Executive Officer

RP:kl

C: OHA, West Hawai'i Community Outreach Coordinator

WILSON OKAMOTO
CORPORATION
ENGINEERS PLANNERS CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Richard Pezzulo, Interim Chief Executive Officer
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Blvd. Suite 500
Honolulu, HI 96813-5097

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Pezzulo:

Thank you for your letter dated February 16, 2012 (HRD12/6089) regarding the subject Draft EA pre-assessment consultation. As referenced, the forthcoming Draft EA will include an archaeological literature research and field inspection, and will fully comply with applicable State and Federal laws concerning Archaeological, Historic, and Cultural resources. This will include consultation pursuant to Section 106 of the National Historic Preservation Act, whereby OHA, among others, will be a consulted Native Hawaiian Organization. The forthcoming EA will also include a cultural impact review for the proposed projects, while the DOT-A is completing a full cultural impact assessment for the Kona International Airport. The utilization of native species common or adapted to the project area will be considered for landscaping features stemming from the proposed improvements.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR

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

MAR 15 2012

GLENN M. OKIMOTO
DIRECTOR

Em

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:
HWY-PS
2.1213

March 14, 2012

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

Subject: Pre-Assessment Consultation, Environmental Assessment
Improvements at Kona International Airport at Keahole
Hawaii, North Kona, Keahole, TMK (3) 7-3-043: pors. 001-003, (3) 7-2-005: 007

Thank you for the opportunity to provide pre-assessment consultation comments on the Department of Transportation, Airports Division's proposal to construct improvements most of which are recommended in its Kona International Airport at Keahole Master Plan (October 2010). Implementation of these improvements are anticipated within five to ten years.

The Master Plan short-term improvements indicates that another access to the airport is being planned from a new road that would connect to Queen Kaahumanu Highway across the existing intersection with Kaiminani Drive, which is being planned by the National Energy Laboratory of Hawaii Authority.

The project's traffic report should address any access to Queen Kaahumanu Highway to establish the traffic impacts that would be associated with the proposed improvements.

If there are any questions, please contact Ken Tatsuguchi, Engineering Program Manager, Highways Division, Planning Branch, at 587-1830. Reference file review 2012-012.

Very truly yours,

GLENN M. OKIMOTO, Ph.D.
Director of Transportation

WILSON OKAMOTO
CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Glenn M. Okimoto, Ph.D., Director of Transportation
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Attention: Mr. Ken Tatsuguchi, Engineering Program Manager, Highways Division, Planning Branch

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Okimoto:

Thank you for your letter dated March 14, 2012 (HWY-PS 2.1213) regarding the subject Draft EA pre-assessment consultation. The forthcoming Draft EA will include a traffic report that discusses proposed roadway improvements and resulting potential impacts to traffic flow. This report will address access to Queen Kaahumanu Highway.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

NEIL ABERCROMBIE
GOVERNOR

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

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

IN REPLY REFER TO:

HAR-EP
1829.12

February 9, 2012

RECEIVED
FEB 17 2012
WILSON OKAMOTO CORPORATION

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826

Dear Mr. Matsukawa:

Subject: Environmental Assessment (EA) Pre-Assessment Consultation RE: Kona International Airport at Keahole Environmental Assessment Tax Map Key: (3) 7-3-043: Portions of 001, 002 and TMK (3) 7-2-005:007 Kailua-Kona, Hawaii

Thank you for the opportunity to comment on your January 17, 2012 letter, which was received on January 20, 2012, regarding the subject matter.

We have no comments to offer as we have determined that the proposed project will not impact the commercial harbors.

Should you have any questions, please call Mr. Arnold Liu of our Harbors Division Engineering Planning Section at 587-1887 or via e-mail at arnold.liu@hawaii.gov.

Very truly yours,

JADINE URASAKI, P. E., LEED AP
Deputy Director – Projects

WILSON OKAMOTO CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. Jadine Urasaki, P.E., LEED AP, Deputy Director - Projects
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Attention: Mr. Arnold Liu

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Urasaki:

Thank you for your letter dated February 9, 2012 (HAR-EP 1829.12) indicating that you have no comments to offer regarding the subject Draft EA pre-assessment consultation. We appreciate your determination that the proposed improvements will not impact commercial harbors.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

William P. Kenoi
Mayor

William T. Takaba
Managing Director

County of Hawai'i

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

25 Aupuni Street • Hilo, Hawai`i 96720
(808) 961-8083 · Fax (808) 961-8086
http://co.hawaii.hi.us/directory/dir_envmng.htm

Dora Beck, P.E.
Acting Director

Hunter Bishop
Deputy Director

February 1, 2012

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, HI 96826

RE: EA Pre-Assessment Consultation
Kona International Airport at Keāhole Environmental Assessment
TMK: (3)7-3-043: portions of 001, 002 and 003 and TMK: (3)7-2-005:007
Kailua-Kona, Hawai`i

Dear Mr. Matsukawa,

We have no comments to offer on the subject project.

Thank you for allowing us to review and comment on this project.

Sincerely,

Dora Beck
Dora Beck, P.E.
ACTING DIRECTOR

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. Dora Beck, P.E., Acting Director
County of Hawaii
Department of Environmental Management
25 Aupuni Street
Hilo, HI 96720

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Beck:

Thank you for your letter dated February 1, 2012 indicating that you have no comments to offer regarding the subject Draft EA pre-assessment consultation.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

William P. Kenoi
Mayor

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

March 22, 2012

Mr. Earl Matsukawa
Project Manager
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, HI 96826

Dear Mr. Matsukawa

SUBJECT: Consultation for the Preparation of an Environmental Assessment (EA)
PROJECT: Kona International Airport at Keahole Master Plan Improvements
Tax Map Key: (3) 7-3-43: 001 thru 003; 7-2-005: 007
Keahole Airport, North Kona, Hawaii

This is in response to your letter dated January 20, 2012, in which you requested our comments on any special environmental conditions or impacts related to the proposed development. We apologize for our delayed response to your request, for which we have the following comments to offer:

1. As noted in your letter, the proposed improvements to be covered by this environmental assessment includes:
   a. Extending the General Aviation (helicopters) area and associated taxiway improvements;
   b. Extend and expand the planned Kona Auxiliary Training runway;
   c. Development of a new parallel runway located makai of existing runway;
   d. New sea water air conditioning system;
   e. Relocation of Onizuka Museum;
   f. Expansion of terminal area;

   g. New connector "Road M" that will intersect with Ka'imi'nani Drive;
   h. Install a hydrogen fuel station;
   i. Replace Airport Rescue Fire Fighting Station (ARFF) with a new facility in a new location;
   j. Develop a new ARFF Regional Training Facility;
   k. Replace helicopter facility with a new, larger facility in a new location;
   l. A new medical transitional facility; and
   m. Construct a Department of Agriculture Inspection Facility.
2. These improvements are described as the "near-term" implementation of the Kona International Airport at Keahole, Airport Master Plan (October 2010). With the exception of the proposed new General Aviation (helicopters) site, the ARFF Regional Training Facility, new parallel runway, DOA Site A Inspection facility, and the proposed Road M, all of the other improvements appear to be situated within the State Land Use Urban District and the County's General Industrial (MG) zoning district and covered under SMA Use Permit No. 325 to allow the expansion of the airport within the County's Special Management Area (SMA).
3. Specific to the proposed new General Aviation (helicopters) site, the ARFF Regional Training Facility, parallel runway, DOA Site A Inspection Facility and the proposed Road M, these improvements appear to be situated within the State Land Use Conservation District and will require approval from the Office of Conservation and Coastal Lands. Given its location within the Conservation district, it would also fall outside of the area covered by SMA Use Permit No. 325. Therefore, an amendment to SMA Use Permit No. 325 will be required to accommodate these specific projects.
4. It would help greatly if the DEA identifies all existing and proposed improvements superimposed upon maps showing the location of the State Land Use District and County zoning district boundaries. Similarly, the DEA should clearly discuss those improvements, structures and uses that depart from the concept originally detailed within the December 1987 Keahole Airport Master Plan and covered by SMA Use Permit No. 325. Based on the information provided, this office can then determine those improvements, structures and uses that would require an amendment to SMA Use Permit No. 325.

5. Please provide a discussion of project compliance with the applicable policies contained within the Kona Community Development Plan. Specifically speaking, please discuss how the project will:

   a. assist in the design and construction of the Frontage Road as defined in Policy TRAN-1.5;

   b. facilitate in the establishment of inter-model connections as discussed in Policy TRAN-3.8; and

   c. assist in the implementation of a 17-mile long protected coastline that fronts the airport complex as discussed in Policy LU-1.6.

d. The EA should consider how airport security will be maintained during construction of the interim commuter airline terminal buildings.

We appreciate being given the opportunity to provide our initial comments regarding the preparation of the DEA and your patience as we prepared our response to you.

Please provide this office with a copy of the DEA upon its publication. Should you have questions, feel free to contact Daryn Arai of my staff at 961-8142.

Sincerely,

BJ LEITHEAD TODD
Planning Director

DSA: smn
P:/wpwin60/dsa/2012/Kona International Airport Master Plan Pre-cmnts.doc

xc: Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

WILSON OKAMOTO CORPORATION
ENGINEERS PLANNERS CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. BJ Leithead Todd, Planning Director
County of Hawaii
Planning Department
Aupuni Center, 101 Pauahi Street, Suite 3
Hilo, HI 96720

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Todd:

Thank you for your letter dated March 22, 2012 regarding the subject Draft EA pre-assessment consultation.

Under context of the forthcoming Draft EA, the following responses are offered in the order of your comments:

1. Subsequent to distributing the Pre-Consultation, State DOT, Airports Division redefined the scope of proposed improvements, as detailed below:
   - Expansion of the General Aviation (GA) Facilities
   - Construction of a new Helicopter Facility
   - Extension and Widening of the planned Kona Auxiliary Training Runway (KATR)
   - Construction of a new road, Road M (Phase I)
   - Construction of a Seawater Air Condition System (SWAC) Relocation of the Astronaut Ellison S. Onizuka Space Center
   - Construction of the Terminal Modernization (Phase I)
   - Construction of a High-Pressure Hydrogen Fuel Storage and Fueling Station
   - Construction of an ARFF Regional Training Facility
   - Construction of a Medical Transitional Facility

2. We appreciate your determination that, with the exception of the proposed new General Aviation (helicopter) site, the ARFF Regional Training Facility, new parallel runway, DOA Site A Inspection Facility, and the proposed Road M, all of the other improvements, appear to lie within the State Land use Urban District and the County's General Industrial (MG) zoning district and are covered under SMA Use Permit No. 325 to allow the expansion of the airport within the County's Special Management Area (SMA).

3. We concur that the proposed new General Aviation (helicopter) site, the ARFF Regional Training Facility, parallel runway, DOA Site A Inspection Facility and the proposed Road M appear to be situated within the State Land Use Conservation District, and will require approval from the Office of Conservation and Coastal Lands. We acknowledge that improvements would also lie outside the area covered by SMA Use Permit No. 325. State DOT, Airports Division, will be pursuing an amendment(s) to SMA Use Permit No. 325 to accommodate these specific improvements as they proceed to design.

4. The forthcoming Draft EA will contain maps detailing existing and proposed improvements superimposed on a depiction of the State Land Use District and County zoning boundaries. Further, the Draft EA will contain a discussion of improvements, structures, and uses that depart from the concept originally detailed within the Keāhole Airport Master Plan and covered by SMA Use Permit No. 325.

5. The forthcoming Draft EA will contain a discussion of the project compliance with applicable policies and guidelines set forth by the Kona Community Development Plan including those aspects referred to in your letter.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

William P. Kenoi
Mayor

Darren J. Rosario
Fire Chief

Renwick J. Victorino
Deputy Fire Chief

County of Hawai'i
HAWAI'I FIRE DEPARTMENT
25 Aupuni Street • Room 2501 • Hilo, Hawai'i 96720
(808) 932-2900 • Fax (808) 932-2928

February 9, 2012

RECEIVED
FEB 17 2012
WILSON OKAMOTO CORPORATION

Earl Matsukawa
Wilson Okamoto Corporation
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawai'i 96826

SUBJECT: ENVIRONMENTAL ASSESSMENT (EA) PRE-ASSESSMENT CONSULTATION
KONA INTERNATIONAL AIRPORT AT KEAHOLE
ENVIRONMENTAL ASSESSMENT
TMK (3) 7-3-043: PORTIONS OF 001, 002 AND 003 AND
TMK (3) 7-2-005:007 KAILUA-KONA, HAWAII

In regards to the above-mentioned pre-Environmental Assessment consultation, the following shall be in accordance:

NFPA 1, UNIFORM FIRE CODE, 2006 EDITION
Note: NFPA 1, Hawai'i State Fire Code with County amendments. County amendments are identified with a preceding "C~" of the reference code.

Chapter 18 Fire Department Access and Water Supply

18.1 General. Fire department access and water supplies shall comply with this chapter.

For occupancies of an especially hazardous nature, or where special hazards exist in addition to the normal hazard of the occupancy, or where access for fire apparatus is unduly difficult, or areas where there is an inadequate fire flow, or inadequate fire hydrant spacing, and the AHJ may require additional safeguards including, but not limited to, additional fire appliance units, more than one type of appliance, or special systems suitable for the protection of the hazard involved.

18.1.1 Plans.

18.1.1.1 Fire Apparatus Access. Plans for fire apparatus access roads shall be submitted to the fire department for review and approval prior to construction.

18.1.1.2 Fire Hydrant Systems. Plans and specifications for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

C~ 18.1.1.2.1 Fire Hydrant use and Restrictions. No unauthorized person shall use or operate any Fire hydrant unless such person first secures permission or a permit from the owner or representative of the department, or company that owns or governs that water supply or system. Exception: Fire Department personnel conducting firefighting operations, hydrant testing, and/or maintenance, and the flushing and acceptance of hydrants witnessed by Fire Prevention Bureau personnel.

18.2 Fire Department Access.

18.2.1 Fire department access and fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2* Access to Structures or Areas.

18.2.2.1 Access Box(es). The AHJ shall have the authority to require an access box(es) to be installed in an accessible location where access to or within a structure or area is difficult because of security.

18.2.2.2 Access to Gated Subdivisions or Developments. The AHJ shall have the authority to require fire department access be provided to gated subdivisions or developments through the use of an approved device or system.

18.2.2.3 Access Maintenance. The owner or occupant of a structure or area, with required fire department access as specified in 18.2.2.1 or 18.2.2.2, shall notify the AHJ when the access is modified in a manner that could prevent fire department access.

18.2.3 Fire Department Access Roads.

18.2.3.1 Required Access.

18.2.3.1.1 Approved fire department access roads shall be provided for every facility, building, or portion of a building hereafter constructed or relocated.

18.2.3.1.2 Fire Department access roads shall consist of roadways, fire lanes, parking lots lanes, or a combination thereof.

18.2.3.1.3* When not more than two one- and two-family dwellings or private garages, carports, sheds, agricultural buildings, and detached buildings or structures 400ft^2 (37 m^2) or less are present, the requirements of 18.2.3.1 through 18.2.3.2.1 shall be permitted to be modified by the AHJ.

18.2.3.1.4 When fire department access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection features.

18.2.3.2 Access to Building.

18.2.3.2.1 A fire department access road shall extend to within in 50 ft (15 m) of at least one exterior door that can be opened from the outside and that provided access to the interior of the building.

18.2.3.2.1.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 300 feet.

18.2.3.2.2 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

18.2.3.2.2.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 450 ft (137 m).

18.2.3.3 Multiple Access Roads. More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

18.2.3.4 Specifications.

18.2.3.4.1 Dimensions.

C~ 18.2.3.4.1.1 FDAR shall have an unobstructed width of not less than 20ft with an approved turn around area if the FDAR exceeds 150 feet. **Exception:** FDAR for one and two family dwellings shall have an unobstructed width of not less than 15 feet, with an area of not less than 20 feet wide within 150 feet of the structure being protected. An approved turn around area shall be provided if the FDAR exceeds 250 feet.

C~ 18.2.3.4.1.2 FDAR shall have an unobstructed vertical clearance of not less then 13ft 6 in.

C~ 18.2.3.4.1.2.1 Vertical clearances may be increased or reduced by the AHJ, provided such increase or reduction does not impair access by the fire apparatus, and approved signs are installed and maintained indicating such approved changes.

18.2.3.4.1.2.2 Vertical clearances shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

C~ 18.2.3.4.2 Surface. Fire department access roads and bridges shall be designed and maintained to support the imposed loads (25 Tons) of the fire apparatus. Such FDAR and shall be comprised of an all-weather driving surface.

18.2.3.4.3 Turning Radius.

C~ 18.2.3.4.3.1 Fire department access roads shall have a minimum inside turning radius of 30 feet, and a minimum outside turning radius of 60 feet.

18.2.3.4.3.2 Turns in fire department access road shall maintain the minimum road width.

18.2.3.4.4 Dead Ends. Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around.

18.2.3.4.5 Bridges.

18.2.3.4.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with county requirements.

18.2.3.4.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

18.2.3.4.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

18.2.3.4.6 Grade.

C~ **18.2.3.4.6.1** The maximum gradient of a Fire department access road shall not exceed 12 percent for unpaved surfaces and 15 percent for paved surfaces. In areas of the FDAR where a Fire apparatus would connect to a Fire hydrant or Fire Department Connection, the maximum gradient of such area(s) shall not exceed 10 percent.

18.2.3.4.6.2* The angle of approach and departure for any means of fire department access road shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m) or the design limitations of the fire apparatus of the fire department, and shall be subject to approval by the AHJ.

18.2.3.4.6.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire lane.

18.2.3.4.7 Traffic Calming Devices. The design and use of traffic calming devices shall be approved the AHJ.

18.2.3.5 Marking of Fire Apparatus Access Road.

18.2.3.5.1 Where required by the AHJ, approved signs or other approved notices shall be provided and maintained to identify fire department access roads or to prohibit the obstruction thereof of both.

18.2.3.5.2 A marked fire apparatus access road shall also be known as a fire lane.

18.2.4* Obstruction and Control of Fire Department Access Road.

18.2.4.1 General.

18.2.4.1.1 The required width of a fire department access road shall not be obstructed in any manner, including by the parking of vehicles.

18.2.4.1.2 Minimum required widths and clearances established under 18.2.3.4 shall be maintained at all times.

18.2.4.1.3* Facilities and structures shall be maintained in a manner that does not impair or impede accessibility for fire department operations.

18.2.4.1.4 Entrances to fire departments access roads that have been closed with gates and barriers in accordance with 18.2.4.2.1 shall not be obstructed by parked vehicles.

18.2.4.2 Closure of Accessways.

18.2.4.2.1 The AHJ shall be authorized to require the installation and maintenance of gates or other approved barricades across roads, trails, or other accessways not including public streets, alleys, or highways.

18.2.4.2.2 Where required, gates and barricades shall be secured in an approved manner.

18.2.4.2.3 Roads, trails, and other accessways that have been closed and obstructed in the manner prescribed by 18.2.4.2.1 shall not be trespassed upon or used unless authorized by the owner and the AHJ.

18.2.4.2.4 Public officers acting within their scope of duty shall be permitted to access restricted property identified in 18.2.4.2.1.

18.2.4.2.5 Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by the fire department or by its order or under its control shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

18.3 Water Supplies and Fire Hydrants

18.3.1* A water supply approved by the county, capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities or buildings, or portions thereof, are hereafter constructed, or moved into or within the county. When any portion of the facility or building is in excess of 150 feet (45 720 mm) from a water supply on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building, on-site fire hydrants and mains capable of supplying the required fire flow shall be provided when required by the AHJ. For on-site fire hydrant requirements see section 18.3.3.
EXCEPTIONS:
1. When facilities or buildings, or portions thereof, are completely protected with an approved automatic fire sprinkler system the provisions of section 18.3.1 may be modified by the AHJ.
2. When water supply requirements cannot be installed due to topography or other conditions, the AHJ may require additional fire protection as specified in section 18.3.2 as amended in the code.
3. When there are not more than two dwellings, or two private garage, carports, sheds and agricultural. Occupanicies, the requirements of section 18.3.1 may be modified by AHJ.

18.3.2* Where no adequate or reliable water distribution system exists, approved reservoirs, pressure tanks, elevated tanks, fire department tanker shuttles, or other approved systems capable of providing the required fire flow shall be permitted.

18.3.3* The location, number and type of fire hydrants connected to a water supply capable of delivering the required fire flow shall be provided on a fire apparatus access

road on the site of the premises or both, in accordance with the appropriate county water requirements.

18.3.4 Fire Hydrants and connections to other approved water supplies shall be accessible to the fire department.

18.3.5 Private water supply systems shall be tested and maintained in accordance with NFPA 25 or county requirements as determined by the AHJ.

18.3.6 Where required by the AHJ, fire hydrants subject to vehicular damage shall be protected unless located within a public right of way.

18.3.7 The AHJ shall be notified whenever any fire hydrant is placed out of service or returned to service. Owners of private property required to have hydrants shall maintain hydrant records of approval, testing, and maintenance, in accordance with the respective county water requirements. Records shall be made available for review by the AHJ upon request.

C~ 18.3.8 Minimum water supply for buildings that do not meet the minimum County water standards:

Buildings up to 2000 square feet, shall have a minimum of 3,000 gallons of water available for Firefighting.

Buildings 2001- 3000 square feet, shall have a minimum of 6,000 gallons of water available for Firefighting.

Buildings, 3001- 6000 square feet, shall have a minimum of 12,000 gallons of water available for Firefighting.

Buildings, greater than 6000 square feet, shall meet the minimum County water and fire flow requirements.

Multiple story buildings shall multiply the square feet by the amount of stories when determining the minimum water supply.

Commercial buildings requiring a minimum fire flow of 2000gpm per the Department of Water standards shall double the minimum water supply reserved for firefighting.

Fire Department Connections (FDC) to alternative water supplies shall comply with 18.3.8 (1)-(6) of *this code.*

NOTE: In that water catchment systems are being used as a means of water supply for firefighting, such systems shall meet the following requirements:

(1) In that a single water tank is used for both domestic and firefighting water, the water for domestic use shall not be capable of being drawn from the water reserved for firefighting;

(2) Minimum pipe diameter sizes from the water supply to the Fire Department Connection (FDC) shall be as follows:
- (a) 4" for C900 PVC pipe;
- (b) 4" for C906 PE pipe;
- (c) 3" for ductile Iron;
- (d) 3' for galvanized steel.

(3) The Fire Department Connection (FDC) shall:
- (a) be made of galvanized steel;
- (b) have a gated valve with 2-1/2 inch, National Standard Thread male fitting and cap;
- (c) be located between 8 ft and 16 ft from the Fire department access. The location shall be approved by the AHJ;
- (d) not be located less than 24 inches, and no higher than 36 inches from finish grade, as measured from the center of the FDC orifice;
- (e) be secure and capable of withstanding drafting operations. Engineered stamped plans may be required;
- (f) not be located more than 150 feet of the most remote part, but not less than 20 feet, of the structure being protected;
- (g) also comply with section 13.1.3 and 18.2.3.4.6.1 of *this code;*

(4) Commercial buildings requiring a fire flow of 2000gpm shall be provided with a second FDC. Each FDC shall be independent of each other, with each FDC being capable of flowing 500gpm by engineered design standards. The second FDC shall be located in an area approved by the AHJ with the idea of multiple Fire apparatus' conducting drafting operations at once, in mind.

(5) Inspection and maintenance shall be in accordance to NFPA 25.

(6) The owner or lessee of the property shall be responsible for maintaining the water level, quality, and appurtenances of the system.

EXCEPTIONS TO SECTION 18.3.8:

(1) Agricultural buildings, storage sheds, and shade houses with no combustible or equipment storage.

(2) Buildings less than 800 square feet in size that meets the minimum Fire Department Access Road requirements.

(3) For one and two family dwellings, agricultural buildings, storage sheds, and detached garages 800 to 2000 square feet in size, and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 1000 feet.

(4) For one and two family dwellings, agricultural buildings, and storage sheds greater than 2000square feet, but less than 3000 square feet and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 500 feet.

(5) For buildings with an approved automatic sprinkler system, the minimum water supply required may be modified.

If there are any questions regarding these requirements, please contact the Fire Prevention Bureau at (808) 932-2912.

DARREN J. ROSARIO
Fire Chief

RP/lc

WILSON OKAMOTO
CORPORATION

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Darren J. Rosario, Fire Chief
County of Hawaii
Hawaii Fire Department
25 Aupuni Street Room 2501
Hilo, HI 96720

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Rosario:

Thank you for your letter dated February 9, 2012 regarding the subject Draft EA pre-assessment consultation. The proposed improvements will comply with the NFPA (1) Uniform Fire Code as referenced in your letter. This will be achieved during the design phase of the respective improvements.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

Greeters of Hawaii

RECEIVED
FEB 15 2012
WILSON OKAMOTO CORPORATION

February 14, 2012

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, HI 96826

Attn: Earl Matsukawa
VP/Dir. Planning

Dear Mr. Matsukawa,

This will acknowledge receipt of your letter reference 8027-01 dated January 17, 2012, wherein you solicited my comments on projects for the near term.

Full disclosure: my family operates some concessions in this airport which were granted subsequent to our committee's activity. I have been involved in airport concessions for nearly 55 years and in Kona for a number of years giving me a pretty thorough understanding of the dynamics involved.

Unfortunately for all, I believe concessionaires have not been consulted on the layout of concessions in most airports in Hawaii and this includes Kona

This is unfortunate and has resulted in a great loss of airport special fund revenue for a long period of time. Kona is a prime example of this failure. The concession revenue is greatly reduced by the present layout

Your letter alludes to this by listing EXPANDING THE TERMINAL AREA, the only item that seems to address the concession situation.

My understanding is that a common entry could be constructed for all passenger screening resulting in efficiencies of TSA staffing not to mention relocation of concessions to access the passenger flows and of course providing sufficient waiting space for departing passengers which simply does not exist today.

Item number 8 is the only item that I can see that offers any potential income to Airport revenues, something sorely needed by the Department. These funds are not general revenues but special funds that go directly to the Department of Transportation for airport activities.

It would seem possible to create a single security entrance undercover from the sidewalk behind the Onizuka Museum which would result in a walk much shorter than many in other airports and much greater efficiencies. It would be accomplished for much less investment than relocating the Museum. Museums at airports are a very complicated subject of which we have had an example in Honolulu for review. This approach would take years off the build out time and result in more immediate benefits.

Mailing: P.O. Box 29638 • Honolulu, Hawaii 96820 • Delivery: 3375 Koapaka Street • Honolulu, Hawaii 96819
Telephone: (800) 366-8559 • Facsimile: (800) 926-2644 • Email: greethi@aol.com

Relocating this Security entrance would require refocusing gates and facilities inside the sterile area and some upgrading of concession facilities which would surely result in markedly increased revenues.

I believe others more competent than I should prioritize the other improvements listed. They all cost money and I am unable to discern any that will be income positive for the airport .

Respectfully Submitted,

Peter S. Fithian

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Peter S. Fithian
Greeters of Hawaii
P.O. Box 29638
Honolulu, HI 96743-9704

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Fithian:

Thank you for your letter dated February 14, 2012 regarding the subject Draft EA pre-assessment consultation. We acknowledge your concerns regarding the existing layout of terminal facilities at Kona International Airport, with regard to concession revenue and access to passengers. Your comments regarding facility design will be forwarded to State DOT, Airports Division for consideration.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

Kohala Coast

RESORT ASSOCIATION

February 14, 2012

RECEIVED
FEB 16 2012
WILSON OKAMOTO CORPORATION

Wilson Okamoto Corporation
1907 South Beretania St., Ste. 400
Honolulu, Hawaii 96826
ATTN: Earl Matsukawa, Project Manager

RE: Environmental Assessment Pre-Assessment Consultation
Kona International Airport at Keahole Environmental Assessment

Aloha Mr. Matsukawa,

Mahalo for contacting the Kohala Coast Resort Association with information regarding the proposed improvements at Kona International Airport at Keahole and for allowing the resort association to participate in the pre-assessment consultation for the environmental assessment process.

The Kohala Coast Resort Association is a destination association representing the resorts and hotels located on the Kohala Coast of the Island of Hawai`i. The association members include Hualalai Resort, Four Seasons Resort Hualalai, Waikoloa Beach Resort, Waikoloa Beach Marriott Resort & Spa, Hilton Waikoloa Village, Mauna Lani Resort, Mauna Lani Bay Hotel & Bungalows, The Fairmont Orchid, Mauna Kea Resort, Mauna Kea Beach Hotel and Hapuna Beach Prince Hotel. These members represent more than 3,500 hotel rooms and an equal number of residences located at these resorts. Altogether about 60 percent of the total visitor accommodations on the Island of Hawai`i are located at the resorts on the Kohala Coast.

The Kona International Airport is the first and last impression for the thousands of visitors who choose the Island of Hawai`i as their vacation destination. It is imperative the island has an airport that provides a quality experience for these visitors and for all island residents.

The resort association is in full support of the proposed airport improvements. It is especially interested in the improvements which relate to the terminal area – the terminal expansion, new ticketing lobby and baggage facilities and upgrade of the communications system which would provide a new public address system and flight information display system.

The association looks forward to participating in any stakeholder meetings regarding these improvements. Please let me know if the resort association can be of assistance during the process – especially as it relates to moving the terminal projects forward in a timely fashion.

Mahalo nui loa,

Sharon Sakai

Sharon Sakai
Administrative Director

68-1310 Mauna Lani Drive, Suite 101, Kohala Coast, Hawaii 96743-9704 • Telephone (808) 885-6414, Facsimile (808) 885-6145
Email: kcra@hawaiiantel.biz • Website: www.KohalaCoastResorts.com

WILSON OKAMOTO CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Ms. Sharon Sakai, Administrative Director
Kohala Coast Resort Association
68-1310 Mauna Lani Drive, Suite 101
Kohala Coast, HI 96743-9704

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Ms. Sakai:

Thank you for your letter dated February 14, 2012 regarding the subject Draft EA pre-assessment consultation. We acknowledge your support of the proposed project, and look forward to your participation in future stakeholder meetings regarding the proposed improvements.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

Wilson Okamoto Corporation
1907 S. Beretania Street, Suite 400
Honolulu, HI 96826
Attention: Mr. Earl Matsukawa, Project Manager

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR THE AIRFIELD, TERMINAL, AND FACILITY IMPROVEMENTS AT THE KONA INTERNATIONAL AIRPORT AT KEAHOLE
Public Information Meeting, Thursday, February 9, 2012

Am interested in more information on the "Medical Transitional Facility". Would want to avoid redundancy with anticipated mid-coast medical facility (replacement for Kona Community Hospital).
Mahalo,
[signature]

(include additional sheets as necessary)

PLEASE PRINT: Name: Ali Bairos Phone: 960-3383
Organization: Board Chairman, West Hawaii Regional Board (HHSC)
Address: PO Box 670
Kealakekua Hawaii 96750
Email: alibaba@hawaii.rr.com

Please submit comments by Friday, February 17, 2012 or email koa@wilsonokamoto.com

---

WILSON OKAMOTO CORPORATION
1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Ali Bairos, Board Chairman
West Hawaii Regional Board (HHSC)
P.O. Box 670
Kealakekua, HI 96750

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Bairos:

Thank you for your comments regarding the subject EA Public Information Meeting held on February 9, 2012 at Kealakehe Elementary School. The Draft EA will include further discussion regarding the proposed Medical Transitional Facility.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

Thank you for providing the opportunity to comment on preparation of the Environment Assessment for the Kona International Airport at Keahole (KOA).

The first points are only administrative housekeeping for the EA process that will affect both proposed and future access and connectivity. As a matter of record, one of the eight Guiding Principles of the Kona Community Development Plan ("Kona CDP") ordinance is "Provide connectivity and transportation choices":

1. The second or "North" Entrance is not indicated in the optimum position. While it is understood that construction is beyond the scope (in both time and work scope constraints) it is crucial that this part of the planning process identify this important infrastructure component accurately. The entrance should be directly across from the "University Drive" entrance roadway to Palamanui, the University of Hawai'i Community College West Hawai'i Center, and the access road to Mamalahoa Highway. This could have an impact on the proposed short term improvements, and will most certainly impact future transit access and connectivity.
2. The Road "N" and Road "M" extensions are even more crucial to the near term improvements. It is recognized that only a portion of the road is physically located on State-owned property under the jurisdiction of the Department of Transportation – Airport Division. Both roads must be extended beyond the boundary to be effectively utilized. The EA should be comprehensive by integrating the entire route for both roads into a collaborative EA with the other agencies. Any incremental cost would be minor allowing many possible solutions for cost sharing. It is noted that the both road extensions are also located upon State-owned land.

The next consideration is based on transit operations and connections. This would have an impact on both internal shuttles, scheduled transit service (currently provided by Hele On), and special charter service. These are important considerations whether luggage accompanies the passenger, it is checked-in off-site and transported separately, or if the traveler is simply commuting without luggage:

1. Will internal circulating shuttle service and necessary infrastructure (such as pull-outs, waiting shelters, and electronic trip information be integrated for the facility improvements?
2. Will accommodations be provided to integrate shuttle circulation to connect with mass transit connecting to the Kona Urban Area as well as destinations located to the north?

The final consideration is how the EA will integrate other modes of travel, primarily pedestrians and bicyclists. KOA is already has thousands of bicycles arriving or departing by air each year in conjunction with major local competitions. The Kona CDP identifies routes for non-motorized transportation such as Shared-Use Paths and trails to and from the airport complex, as well as through it, connecting the Kona Urban Area with destinations located to the north. There are several plans, documents and legislation that specify or mandate this requirement:

1. <u>County Plan.</u> The Kona CDP includes an Official Transportation Network Map. The map component addressing bicycle and pedestrian facilities was revised February 24, 2010. The map indicates a Shared-Use Path along the coast makai of the airport.
2. <u>County Policy.</u> The Kona CDP was first mandated as a component of the County's General Plan. It was subsequently codified into the Hawai'i County Code as Ordinance 08-131. The detailed document is readily available on the county web site.
3. <u>State Plan.</u> DOT's Bike Plan Hawai'i lists Shared-Use Paths parallel to Queen Ka`ahumanu Highway between Makala Blvd in the Kona Urban Area and Kawaihae. The location has yet to be surveyed, so now is the optimum time for planning and design, considering airport operation and security issues as well as the community need to reach commuter destinations at the airport and recreational and historical sites along the coast.
4. <u>State Policy.</u> Act 54 (2009) provides a mandate to DOT that Complete Streets principals (that will accommodate all users) must be taken into account when planning or designing projects subsequent to January 1, 2010. This law was codified as HRS 264-20.5 upon adoption.
5. <u>Federal Plan.</u> The Ala Kahakai national Historical Trail also traverses the airport proper. Preservation of original remnants, restoration where practical and reconstruction when necessary are solutions to accommodate non-motorized transportation.
6. <u>Federal Policy.</u> The US DOT issued a policy statement to incorporate safe and convenient walking and bicycling facilities into transportation projects. The policy was signed on March 11, 2010 and is derived from United States Code: title 23, Title 49, and Title 42.

It is fortunate that all of the references sited above are compatible with each other. It is also understood that certain restrictions related times or conditions of operating may need to be considered. Certain consolidations of facility functions could also be considered to reduce costs:

a) Providing paved security roads outside perimeter fences could double as a Shared-Use Path.
b) The emergency launch pier access road could also serve as a Shared-Use Path segment.
c) Use of blended (raised with sinusoidal vehicle approaches) crosswalks. These provide a level surface for pedestrians of all abilities while calming vehicle speeds without jarring bumps. They exceed ADA requirements at a lower cost than installing curb ramps.

Bob Ward 808.324.7272 77-6526 Ho'olaupa'i St Kailua Kona, HI 96740
rgward007@hawaii.rr.com

WILSON OKAMOTO CORPORATION
ENGINEERS • PLANNERS • CONSULTANTS

1907 South Beretania Street
Artesian Plaza, Suite 400
Honolulu, Hawaii, 96826 USA
Phone: 808-946-2277
FAX: 808-946-2253
www.wilsonokamoto.com

8027-01
August 10, 2012

Mr. Bob Ward
77-6526 Ho'olaupa'i St.
Kailua Kona, HI 96740

Subject: Pre-Assessment Consultation
Draft Environmental Assessment (EA) for
Airfield, Terminal, and Facility Improvements for the
Kona International Airport at Keahole
Keahole, North Kona, Hawaii
TMK (3) 7-3-043: portions of 001, 002, and 003; and (3) 7-2-004:007

Dear Mr. Ward:

Thank you for your letter dated March 22, 2012 regarding the subject Draft EA pre-assessment consultation. We acknowledge your concerns and suggestions regarding transit access, connectivity, and operations, as well as pedestrian/bicyclist integration. Your letter, however, comments on overarching issues stemming from the Kona International Airport at Keāhole (KOA) Master Plan that fall beyond the scope of the subject Draft EA.

The forthcoming Draft EA will be assessing environmental impacts associated with select near-term proposed terminal and facility improvements to KOA, will contain a section detailing the relationship of the proposed project improvements to the guiding principles of the Kona Community Development Plan, as well as applicable County, State, and Federal plans and policies.

Though the forthcoming EA will factor in and account for cumulative impacts arising from potential development foreshadowed by the KOA, it will not directly assess impacts in detail beyond those resulting from the proposed action.

Your letter, along with this response, will be reproduced and included in the forthcoming Draft EA. We appreciate your participation in the pre-assessment consultation review process.

Sincerely,

Earl Matsukawa, AICP
Project Manager

cc: Ms. Lynn Becones, State DOT, Airports Division

WILSON OKAMOTO
CORPORATION
ENGINEERS | PLANNERS | CONSULTANTS

1907 S. Beretania St., Suite 400
Honolulu, Hawaii 96826

PH 808-946-2277
FX 808-946-2253

www.wilsonokamoto.com
woc@wilsonokamoto.com